FINAL INTEGRATED ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE PROPOSED PAARDEPLAATS COAL MINE

PREPARED ON BEHALF OF:

EXXARO RESOURCES (PTY) LTD

AS PER SECTION 39 & REGULATIONS 50 & 51 OF THE MPRDA

&

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Final Integrated Environmental Management Programme for the Proposed Paardeplaats Coal Mine

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REVISION AND AMENDMENTS

DATE	NO.	DESCRIPTION OF REVISION OR AMENDMENT
07/12/2012	0	Draft Integrated Environmental Management Programme for the Proposed Paardeplaats Coal Mine
18/02/2013	**1**	Updated hydrology and ecology sections
22/02/2013	**2**	Final Integrated Environmental Managament Programme for the Proposed Paardeplaats Coal Mine

EXECUTIVE SUMMARY

INTRODUCTION

Exxaro Coal Mpumalanga (Pty) Ltd (hereafter referred to as Exxaro) compiled and submitted a New Order Mining Right Application in terms of the MPRDA for the proposed Paardeplaats Coal Mine in 2011. The application was subsequently accepted on 19 July 2012. As required by the MPRDA, the acceptance of the application required the applicant to undertake a full Scoping, EIA and EMP in support of the application.

The proposed Paardeplaats Coal Mine is located on Portions 13, 28, 29, 30 and 40 of the farm Paardeplaats 380 JT and Remaining Extent and Portion 2 of the farm Paardeplaats 425 JS. The area under application is approximately 1 415 ha and falls within the jurisdiction of the eMakhazeni Local Municipality in the Nkangala District Municipality. The application area lies approximately 2 km west of eMakhazeni (formerly Belfast) in the Mpumalanga Province and is linked to Mhluzi via the N4 highway.

BASELINE RECEIVING ENVIRONMENT

GEOLOGY

The proposed Paardeplaats Coal Mine is located within the Witbank Coal Field and is close to the north-eastern edge of the Karoo Basin. The Karoo sequence is represented by the Dwyka Formation consisting of diamictite and the overlaying Ecca Group. The coal seams of the Witbank Coal Field are found at the base of the Vryheid Formation of the Ecca Group and the strata in which coal seams occur consist predominantly of fine, medium and course grained sandstone with subordinate mudstone, shale, siltstone and carbonaceous shale.

All five coal seams of the Witbank Coal Field occur within the proposed Paardeplaats Coal Mine application area. The number 2 and 4 seams are more extensively developed than seams 1, 3 and 5. In the far north–east portion of the application area a dolerite sill is believed to have completely displaced coal seams. The dolerite sill is likely a post depositional feature related to the Lesotho Basalts.

TOPOGRAPHY

The proposed project area lies between 1 840 and 1 880 metres above sea level, with the highest point occurring in the southern part. The terrain is comprised of undulating plains, with slopes of between 3% and 8%. The site is has relatively steeply-incised streams in various sections that drain into water catchment dams/ponds within the area. The landscape contains no especially vivid, distinguished, uncommon or rare visual features or abstract attributes; although the wide open spaces and the ability of the landscape to attract nature lovers and other tourists renders the landscape more than able to elicit evocative responses from the viewer.

CLIMATE

The climate of the study area is typical of the South African Highveld with warm summers and cold winters. The climate has warm, moist summers with cool, dry winters. On average, 85% of the annual average rainfall of 757 mm falls in the growing season (October to March). Frost, often severe, occurs in winter. The extreme maximum temperature is 35.6^{o}C and the extreme minimum temperature is –13.3^{o}C.

SOILS

The soils are of light texture, slightly sandy loam to loamy soils, are highly weathered, slightly to strongly acidic, with low to moderate organic carbon. The P and K levels are very low. The map units with the highest agricultural potential are the dHu and dCv map units. The other map units have moderate to very low agricultural potential.

In general, the greater part of the area contains deep soils intermixed in certain areas with soils of varying depths from shallow to moderate; with predominantly yellow-brown and red (occasionally reddish-brown) colors. The soils are weakly structured to structureless across the entire area, with rock outcrops and surface stones in places. The south western portion of the site is dominated by shallower soils mixed with some moderately deep soils. Wetland areas (including streams and dams) occur in the lower-lying positions in various portions of the site

LAND USE

The current land uses on site comprises of a mixture of commercial agriculture (arable and grazing), irrigation in the south-west for the Hadeco cold climate bulb operation and workers village as well as stands of exotic plantations. Most of the commercial agriculture on site involves the farming of maize monoculture as well as grazing for livestock such as cattle, sheep, springbok, and blesbok. Some dams are present and used for trout fishing on a small commercial scale and recreationally by surface rights holders.

LAND CAPABILITY

The current land capability of the proposed project area is a mixture of arable, grazing, wilderness, wetland and other land capability classes. Moderate and High arable potential are the most prevalent land capabilities within the area followed by grazing. For the areas that are best suited for grazing, the prevailing climatic and other conditions in the area mean that the approximate grazing capacity is around 7-8 ha/LSU.

SOCIO-ECONOMIC

The Nkangala District Municipality (NDM) is one of the three district municipalities in Mpumalanga. Local municipalities forming part of the Nkangala DM are Delmas, Dr. JS Moroka, Emalahleni, eMakhazeni, Steve Tshwete, and Thembisile, as well as the Mdala District Management Area. The district is approximately 17 000 km^2 and consists of about 165 towns and villages, with Emalahleni and Middelburg being the primary towns. The Nkangala DM has a population of approximately 1.1 million people. The district's economy is dominated by electricity, manufacturing and mining. Community services, trade, finance, transport, agriculture and construction) are also important sectors. Nkangala's Integrated Development Plan (IDP) states that the district has extensive mineral deposits, including chrome and coal. Another important economic activity in Nkangala is agriculture. The southern regions of the municipality are suitable for crop farming, specifically for fresh produce such as maize and vegetables, while cattle and game farming occur in the northern regions.

In terms of the population profile of the Nkangala DM, the majority of its inhabitants are extremely poor and do not have access to mainstream economic activities. The main poverty concentration is amongst the communities residing in Dr. JS Moroka and Thembisile Local Municipalities. The most important employment centre for these communities is the City of Tshwane, reducing their reliance on NDM and daily commuting by means of public transport is a necessity.

CULTURE AND HERITAGE

The proposed Paardeplaats operation is located within an area rich in heritage and cultural features which range from graves, historical structures, a potential rock art site, and historic mining shafts. 33 features have been identified and assessed.

ECOLOGY

651 ha (46%) of the site is considered natural vegetation of the Eastern Highveld Grassland, according to Mucina & Rutherford (2006), which is under severe pressure from grazing. This regional vegetation unit is classified as Endangered. According to the latest national land cover 2000 dataset, 77% of the study area is considered to be natural and 20% is considered to be transformed. The vegetation community associated with the outcrops contains the highest species richness, but in the context of study area all the remaining natural vegetation has a high sensitivity and therefore a high conservation significance. In terms of persistent grassland within the study area, two areas are of very high conservation significance, the area to the northeast (most of Portion 13 and a small area of Portion 29) and the area along the Steelpoort River (most of Portion 40, and parts of Portions 28, 29, 2, and RE).

The study site sustains a remarkably high diversity of bird species including many with strong highveld affinities (Portions 13, 28, 40, 2, and RE). However, anecdotal evidence suggests that the long-term effect of the current grazing regime in the region will be detrimental for the persistence of conservation-dependant bird species on the site, such as the Blue Crane (*Anthropoides paradiseus*), the African Marsh Harrier (*Circus ranivorus*), the Lesser Kestrel (*Falco naumanni*), the Southern Bald Ibis (*Geronticus calvus*), the Secretarybird (*Sagittarius serpentarius*), and the Broad-tailed Warbler (*Schoenicola brevirostris*). This study area also has two distinct areas of high herpetofauna sensitivity and it is likely that the three species of conservation concern may occur here (Portions 28, 2, and RE, most of Portions 13 and 40, and a small area of Portion 29). In addition, there is a strong presence of carnivores such as the Side-striped Jackal (*Canis adustus*), the Brown Hyaena (*Hyaena brunnea*), and the Serval (*Leptaiurus serval*), within the study area that suggests the area is exhibiting an overall sound system health. Preliminary evidence suggests that up to eight servals (IUCN Near-Threatened) are resident on the study area and in the neighbouring Glisa Coal Mine.

WETLANDS AND AQUATIC ECOLOGY

Approximately 27% of the Paardeplaats study area is considered to be covered by wetlands, making up a combined wetland extent of over 338 ha (Table 48). A number of different wetland types were identified, with hillslope seepage wetlands being the dominant wetland type and making up more than 70% of the wetland area on site. Several dams were also identified within the wetlands, totalling just over 27 ha. According to the Ecological Importance and Sensitivity Assessment, the majority of the wetlands in the study area are considered to be of High (42.75%) and Moderate (41.78%) ecological importance and sensitivity, and a small proportion (15%) are considered to be of Low importance and sensitivity. Compared with other pans and dams sampled in the Mpumalanga Highveld, the diversity of aquatic macro invertebrates at Paardeplaats was relatively high. A total of 31 macro invertebrate SASS5 taxa were sampled.

SURFACE WATER

The proposed Paardeplaats Coal Mine is located on quaternary B41A of the Olifants River catchment (Primary catchment B). A small part of the area of investigation falls into quaternary catchment X11D of the Crocodile/ Komati Catchment (Primary Catchment X). The area forms part of the headwaters of two river systems, one flowing to the northwest (Steelpoort River) and the other to the south (Komati River). The topographic elevation ranges from 1800 to 1905 metres above mean sea level (mamsl). A number of small sized dams are located on the streams feeding onto major rivers within the area.

GEOHYDROLOGY

In terms of ground water, the water bearing strata is mainly the sandstones above the coal seams with the major flow path being on the contact between the sandstone and coal strata. The water quality samples on site range from relatively good to slightly deteriorated likely due to contamination from either mining or agricultural land uses.

AIR QUALITY

Power generation, mining activities, farming and residential land-uses occur in the vicinity of the proposed Paardeplaats project. These land-uses contribute baseline emission sources via vehicle tailpipe emissions, household fuel combustion, biomass burning and various fugitive dust sources. Long-range transport of particulates, emitted from remote tall stacks and from large-scale biomass burning in countries to the north of South Africa, has been found to contribute significantly to background fine particulate concentrations over the interior. The largest contributor to particulate emissions is as a result of vehicle entrainment on the unpaved roads.

NOISE

The study area is one of changing character. Previously, and still in some areas, the main land use is agricultural and a rural noise climate prevails. Residual noise levels at the various farmhouses and farm labourers' dwellings which are remote from the main roads and the mines are relatively low (quiet). Daytime ambient conditions across the area range from about 42 dBA to 53 dBA near the main road. Evening conditions range from about 30 dBA to 39 dBA, while the night-time ambient levels fall even lower to about 25 dBA in places. These are acceptable rural residential conditions (SANS 10103). Residual noise levels at some of the schools do not meet the noise standards required for educational purposes, namely they exceed 50 dBA during school hours. There are numerous noise sensitive receptors in the area that potentially will be impacted by the mining of the new pit, namely schools, farmhouses, farm workers' dwellings, eMakhazeni (Belfast) and Siyathuthuka. The existing noise climate alongside many of the roads through the area is degraded with regard to residential living. The operations at the Glisa Mine to the north of the planned Paardeplaats Project have raised ambient noise levels in this sector of the study area significantly.

VISUAL

The area has a low to moderate visual complexity, as it includes scenes with water and topographic interest. The landscape also has a moderate visual complexity as there is an amount of natural landscape within the long views of this area, punctuated at intervals by agricultural development and mining development. The landscape contains no especially vivid, distinguished, uncommon or rare visual features or abstract attributes; although the wide open spaces and the ability of the landscape to attract nature lovers and other tourists renders the landscape more than able to elicit evocative responses from the viewer.

TRAFFIC

The main route to the proposed Paardeplaats site is Spitkskop Road and the results from the traffic counts can be summarised as follows:

- During the AM peak hour approximately 114 vehicles are travelling on the road to the east and 70 to the west of the site;
- Of the 114 vehicles to the east, 40% are heavy vehicles and this decreases to 18% west of the site;
- During the PM peak hour approximately 78 vehicles are travelling to the east of the site and 41 vehicles to the west; and
- Approximately 41% are heavy vehicles.

The major road in the area is Vermooten Street (R33) and traffic flows on this road can be summarised as follows:

- Approximately 400 vehicles travel on this road during the AM peak hour in both directions with the flow evenly split between northbound and southbound traffic;
- In the PM peak hour approximately 530 vehicles travel in both directions with the heaviest flow being northbound.

The N4 Road carries approximately 1 060 vph during the AM peak hour in both directions of which the majority is eastbound. During the afternoon peak, the N4 Road carries approximately 1 020 vph in both directions. The peak direction in the afternoon is in a westerly direction.

PROJECT DESCRIPTION

The proposed Paardeplaats Coal Mine is best viewed conceptually as an extension of the bordering NBC Glisa. Paardeplaats is proposed as an open cast mining development where a hybrid of roll-over and bench/box cut mining techniques will be employed to access and mine coal from both shallow and deeper target seams. The project is aimed at supplying Run of Mine (RoM) to NBC Glisa for minerals processing at a rate of 4.2 – 4.4 million tonnes per annum (mtpa) and supply Eskom’s power stations at a rate of 2.4 mtpa.

All mineral processing and waste disposal will be undertaken at NBC Glisa and as such the Paardeplaats Coal Mine requires limited infrastructure. Infrastructure that is required, and that has been applied for includes haul roads, dewatering pipelines, pollution control dams, a pit dewatering dam, diesel storage and a temporary general waste storage facility.

ALTERNATIVES

Three feasible project alternatives have been identified and impacts assessed for all project phases. The alternatives identified and assessed include:

- Alternative 1 No Go;
- Alternative 2 Maximum Mine Production; and
- Alternative 3 Sensitivity Planning Approach.

Alternative 1 implies that proposed Paardeplaats Coal Mine does not go ahead. The No Go Alternative will result in few if any mining related impacts being experienced by the receiving environment of the proposed site. The bio physical impacts likely to be experienced by the selection of this alternative include those related to agriculture, grazing and the Hadeco's cold climate bulb operation. The No Go Alternative will also allow for the following:

- Continuation of the Hadeco operations;
- Continued employment of 60 + (12-150) seasonal workers; and
- Continued employment of an additional 85 employment positions at Hadeco's Head Office as a result of its Belfast operations.

However, if the proposed Paardeplaats mining development does not proceed it is likely that no additional socio-economic benefits would be created in the area, the mineral resource will be lost and future secure supply of coal to Eskom may be compromised. In addition, the continued operation of NBC Glisa Coal Mine is likely to be halted as the proposed Paardeplaats Coal Mine is envisaged to act as an extension of Glisa to assist in the current mines rapidly dwindling RoM and LoM. Further implications of the No-Go option include:

- Loss of approximately 161 employment options at the NBC Glisa Coal Mine;
- Loss of economic input into the area; and
- Loss of regional socio-economic benefit.

Alternative 2 implies that the proposed Paardeplaats Coal Mine will mine and utilise mineral resources as delineated in the Mine Works Programme (MWP). The implications of Alternative 2 are as follow:

- Mining operation will move closer toward the town of Belfast;

- Increase in resident complaints and conflict as mining moves closer exacerbated by historical grievances with Glisa;
- Mining operation will require the resettlement of the Hadeco Village;
- Loss of 60 permanent employment opportunities at Hadeco;
- Loss of 62 seasonal employment opportunities at Hadeco;
- Loss of 85 employment opportunities at Hadeco's Head Office;
- Disruption of livelihoods at the Hadeco Village;
- Removal of Hadeco's infrastructure;
- Retention of 161 employment opportunities at Glisa;
- Potential limited additional employment opportunities at Glisa;
- Increase in net income;
- Increased economic input into the area;
- Increase in regional socio-economic benefit
- Increase in infrastructure investment; and
- Loss of *net employment* opportunities due to Hadeco Relocation, possibly abroad.

The Maximum Mine Production Alternative will have severe socio-economic impacts that will prove incredibly difficult to manage. In terms of bio-physical aspects, the Maximum Mine Production Alternative is likely to experience similar impacts in nature to the Sensitivity Planning Approach however these impacts will be exacerbated by the extension of both the temporal and spatial scale of the proposed mining operation. The increase in both scale and time is significant in terms of cumulative impacts and the capacity to manage impacts and remediate environmental contamination and pollution. Notable impacts exacerbated by the selection of this Alternative include the destruction of 220 ha of wetland, the possible relocation of 5 informal cemeteries with a total of 136 graves, inter catchment water quality impacts and increases in fall out dust and noise nuisances due to increased infrastructure requirements as well as the relocation of Hadeco and its employees which include 39 families.

Alternative 3 Sensitivity Planning Approach focused on restricting the actual mining footprint and emphasised resource (bio-physical and socio-economic) protection. In terms of the bio-physical environment, the (relative) advantages of the Sensitivity Planning Approach Alternative are as follows:

- Located in an area of no mammalian importance;

- Located in an area of moderate to low with small area of very high avifauna importance;
- Located in an area not considered to have any herpto fauna conservation importance;
- In a location of equal parts natural, successional and transformed habitat;
- 46 ha of wetland (Two class D, one class C and a portion of a Class B);
- Ground water flow is toward Glisa;
- Lower impact in terms of fallout dust from vehicle entrainment;
- Mining activity restricted to a single sub-catchment that is already heavily impacted on by NBC Glisa; and
- Potential disturbance of 2 heritage structures and one informal cemetery with 2 graves.

The mining of only Portion 30 also allows for off-set planning in an eco-system displaying sound ecological health. With regards to wetlands, if an off-set ratio of 5:1 is assigned then the remaining wetlands on site can be used to off-set the loss of 46 ha wetlands (as a result of mining Portion 30) and preserving 231.95 ha as well as habitat for fauna and flora, possibly turning the land into a designated conservation area thereby sterilising it from further development and maintaining the ecological integrity of remaining areas within the second sub-catchment

In terms of the socio-economic environment, the (relative) advantages of the Sensitivity Planning Approach Alternative are as follows and pronounced:

- Retention of 161 employment opportunities at Glisa;
- Increased economic input into the area;
- Maintenance of regional socio-economic benefit
- Retention of 60 permanent employment opportunities at Hadeco;
- Retention of 62 seasonal employment opportunities at Hadeco;
- Retention of 85 employment opportunities at Hadeco's Head Office;
- Maintenance of Hadeco's highly specialised operations on Portion 28 and 40 respectively;
- Maintenance of Hadeco's infrastructure;
- Maintenance of livelihoods at the Hadeco Village; and
- Net positive increase in both *employment* and *income*.

In summary, the advantages of Alternative 3, the Sensitivity Planning Approach are two-fold. Firstly, Alternative 3 allows for the continuation of existing land uses on other portions within the application area, most notably the highly specialised Hadeco cold climate bulb farming operation and for mining. This in turn provides the local economy a net gain in terms of both income and employment in a municipality in which both are required. The concurrent existence of both land uses also results in less socio-economic disruptions to the livelihoods of people living and working within the application area, particularly those of the Hadeco Village. Secondly, Alternative 3 allows for a reduction in temporal and spatial scales of mining related impacts as the mining operation is confined to Portion 30 only. The reduction in both scale and time is significant in terms of cumulative impacts and the capacity to manage environmental impacts as well as remediate environmental contamination and pollution. Alternative 3 Sensitivity Planning Approach is the preferred development alternative and this is supported by reccomendations from the EAP and several other specialist consultants.

SPECIALIST STUDIES

The compilation of the EIA and EMP for the proposed Paardeplaats Coal Mine required the input and contribution from several specialists namely:

- Air quality;
- Blasting and vibration;
- Closure costing, rehabilitation and final land use;
- Ecology (Fauna and Flora);
- Heritage;
- Hydrology (Ground and Surface water);
- Noise;
- Socio-Economic;
- Soils, land use and land capability;
- Traffic;
- Visual; and
- Wetlands and aquatic ecology.

Specialist studies where undertaken to determine the baseline receiving environmental conditions, identify and assess potential impacts of all project phases and provide suitable mitigation measures.

SIGNIFICANT IMPACTS IDENTIFIED AND ASSESSED

As a result of the impact assessment a detailed list of significant impacts is provided below and for each project phase. The selection criteria for impacts deemed “significant” is simply the final score calculated post mitigation and with the addition of the prioritisation factors described in the assessment methodology, which includes cumulative impacts, loss of irreplaceable resources and I&AP comment or concern. The list below includes significant positive and negative impacts during each project phase.

SIGNIFICANT PRE-CONSTRUCTION IMPACTS

- Skills development
- Co-operative governance
- Resettlement of Hadeco Village

SIGNIFICANT CONSTRUCTION PHASE IMPACTS

- Increase in HIV/Aids and other infectious diseases
- Skills development
- Co-operative governance
- Chemical pollution of soil
- Transformation of vegetation
- Loss of biodiversity
- Spread of alien invasive species
- Loss of aquatic ecosystems
- Decline in water quality
- Biodiversity loss in aquatic ecosystems
- Loss of wetland habitat
- Elevated PM_{10} levels
- Alteration of natural drainage patterns
- Alteration of ground water levels
- Wetland dewatering

SIGNIFICANT OPERATION PHASE IMPACTS

- Damage/destruction of palaeontological resources
- Increase in HIV/Aids and other infectious diseases
- Skill development
- Co-operative governance
- Net employment
- Income generation
- Reduction in agricultural potential
- Loss of soil fertility
- Soil erosion hazard
- Soil compaction
- Chemical pollution of soil
- Change in natural landscape
- Transformation of vegetation
- Damage to habitat
- Habitat destruction
- Loss of biodiversity
- Direct and indirect mortality
- Red Data and protected species
- Spread of alien invasive species
- Decline in water quality: seepage
- Biodiversity loss in aquatic ecosystems
- Elevated PM_{10} levels
- Noise nuisance
- Visual impact of dust
- Day time visual impact
- Surface water contamination

- Alteration of ground water levels
- Contamination of ground water
- Wetland dewatering

SIGNIFICANT DECOMMISSIONING PHASE IMPACTS

- Reduction in agricultural potential
- Soil compaction
- Soil erosion hazard
- Transformation of vegetation
- Spread of alien invasive species
- Decline in water quality: Acid Mine Drainage and decant
- Biodiversity loss in aquatic ecosystems
- Increased surface runoff
- Water quality deterioration due to Acid Mine Drainage
- Elevated PM_{10} levels
- Visual impact of dust
- Alteration of ground water levels
- Contamination of ground water
- Contamination of surface water through groundwater decant

SIGNIFICANT REHABILITATION AND CLOSURE PHASE IMPACTS

- Reduction in agricultural potential
- Soil compaction
- Reduction in soil fertility
- Decline in water quality: Acid Mine Drainage and decant
- Biodiversity loss in aquatic ecosystems
- Increased surface runoff
- Alteration of ground water levels

- Contamination of ground water
- Contamination of surface water through groundwater decant

Each of the significant impacts identified above have been individually assessed and described in Section 7 of this report.

PUBLIC PARTICIPATION

The initial identification of I&AP's was undertaken using the existing NBC Glisa I&AP database as well as Windeed searches to determine registered landowners on properties under application and registered landowners in the surrounding area. From the initial list of I&AP's a database was compiled that separated I&AP's into the following four broad categories:

- Registered landowners and lawful occupiers of properties under application;
- Registered landowners of surrounding properties and key individuals;
- Authorities and government departments; and
- Organisations, agencies, groups, unions and companies.

Throughout the project, any and all I&AP's who have expressed interest in the project or have been identified through the dissemination of notification documents have been captured and added to the database for the proposed Paardeplaats Coal Mine.

INTRODUCTORY OPEN DAY

After initial I&AP notification period an introductory open day was held at the Belfast Gold Club on 31 August 2012. The open day ran from 09:00 to 18:00 and was held in an informal manner in which I&AP's were provided individual time with the EAP.

The purpose of the introductory open day was to introduce I&AP's to the proposed project, explain the process going forward, inform them that the Draft Scoping Report was available for review and to solicit any further comment, concerns, suggestions and objections to the proposed project. I&AP's were afforded 45 days to review the Draft Scoping Report and provide comment by 15 September 2012 for inclusion into the final document that was submitted to MDEDET and re-submitted to DMR. From the initial open day it was gathered that most I&AP's expressed historical grievances with NBC Glisa over concerns regarding blasting, vibration, noise and dust.

EIA FEED BACK OPEN DAY

The second I&AP open day was held on 18 January 2013 at the Belfast Golf Club. It ran fron 19:0 to 16:00 and was held in an informal manner in which I&AP's were provided individual time with the EAP to discuss the project.

The purpose of the second open day was to present the results of the EIA and specialist studies to I&AP's, discuss the suggested mitigation measures and project alternatives as well as a review of the Draft Environmental Management Programme.

I&AP's were provided 42 days from 19 December 2012 to 15 February 2013 (excluding the period from 19 December 2012 – 03 January 2013) to review the Draft Integrated Environmental Management Programme and provide comment for inclusion into the final EMPR to be submitted to MDEDET and re-submitted to DMR.

FINANCIAL PROVISIONS

The calculations for the financial provision for closure were calculated in line with the master rates provided by the DMR and adjusted for 2012 CPI as referenced in the Mine Closure Quantum Guideline document. As two operating project alternatives were assessed, two closure cost calculations have been undertaken for Alternative 2 Maximum Mine Production and Alternative 3 Sensitivity Planning Approach

The closure cost liability for Alternative 2 Maximum Mine Production is as follows:

- Clean Closure Liability Cost: R 59 440 341.00; and
- Total Closure Liability (including preliminary & general and VAT): R 73 230 500.00

The closure cost liability for Alternative 3 Sensitivity Planning Approach is as follows:

- Clean Closure Liability Cost: R 19 075 122; and
- Total Closure Liability (including preliminary & general and VAT): R 26 790 627.00

The future post mining land use of the proposed Paardeplaats Coal Mine is aligned with that of NBC Glisa and is aimed at re-establishing grazing and wilderness land supporting both wetlands and dams in approximate locations where these uses existed prior to mining.

CONCLUSION

The proposed Paardeplaats Coal Mine, if approved, is likely to have several significant environmental impacts. If approved it is the recommendation of the EAP that Alternative 3 - Sensitivity Planning Approach be approved due to the limited temporal and spatial scales of environmental impacts and the fact that established land users such as Hadeco will be allowed to continue their operations on adjacent properties.

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SECTION 1: ENVIRONMENTAL IMPACT ASSESSMENT

1 INTRODUCTION

This report represents an Integrated Environmental Management Programme. As an Integrated Environmental Management Programme, the report has been designed to meet the requirements for conducting an Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) as stipulated in the Regulations contained in the Mineral and Petroleum Resources Development Act (MPRDA, Act No. 28 of 2002) and the National Environmental Management Act (NEMA, Act No. 107 of 1998) respectively.

This Integrated Environmental Management Programme is submitted in support of the Mining Right Application submitted by Exxaro Coal Mpumalanga (Pty) Ltd; a wholly owned subsidiary of Exxaro Coal (Pty) Ltd for the proposed Paardeplaats open cast Coal Mine, located close to the town of Belfast, Mpumalanga.

The proposed Paardeplaats Coal Mine is planned as operating as an extension of the bordering Glisa North Block Colliery (NBC) also owned and operated by Exxaro. As an extension of NBC Glisa, the Paardeplaats Coal Mine require limited infrastructure as all supporting services such as minerals processing and waste disposal are to be undertaken on site at NBC Glisa and through the use of its existing infrastructure.

The need for the Paardeplaats Coal Mine is due to the dwindling coal reserves at NBC Glisa. NBC Glisa's Life of Mine (LoM) is estimated at between 4-12 years and requires further coal product to meet its contractual obligations to supply existing Eskom power stations in the short to medium term.

1.1 PROJECT BACKGROUND

Exxaro Coal Mpumalanga (Pty) Ltd (hereafter referred to as Exxaro) compiled and submitted a New Order Mining Right Application in terms of the MPRDA for the proposed Paardeplaats Coal Mine in 2011. The application was subsequently accepted on 19 June 2012. As required by the MPRDA, the acceptance of the application required the applicant to undertake a full Scoping, EIA and EMP in support of the application.

To this end Exxaro have submitted a Draft Scoping Report to the Department of Mineral Resources (DMR) Mpumalanga on 19 July 2012 in order to comply with the stipulated deadline in the acceptance letter. Following submission of the Draft Scoping Report, the Public Participation Process was started on 1 August 2012 and included the identification and notification of all Interested and Affected Parties (I&AP's), notice of the first Public Participation Open Day and notice that the Draft Scoping Report was available for review.

The first Public Participation Open Day was held on 31 August 2012 at the Belfast Golf Club from 09:00 to 18:00. The purpose of the open day was to introduce I&AP's to the project and solicit comment for inclusion and opinion on the Draft Scoping Report. I&AP's were afforded 45 days to register, review the Draft Scoping Report and submit comment for inclusion into the Integrated Scoping Report to be simultaneously submitted to both DMR and Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET).

The final Integrated Scoping Report was completed, with input from I&AP's and submitted to the DMR and MDEDET respectively on the 15 October 2012 at their regional offices in Witbank. Copies of the report were also sent through to the Department of Water Affairs (DWA) Lydenburg for review.

This document is the final Integrated Environmental Management Programme (EMPR) due for submission on 1 March 2013 to the DMR, MEDET, and DWA. I&AP's where notified when the draft report was available for review and informed of the second Public Participation open day held on 18 January 2013 at the Belfast Golf Club to discuss the results of the EIA. I&AP's were provided until 14 February 2013 to review the report and provide comment for inclusion into the final EMPR. The surface water, ground water, and ecology specialist reports were updated in January and February 2013 and I&AP's have been informed that they have until 2 March 2013 to review the updated documents and provide comment to the DMR or to EIMS to forward on to the DMR.

1.2 BRIEF PROJECT DESCRIPTION

The proposed Paardeplaats Coal Mine is best viewed conceptually as an extension of the bordering NBC Glisa. Paardeplaats is proposed as an open cast mining development where a hybrid of roll-over and bench/box cut mining techniques will be employed to access and mine coal from both shallow and deeper target seams. The project is aimed at supplying Run of Mine (RoM) to NBC Glisa for minerals processing at a rate of 4.2 – 4.4 million tonnes per annum (mtpa) and supply Eskom's power stations at a rate of 2.4 mtpa.

All mineral processing and waste disposal will be undertaken at NBC Glisa and as such the Paardeplaats Coal Mine requires limited infrastructure. Infrastructure that is required, and that has been applied for includes haul roads, dewatering pipelines, pollution control dams, a pit dewatering dam, diesel storage and a temporary general waste storage facility. A detailed project description is provided in Section 4 of this report.

1.3 PROJECT LOCATION

The proposed Paardeplaats Coal Mine is located on Portions 13, 28, 29, 30 and 40 of the farm Paardeplaats 380 JT and Remaining Extent and Portion 2 of the farm Paardeplaats 425 JS. The area under application is approximately 1 415 ha and falls within the jurisdiction of the eMakhazeni Local Municipality in the Nkangala District Municipality. The application area lies approximately 2 km west of eMakhazeni (formerly Belfast) in the Mpumalanga Province. It is linked to Mhluzi via the N4 highway. The registered surface rights holders of the land parcels under application are provided below:

Table 1: List of land parcels and surface rights holders

Farm Name	Farm Portion	Registered Owner
Paardeplaats 380 JT	13	Neville Wilkie, Petro Wilkie, Sue Sabaggha & Marguerite Eiselen
Paardeplaats 380 JT	28	Exxaro
Paardeplaats 380 JT	29	Hadeco
Paardeplaats 380 JT	30	Exxaro
Paardeplaats 380 JT	40	Hadeco
Paardeplaats 425 JS	2	Exxaro
Paardeplaats 425 JS	RE	Exxaro

The application area lies approximately 2 km west of eMakhazeni (formerly Belfast) in the Mpumalanga Province (Figure 1). It is linked to Mhluzi via the N4 highway.

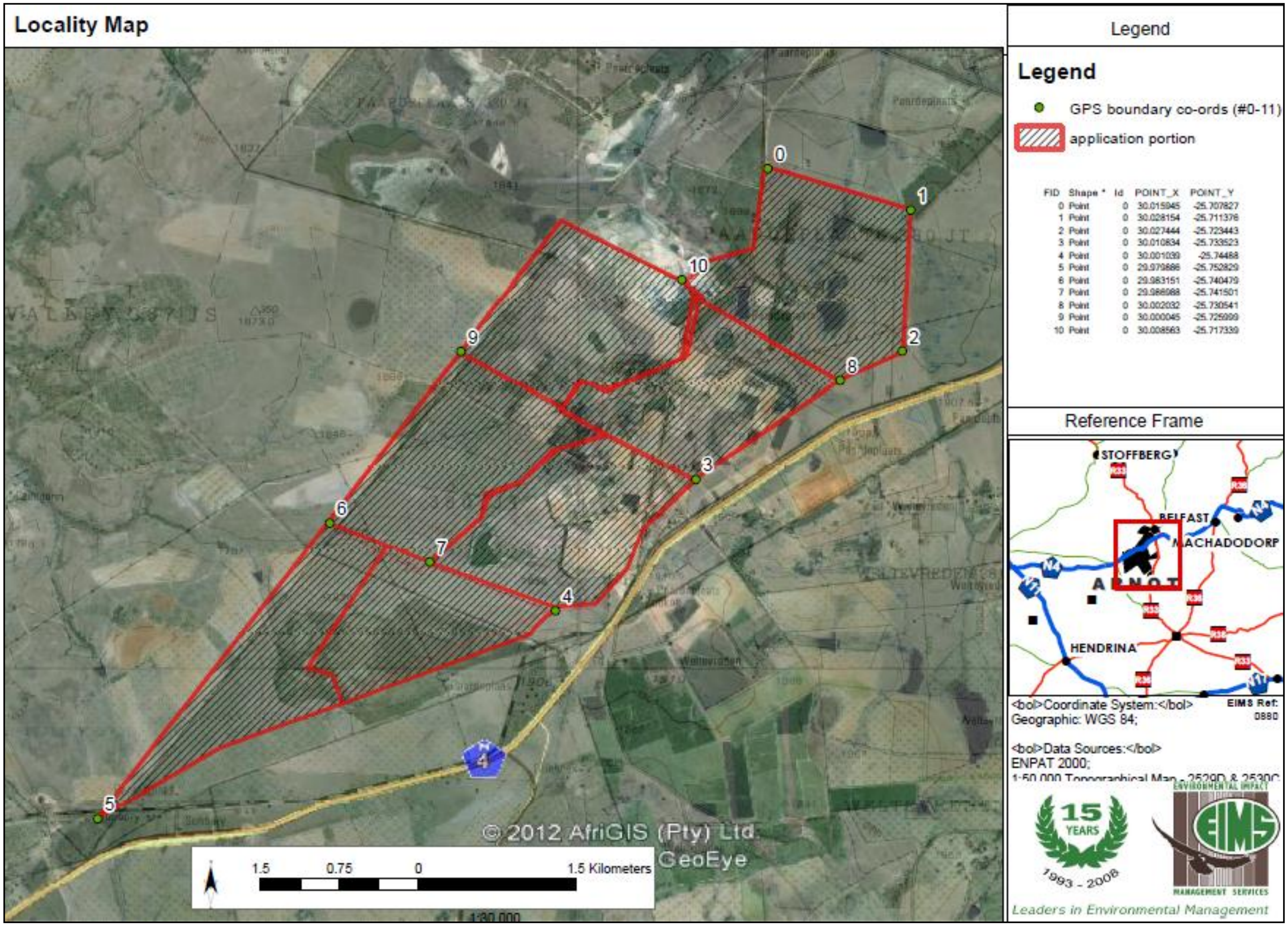

Figure 1: Map of the proposed Paardeplaats mining area

1.4 CONTACT DETAILS OF THE APPLICANT

The applicant is Exxaro Coal Mpumalanga (Pty) Ltd. The relevant contact person for the project is Igna Dougal and her details are provided below:

Table 2: Applicant contact details

ITEM	COMPANY CONTACT DETAILS
Name	Exxaro Coal Mpumalanga (Pty) Ltd
Tel no	+27 83 259 5822
Fax no:	+ 27 13 665 7630
Cellular no	+ 27 83 259 5822
E-mail address	Igna.Dougal@exxaro.com
Postal address	Exxaro Resources (Pty) Ltd P.O. Box 9229 Pretoria

1.5 PROJECT MOTIVATION

1.5.1 WHY COAL MINING?

Coal, because of its strategic importance is one of the five minerals selected by the Department of Mineral Resources (DMR) for local beneficiation as it is considered critical to the on-going development of South Africa (Beneficiation Strategy for the Minerals Industry, June 2011). The driving force behind the emphasis of the importance of coal, coal mining and local beneficiation is primarily due to concerns voiced by Eskom over the future security of supply in both the medium and long term of the mineral to its coal fired electricity generating power stations.

Eskom's existing coal fired power stations are critical in terms of electricity production and in meeting the growing energy requirements of South Africa as a whole. Coal and coal supply is consequently seen as critical and its importance is detailed in the Eskom Transmission Ten Year Development Plan 2011-2020 (Eskom, 2011). Without steady, secure supply of the mineral, it is unlikely that Eskom will be able to meet the energy demands of the country.

Furthermore, Eskom's concern over coal supply to its power stations has been heightened due to competition from Indian buyers for the low grade coal required by the Indian Sub-Continents electricity generating power stations. Until recently there has been no viable export market for such low grade coal.

As a result coal mining, beneficiation and supply is of paramount importance to Eskom for continued electricity generation in order to meet the rising energy demands of the country in the short, medium and long term.

1.5.2 WHY THE PROPOSED PAARDEPLAATS COAL MINE?

The existing approved NBC Glisa Coal mine has an existing agreement to supply Eskom with coal for their Tutuka, Komati, Arnot, Camden, and Majuba coal fired power stations. However, the remaining estimated LoM of NBC Glisa is between 4-8 years and as a result of the reduction in run of mine (RoM) and corresponding reduction in LoM of NBC Glisa, the proposed Paardeplaats Coal Mine is required by Exxaro in order to meet its contractual obligations to Eskom, which are to provide steady and secure coal to its power stations. As such, the Paardeplaats Coal Mine is proposed as a viable mining option in order to meet these energy requirements.

It is anticipated that the proposed Paardeplaats Coal Mine will target a RoM production rate of between 4.2 – 4.4 mtpa and the available reserve is approximately 76.65 million tonnes which equates to approximately 20 years' worth of coal production and 20 years' worth of secure supply to Eskom. On occasion the Paardeplaats Coal Mine may also produce coal of export quality, namely A-Grade and P-58 coal which will be exported to markets in Asia, Europe and the USA (Exxaro Paardeplaats Mine Work Programme, 2011).

The proposed Paardeplaats Coal Mine is located directly south of and borders NBC Glisa. In essence, the proposed Paardeplaats project can be viewed as an extension of Glisa and its mining and mineral processing operations. As an extension and due to the close proximity of the proposed Paardeplaats Coal Mine to NBC Glisa, certain advantages are conferred.

Firstly, the location of the proposed Paardeplaats Coal Mine allows for the continued re-use of existing approved mine infrastructure of NBC Glisa. Infrastructure that will be re-used is listed below and includes (but is not limited to):

- Haul roads;
- RoM Stockpile area;
- Slurry and Co-Disposal facilities;
- Water treatment plant;
- Tailings; and

- Waste facilities.

The re-use of the infrastructure mentioned above will allow for an overall reduction in the environmental footprint of the proposed Paardeplaats Coal Mine. The overall reduction in the environmental footprint of the proposed Paardeplaats Coal Mine will also confer benefits downstream in terms of a (relatively) reduced environmental impact and consequent rehabilitation plan. In addition to the advantages of infrastructure re-use, the proposed Paardeplaats Coal Mine will also provide the following opportunities:

- Long-term retention of employment at Paardeplaats Coal Mine of existing NBC Glisa Coal Mine staff;
- On-going economic input into the area;
- Establishment of infrastructure;
- Maintenance of the regional socio-economic benefit;
- Secure on-going local supply of coal to Eskom which will ensure supply of electricity to South Africa; and
- Supply markets in Asia, Europe, and the USA with export quality coal.

1.5.3 CONCLUSION

In summary, the proposed Paardeplaats Coal Mine is of critical importance to Exxaro as it will allow the applicant to continue producing a secure, steady supply of coal to Eskom in order to meet its contractual obligations in the medium to long term. The secure, steady supply of coal to Eskom also aligns directly with the goals of the energy producer, as the proposed Paardeplaats Coal Mine will produce 20 years, if mining proceeds as per the Mining Schedule (Paardeplaats Mine Works Programme, Exxaro, 2011), worth of coal supply for power generation and occasional export.

The continued use of existing minerals processing and waste disposal facilities of NBC Glisa will also confer additional advantages as infrastructure for the proposed Paardeplaats Coal Mine will not need to be developed and installed, thereby reducing the overall environmental footprint and impact on the receiving environment of the proposed mining development.

1.6 THE ENVIRONMENTAL ASSESSMENT TEAM

Exxaro has appointed Environmental Impact Management Services (Pty) Ltd (hereafter referred to as EIMS) to act as the independent Environmental Assessment Practitioner (EAP) for the proposed Paardeplaats project. EIMS then appointed a team of specialists from a broad range of fields to undertaken specialised and diverse studies required for the project.

1.6.1 ENVIRONMENTAL IMPACT MANAGEMENT SERVICES (PTY) LTD

Environmental Impact Management Services (Pty) Ltd (EIMS) was founded in 1993 and has steadily grown to be a significant player in the environmental management consulting industry in South Africa and the rest of Africa. EIMS is responsible for project management and the compilation of the, EIA/ EMP, EMPR and IWULA for the Paardeplaats project with the guidance and input from the independent specialists listed below.

1.6.2 SPECIALIST CONSULTANTS

The following table lists the specialists appointed to the project and responsible for their respective component of the EIA investigation:

Table 3: List of specialists appointed to the project

Component	Company Responsible
Air Quality	Airshed Planning Professionals (Pty) Ltd.
Blasting and Vibration	Blast Management & Consulting
Ecology (Fauna and Flora)	EkoInfo CC & Associates
Heritage	PGS Heritage & Grave Relocation Consultants
Hydrology (Ground and Surface Water)	Aqua Earth Consulting (AEC)
Noise	Jongens Keet Associates (JKA)
Rehabilitation, Final Land Use and Closure	Reichardt and Reichardt Consulting
Sensitive Receptors Screening	GCS (Pty) Ltd
Social	Ptersa Environmental Management Consultants

Component	Company Responsible
Economic	Strategy4Good
Soils, Land Use and Land Capability	The ARC-Institute for Soil, Climate and Water (ARC-ISCW)
Traffic	Arup Consulting
Visual	Newtown Landscape Architects (NLA)
Wetlands and Aquatic Ecology	Wetland Consulting Services (Pty) Ltd

2 LEGAL FRAMEWORK

The proposed Paardeplaats Coal Mine requires authorisation in terms of the following interlinked pieces of legislation:

- The Mineral and Petroleum Resources Development Act (MPRDA, Act No. 28 of 2002);
- The National Environmental Management Act (NEMA, Act No. 107 of 1998);
- The National Environmental Management Waste Act (NEMWA, Act No, 59 of 2008); and
- The National Water Act (NWA, Act No. 36 of 1998).

These pieces of legislation stipulate the required studies, reports and legal processes to be conducted and the results thereof submitted to the relevant authorities for approval prior to commencement.

2.1 ENVIRONMENTAL AUTHORISATION PROCESS

As a result of the requirements of the legislation listed above, the proposed project is required to undertake three processes in order to apply for environmental authorisation to the relevant authorities.

The Public Participation Processes required by all three processes has been undertaken simultaneously and will conclude with the review of the Integrated Water Use License Application review by I&AP's, pending the finalisation and submission of this Integrated Environmental Management Programme as stipulated by the Department of Water Affairs (DWA).

Two of the processes, namely the MPRDA and NEMA processes have been undertaken in parallel and have culminated in this Final Integrated Envionmental Management Programme. The comments received from I&AP's have been included in this, the final report.

The Public Participation Processes required by all three processes has been undertaken simultaneously and will conclude with the review of the Integrated Water Use License Application review by I&AP's, pending the submission of this finalised Integrated Environmental Management Programme to the Department of Water Affairs (DWA) for comment as stipulated by the DWA.

2.1.1 MPRDA PROCESS

In support of the new order mining right application submitted by Exxaro, the applicant is required as to conduct an EIA /EMP and I&AP consultations to be submitted to the DMR for adjudication. This report has been compiled in accordance with Regulations 50, 51, 52, 53 and 54 of the MPRDA in order to satisfy the criteria for an EMPR.

2.1.2 NEMA PROCESS

In terms of Chapter 5 of the NEMA, the proposed Paardeplaats Coal mine is required to conduct the necessary environmental process and submit an application for Scoping and EIA/EMP to Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET). The activities applied for are listed in Section 4.13. This report has been compiled in accordance with Regulations 31, 32 and 33 of the NEMA in order to satisfy the criteria for an EIA and EMP.

2.1.3 NWA PROCESS

Water may not be used without prior authorisation by the (DWA. Due to the requirements of the NWA, the applicant is required to compile and submit for adjudication an Integrated Water Use License Application (IWULA) for the following Section 21 water uses:

- Section 21(a) – Taking water from a water resource;
- Section 21(b) – Storing water;
- Section 21(c) - Impeding or diverting the flow of water in a watercourse;
- Section 21(d) - Engaging in a stream flow reduction activity contemplated in section 36;
- Section 21(f) – Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- Section 21(g) - Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(i) – Altering the beds, banks, course or characteristics of a water course; and

- Section 21(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.

The IWULA, under advice from the DWA is to be compiled and submitted once the final Integrated Environmental Management Programme has been completed, reviewed by I&AP's and submitted to the relevant authorities. This process will be completed in early 2013.

2.2 REPORT STRUCTURE

This document is compiled as an Integrated Environmental Management Programme Report in order to meet the legislative requirements for EIA's and EMP's as stipulated in the respective regulations of the MPRDA and NEMA. The following reference documents, listed below were consulted to develop the framework and reporting structure of this report. The reference documents include, at a minimum, the following resources:

- MPRDA EMPR Requirements:
    - Regulation 50 of GNR 527 of 23 April 2004: Mineral and Petroleum Resources Development Regulations – Contents of Environmental Impact Assessment Report;
    - Regulation 51 of GNR 527 of 23 April 2004: Mineral and Petroleum Resources Development Regulations – Environmental Management Programme; and
    - The DMR Environmental Impact Assessment and Environmental Management Programme Report Guideline and Template (2012).
- NEMA EIA/EMP Requirements
    - Regulations 31 of GNR 543 of 18 June 2010: Environmental Impact Assessment Regulations – Environmental Impact Assessment Reports; and
    - Regulation 33 of GNR 543 of 18 June 2010: Environmental Impact Assessment Regulations – Content of Environmental Management Programme.

The structure of the report is tailored to meet the requirements of the above mentioned regulations and as such the information presented, and its location in reference to the requirements of the regulations listed above is provided, below in tabular form for ease of reference.

Table 4: Report structure

EMPR Section	MPRDA Requirement as per the Guideline	NEMA Requirement
1. Introduction		Regulation 31(2)(a) Regulation 31(2)(b) Regulation 31(2)(c) Regulation 31(2)(f) Regulation 33(a)
2. Legal framework		
3. The baseline receiving environment	Regulation 50(a)	Regulation 31(2)(d) Regulation 31(2)(j) Regulation 31(2)(o)
4. Proposed mining operation description	Regulation 50(a)	Regulation 31(2)(b)
5. Potential impacts of the mining operation	Regulation 50(a) Regulation 50(c)	
6. Alternative land use and development	Regulation 50(b) Regulation 50(d)	Regulation 31(2)(g)
7. Assessment and evaluation of potential project impacts	Regulation 50(c)	Regulation 31(2)(h)

EMPR Section	MPRDA Requirement as per the Guideline	NEMA Requirement
	Regulation 50(g)	Regulation 31(2)(i) Regulation 31(2)(k) Regulation 31(2)(l) Regulation 31(2)(o)
8. List of significant impacts identified	Regulation 50(e)	
9. Stakeholder engagement	Regulation 50(f)	Regulation 31(2)(e)
10. Adequacy of predictive methods, underlying assumptions and uncertainties	Regulation 50(g)	Regulation 31(2)(m)
11. Description and arrangement for monitoring and management of environmental impacts	Regulation 50(h)	Regulation 33(b)
12. Technical supporting information	Regulation 50(d) Regulation 50(i)	Regulation 31(2)(q)
13. Environmental management principles		Regulation 33(g)
14. Duty of care responsibilities		Regulation 33(g)
15. Failure to comply with environmental considerations		

EMPR Section	MPRDA Requirement as per the Guideline	NEMA Requirement
16. Roles and responsibilities	Regulation 51(a)	Regulation 33(d)
17. Auditing and reporting procedures	Regulation 51(a)	Regulation 33(e)
18. Review and revision of the EMPR		
19. Environmental awareness plan and training	Regulation 51(b)(vi)	Regulation 33(j)
20. Action plan to achieve objectives and goals	Regulation 51(a) Regulation 51(b)(ii)	Regulation 33(b) Regulation 33(c) Regulation 33(h) Regulation 33(i)
21. Appropriate technical and management options for impacts	Regulation 51(a) Regulation 51(b)(i) Regulation 51(b)(ii)	Regulation 31(2)(p) Regulation 33(b) Regulation 33(g) Regulation 33(h) Regulation 33(i)
22. Procedure for environmental emergencies and remediation	Regulation 51(b)(iii)	Regulation 33(g) Regulation 33(i)
23. Monitoring protocols	Regulation 51(a)	Regulation 33(e)

EMPR Section	MPRDA Requirement as per the Guideline	NEMA Requirement
	Regulation 51(b)(iv)	
24. Rehabilitation monitoring	Regulation 51(b)(iv)	Regulation 33(f)
25. The EMPR performance assessment	Regulation 51(b)(iv)	
26. Mine closure	Regulation 51(a)(i)	Regulation 33(f) Regulation 33(g) Regulation 33(k)
27. Financial provision	Regulation 51(b)(v)	Regulation 33(g)
28. Technical supporting information	Regulation 51(b)(vii)	
29. Capacity to manage and rehabilitate the environment	Regulation 51(b)(vii)	
30. Undertaking signed by applicant	Regulation 51(b)(viii)	
31. Environmental impact statement and conclusion		Regulation 31(2)(n) Regulation 31(2)(o)
32. References		

3 THE BASELINE RECEIVING ENVIRONMENT

The description of the baseline receiving environment (on site and surrounding) was obtained from the studies undertaken by the specialist team and in conjunction with EIMS. All specialist studies undertaken for the proposed Paardeplaats Coal Mine are included as supporting technical appendices to this report. A list of these reports and corresponding appendices are included in Section 12.

3.1 GEOLOGY

3.1.1 INTRODUCTION AND RELATION TO IMPACT

The prevailing baseline geology and associated geological features are significant in that they provide an understanding of the following:

- Geological processes responsible for the determination of soil forms and paleontological resources;
- The potential for sterilisation of mineral resources due to infrastructure placement;
- Geochemistry and potential pollution of water resources from mineralised waste and stockpiles; and
- Preferential flow paths of groundwater that influence the dispersion of potential pollution.

3.1.2 DATA COLLECTION

Geological data collection was undertaken through review of the prospecting work undertaken, the proposed Mining Works Program for Paardeplaats and investigation of the 1:250 000 geology topographical map series. Detailed information on geohydrology which was used to support the geological information was collected in the following manner:

3.1.3 RESULTS

The study area is located within the Karoo Sequence (Vryheid Formation). The Vryheid Formation comprises mudrock, shales, rhythmite, siltstone and fine- to coarse-grained sandstone (pebbly in places). The Formation contains up to five (mineable) coal seams. The different lithofacies are mainly arranged in upward coarsening deltaic cycles. Since the shales are very dense, they are often overlooked as significant sources of groundwater. The permeabilities of these sandstones are also usually very low. The main reason for this is that the sandstones are usually poorly sorted, and that their primary porosities have been lowered considerably by diagenesis. These sedimentary formations have been extensively intruded by dolerite dykes.

The Karoo dolerite, which includes a wide range of petrological facies, consists of an interconnected network of dykes and sills and it is nearly impossible to single out any particular intrusive or tectonic event. Dolerite dykes are vertical to sub-vertical discontinuities that, in general, represent thin, linear zones of a lower permeability sandwiched between fracture zones. These fracture zones can have a relatively higher permeability and can therefore act as conduits for groundwater flow within the aquifer. The dykes on the other hand may also act as semi- to impermeable barriers to the movement of groundwater. The dykes are commonly expressed on the surface as a line of green bushes, which can be readily observed during the dry season. The generalised stratigraphy is summarised in Table 5 below.

Table 5: Geology

Stratigraphic section		Description
Transport and residual soils	Increasing with depth	- topsoil - clayey hillwash - clayey siltstone and sandstone
Vryheid Formation		-silty, laminated shale - laminated siltstone with sandstone - No 2 seam (coal) - ripple cross-bedded fine grained sandstone
Dwyka Group		Tillite, diamictite and glacial shales
Pre-Karoo basement		Paleo-weathered Selonsrivier felsite

There are numerous fractures within the study area - these fractures can form conduits for groundwater flow. The study area overlays arenite (coarse sandstone), shale and coal. These lithological units represent sedimentary rocks. In high rainfall areas these rocks provide resistance against weathering due to the nature of the minerals, while the igneous rock succumbs to chemical weathering (Read & Watson, 1983; Strahler & Strahler, 1987; Johnson, Anhaeusser & Thomas, 2006). The landscape reflects this trend with the study area located within strongly undulating plains, while the surface slopes and drains towards the north - northwest where igneous rocks dominate the landscape.

It is expected that the weathering of the arenite and shale will result in the formation of sandy to sandy-loam soils within the flat area (slope less than 8%) of the study area. In these conditions rainfall tends to infiltrate rather than runoff, resulting in water moving within the soil profile

3.1.4 CONCLUSION

The proposed Paardeplaats Coal Mine is located within the Witbank Coal Field and is close to the north-eastern edge of the Karoo Basin. The Karoo sequence is represented by the Dwyka Formation consisting of diamictite and the overlaying Ecca Group. The coal seams of the Witbank Coal Field are found at the base of the Vryheid Formation of the Ecca Group and the strata in which coal seams occur consist predominantly of fine, medium and course grained sandstone with subordinate mudstone, shale, siltstone and carbonaceous shale.

All five coal seams of the Witbank Coal Field occur within the proposed Paardeplaats Coal Mine application area. The number 2 and 4 seams are more extensively developed than seams 1, 3 and 5. In the far north–east portion of the application area a dolerite sill is believed to have completely displaced coal seams. The dolerite sill is likely a post depositional feature related to the Lesotho Basalts.

3.2 TOPOGRAPHY

3.2.1 INTRODUCTION AND RELATED IMPACTS

Topography refers to the surface shape and features of an area. The topography will be permanently altered by the removal of the mineral resource from the study area. Changes to the current topography are also likely to impact on ground water, surface water drainage, visual character and the safety of both people and animals.

3.2.2 DATA COLLECTION

Data collection was undertaken through careful review of the relevant topographical maps and confirmed in site visits undertaken by the project team.

3.2.3 RESULTS

The proposed project area lies between 1 840 and 1 880 metres above sea level, with the highest point occurring in the southern part. The terrain is comprised of undulating plains, with slopes of between 3% and 8%. The site is has relatively steeply-incised streams in various sections that drain into water catchment dams/ponds within the area. The landscape contains no especially vivid, distinguished, uncommon or rare visual features or abstract attributes; although the wide open spaces and the ability of the landscape to attract nature lovers and other tourists renders the landscape more than able to elicit evocative responses from the viewer.

3.2.4 CONCLUSION

Mining activities have the potential to alter the topography of the area. An alteration of the natural topography has the potential to impact on water flows, visual character, animals and people. The design and placement of mining activities and infrastructure must be undertaken in a manner such that any alteration of the current topography must result in stable topographical features which do not pose a significant risk to third parties as well as limit the impact on the visual character of the area.

3.3 CLIMATE

3.3.1 INTRODUCTION AND RELATED IMPACTS

The following climatic aspects can influence potential environmental impacts:

- Rainfall can influence erosion and vegetation growth, which affect rehabilitation planning;
- Evaporation rates influence vegetation growth;
- Air temperature can influence air dispersion through atmospheric stability and mixing layers; and
- Wind speed and direction can influence erosion and the dispersion of potential atmospheric pollutants.

3.3.2 DATA COLLECTION

Climate data was obtained from the Agroclimatology database at ARC-ISCW (ARC-ISCW, 2011), South African Weather Service (SAWS) and the Department of Environmental Affairs (DEA).

3.3.3 RESULTS

A description of the climate of the study area is based on the climate of the closest town, Belfast. The climate of the study area is typical of the South African Highveld with warm summers and cold winters. The climate has warm, moist summers with cool, dry winters. On average, 85% of the annual average rainfall of 757 mm falls in the growing season (October to March). Frost, often severe, occurs in winter. The extreme maximum temperature is 35.6^{o}C and the extreme minimum temperature is –13.3^{o}C.

The climatic data is given in Table 6 below.

Table 6: Climate

Month	Rainfall (mm)	Min. Temp (^{o}C)	Max. Temp (^{o}C)	Average frost dates
Jan	128.1	11.8	23.1	Start date: 11/05 End date: 01/09 Days with frost: ±25
Feb	99.8	11.7	22.5	
Mar	81.7	10.1	21.9	
Apr	41.8	7.5	19.9	
May	16.8	4.0	18.1	
Jun	6.4	1.2	15.5	
Jul	7.9	1.2	15.9	**Heat units (hrs > 10^{o}C)**
Aug	8.6	3.1	18.3	Summer (Oct-Mar): 1419 Winter (Apr-Sept): 353
Sep	25.7	6.7	21.2	
Oct	76.2	8.1	21.8	
Nov	126.9	10.0	21.8	
Dec	137.2	11.3	22.7	

Year	**757.2**	**(Average) 13.7°C**	

3.3.3.1 Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers (Tiwary and Colls, 2010). Temperature provides an indication of the extent of insolation, and therefore of the rate of development and dissipation of the mixing layer.

A monthly-average ambient temperature trend (Figure 2) shows temperatures typically range between 13°C and 24°C during summer months, with daily-averages in the order of 18°C. During winter months, temperature ranges of between 3°C and 16°C are typical, with average temperatures of 8°C in June and 10°C in August.

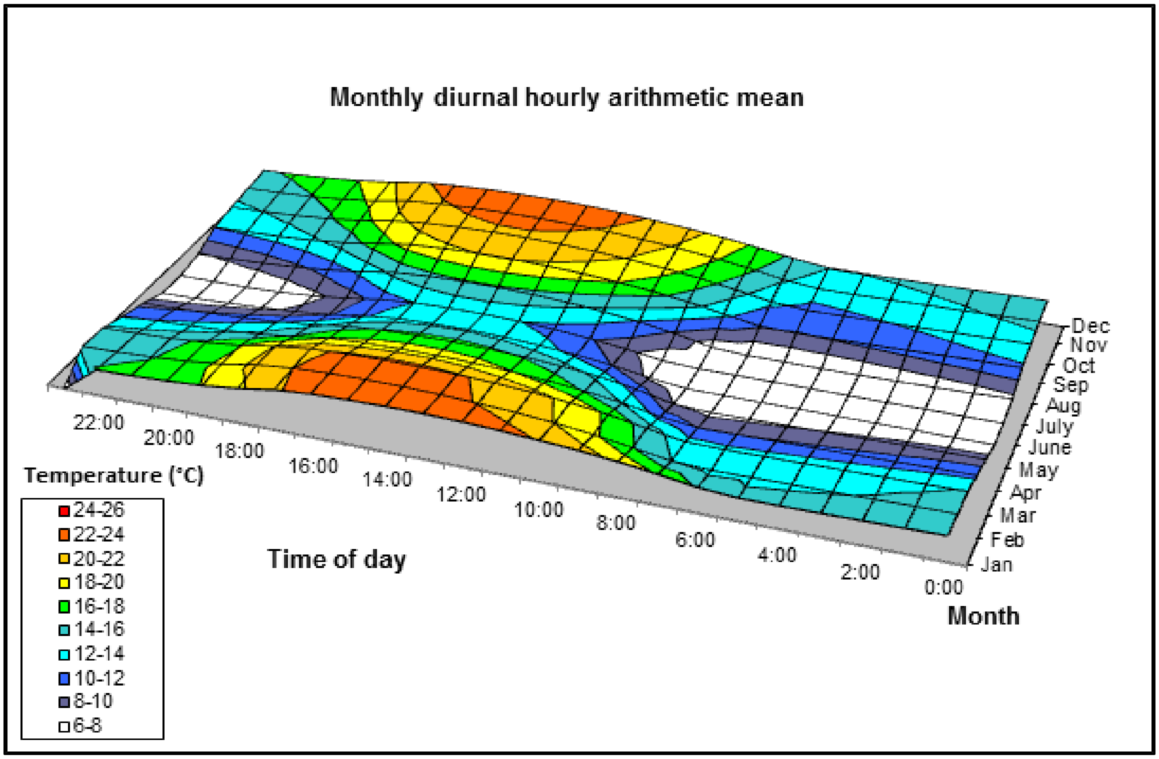

Figure 2: Monthly temperature variation at Paardeplaats Project site for 2009 – 2011, based on MM5 modelled data.

The long-term temperature trends recorded for Belfast from 1920-1959 were considered to be representative of the proposed mine site (Table 7). Minimum long-term temperatures have been recorded as ranging from -1.6°C to 16.6°C with maximum temperatures ranging between 15.2°C and 22.8°C (Table 7). Mean temperatures, recorded over the long-term, ranged between 6.6°C and 16.6°C.

Table 7: Long-term minimum, maximum and mean temperature for Belfast (1920 -1959) (Schulze, 1986)

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Belfast	Maximum	22.3	22.2	21.3	20.1	17.6	15.2	15.3	17.8	20.4	22.2	22.0	22.8
	Mean	16.6	16.4	15.2	12.9	9.5	6.6	6.8	9.0	12.0	14.7	15.5	16.5
	Minimum	10.9	10.7	9.1	5.8	1.4	-1.8	-1.6	0.2	3.6	7.4	9.0	10.2

3.3.3.2 Winds

The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness (Tiwary and Colls, 2010).

MM5 modelled meteorological data for the Paardeplaats Project site (25.729289°S; 30.004964°E) were used to generate wind roses based on 16 spokes, representing the directions from which winds blew during the period, 2009 - 2011 (Figure 3). The colours reflected the different categories of wind speeds with the dotted circles indicating the frequency of occurrence. The flow field is dominated by winds from the east and north-west. During day-time conditions, frequency of wind from the north-western sector increases while winds from the north-eastern sector are more common at night.

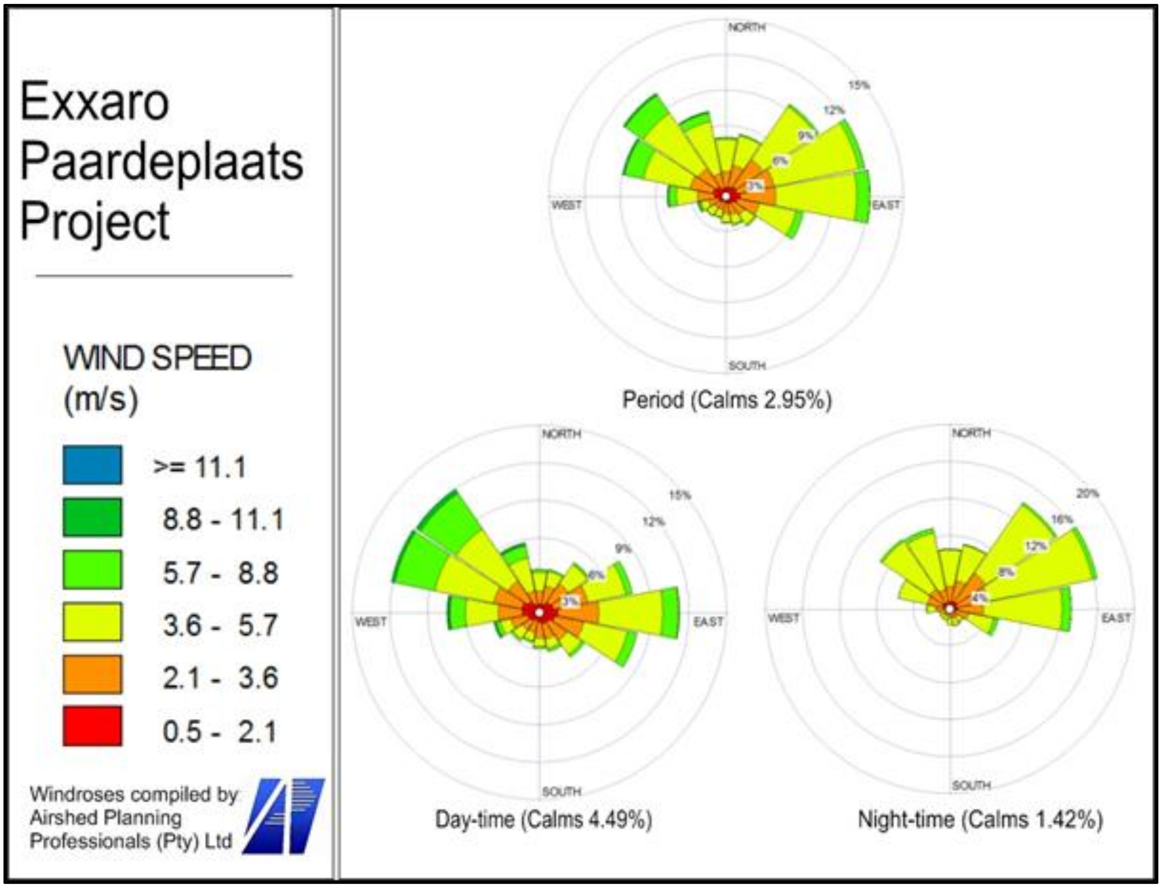

Figure 3: Period, day and night wind roses for the Paardeplaats project site for the period 2009 – 2011, based on MM5 model data.

Seasonal variation in wind direction is also evident (Figure 4) with winds from the north-western sector dominating during spring and summer. Easterly winds are more frequent in autumn and winter.

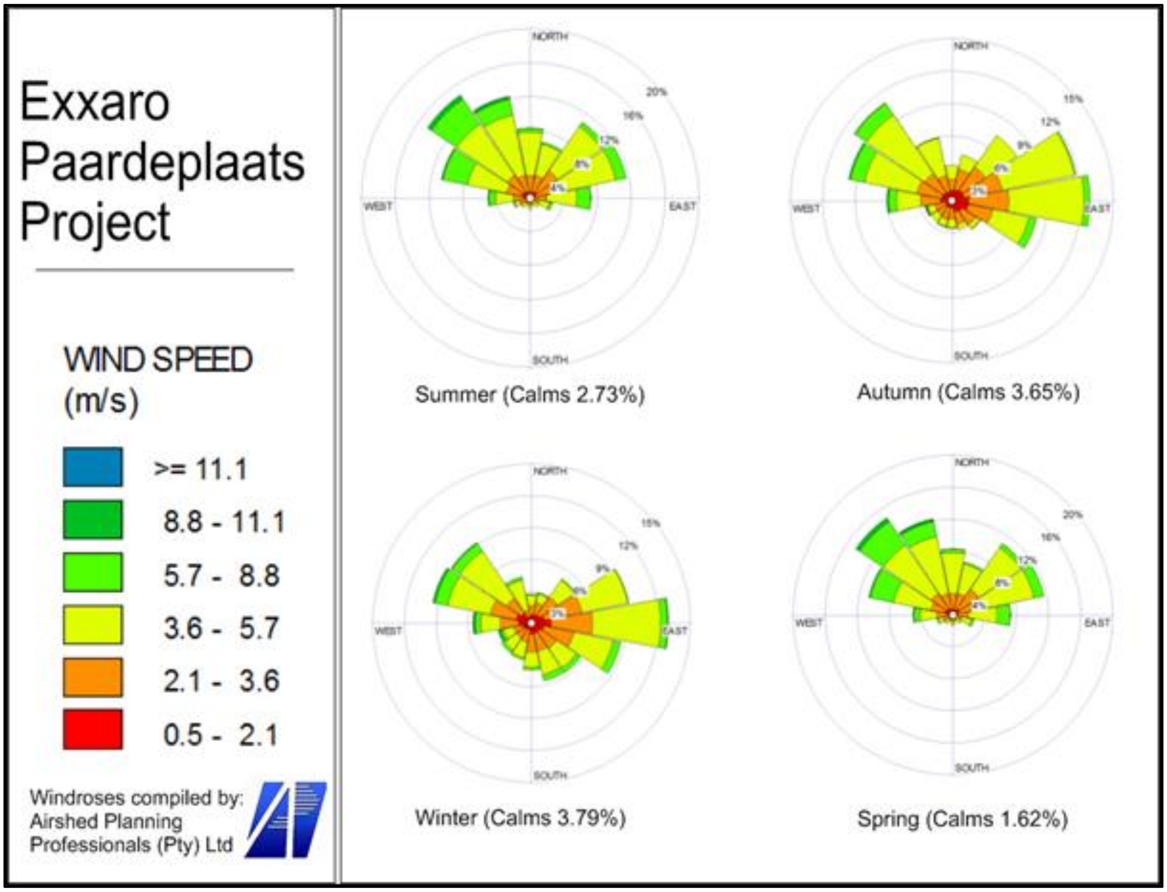

Figure 4: Seasonal wind roses for the Paardeplaats project site for the period 2009 – 2011, based on MM5 model data.

3.3.3.3 Mean Annual Precipitation and Mean Monthly Rainfall

The precipitation is important to air pollution studies since it represents an effective removal mechanism for atmospheric pollutants and inhibits dust generation potentials. The long-term average total annual rainfall for Belfast is ~842 mm (Table 8). Long-term monthly average rainfall data (Table 8) shows that rain falls mainly in summer from October to April (Figure 5), with the peak being in January (Schulze, 1986). Between 2009 and 2011 MM5 modelled data shows higher than average annual rainfall, especially in January and December (Figure 5). While snow and hail are relatively rare, fog is a common phenomenon in the vicinity of Belfast; more common (on average) than thunderstorms (Table 9).

Table 8: Long-term average monthly rainfall (mm) for Belfast (1905-1959) (Schulze, 1986)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Belfast	145	116	101	50	25	8	9	11	33	81	131	132	842

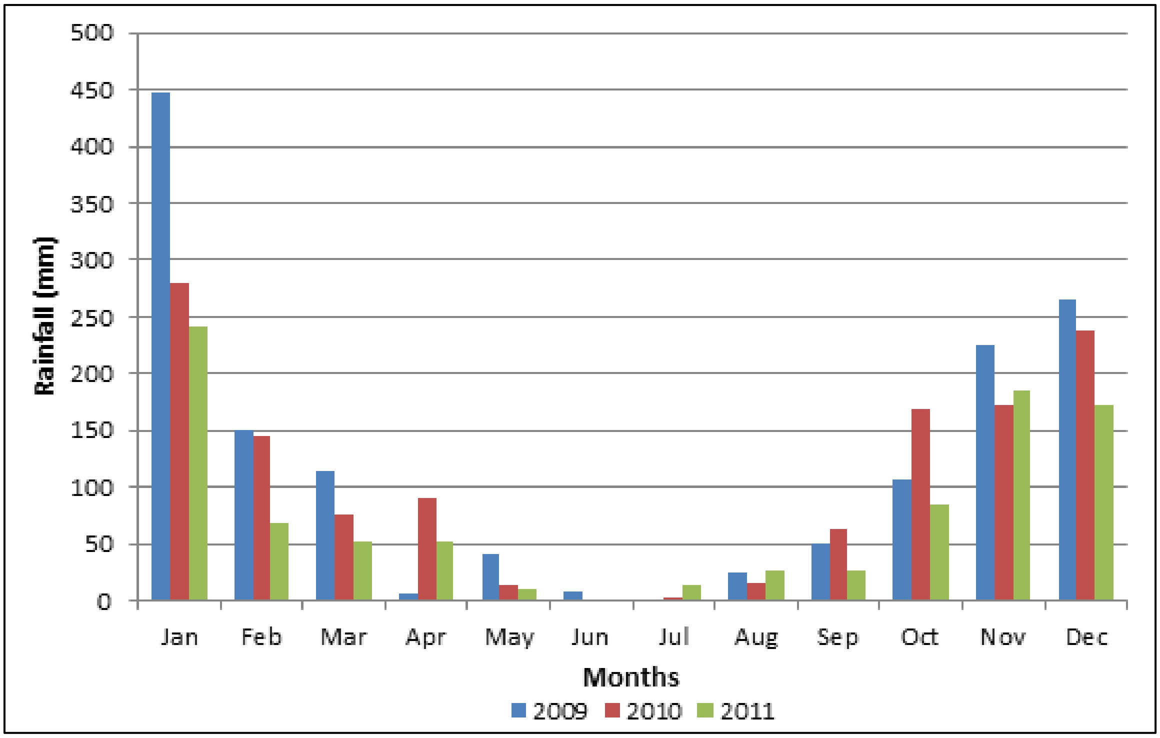

Figure 5: Monthly precipitation (mm) at the Paardeplaats Project site, based on MM5 modelled data, for the period 2009 – 2011. Annual average for the three years is 1 213 mm.

Table 9: Monthly rainfall maximums and average thunderstorm, hail, snow and fog days observed to occur at Belfast during the period 1905 to 1959 (Schulze, 1986)

Month	Maximum Monthly Rainfall (mm)	Maximum No. of Rain-days	Average No. Days Experiencing:			
			Thunder-storms	Hail	Snow	Fog
Jan	122	20	5.4	0.2	0.0	4.0
Feb	72	15	4.7	0.0	0.0	3.8
Mar	56	12	4.8	0.0	0.0	3.0
Apr	112	11	2.8	0.0	0.0	4.8
May	76	11	1.6	0.0	0.0	2.3
June	36	3	0.4	0.0	0.3	2.2
July	30	6	0.6	0.0	0.0	1.6
Aug	56	6	0.5	0.0	0.0	4.6
Sep	53	9	2.3	0.1	0.1	3.3
Oct	60	16	5.4	0.5	0.0	6.3
Nov	76	16	6.8	0.4	0.0	5.2
Dec	103	17	6.3	0.1	0.0	2.0
Annual	964		41.6	1.3	0.4	43.1

Fog is a cloud that is in contact with the ground and forms when the difference between temperature and dew point is generally less than 2.5°C. Fog begins to form when water vapour condenses into tiny liquid water droplets in the air. Since water vapour is colourless, fog is actually small liquid water droplets that have condensed from water vapour suspended in the atmosphere. Fog normally occurs at a relative humidity near 100%. This can be achieved by either adding moisture to the air or dropping the ambient air temperature.

Fog formation requires all of the elements required for normal cloud formation, the most important being condensation nuclei, in the form of dust, aerosols, pollutants, etc., on which water vapour can condense. When there are exceptional amounts of condensation nuclei present, especially hygroscopic (water seeking) particles such as salt, then the water vapour may condense below 100% relative humidity. Fog can form suddenly, and can dissipate just as rapidly, depending on the relative difference between ambient and dew-point temperatures. This phenomenon is known as flash fog.

The types of fog include advection fog, occurring when moist air is advected over a cool surface; and radiation fog, forming under very stable atmospheric conditions with clear skies, leading to heat radiation from the ground upward. Radiation fog is characteristic around Belfast, mostly occurring in the morning and is proposed to aid in cleaning up air pollution. Fog will contribute to collection of particles depending on the particle size distribution; particle collection efficiency is known to decrease as the particle sizes fall below 10 µm (Ma *et al*., 2004). As the sun rises, the water droplets evaporate, thereby dissipating the fog, cleaning the particles out of the air and leaving dirt and dust on the ground. The extent of this removal process could not be verified because site specific information on fog scavenging in the Belfast area is not available.

3.3.3.4 Runoff and Evaporation

The mean annual run-off and evaporation for the study area is provided in the table below:

Table 10: Table showing the mean annual precipitation, run-off and potential evaporation per quaternary catchment (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990)

Quaternary Catchment	Catchment Surface Area (ha)	Mean Annual Rainfall (MAP) in mm	Mean Annual Run-off (MAR) in mm	MAR as a % of MAP	Study area as % of catchment
B41A	68 724	714.5	65	9.1 %	1.75 %
X11D	53 153	744.0	87.8	11.8 %	0.08 %

3.3.4 CONCLUSION

The proposed Paardeplaats project area is characterised by warm, but not hot, moist summers with heavy thunderstorms that last for short periods at a time, and cool, dry winters. High evaporation rates reduce infiltration rates, while the high rainfall levels can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however allow for surface infiltration thereby reducing the effects of erosion. The mixing of layers resulting in the formation of temperature inversion and the presence of cloud cover limits the dispersion of pollutants into the atmosphere. These climatic aspects need to be taken into consideration during rehabilitation and surface water management planning.

3.4 SOILS

3.4.1 INTRODUCTION AND RELATED IMPACTS

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

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

The impacts of open-cast coal mining on the soil resource, and the availability of that resource for agriculture, are usually long-lasting and severe. Even when soils are stockpiled then replaced, there are usually problems such as compaction, acidification, impeded drainage and insufficient soil depth after rehabilitation, all of which are likely to lower the prevailing land capability class.

For this reason, it is desirable to avoid, wherever possible, both high potential agricultural land and wetland areas in the mining process. Ideally a buffer distance of at least 250 m around wetland and high potential agricultural land would help to ensure that effects of mining, such as subsurface seepage of water, coal dust contamination of topsoils are minimized as far as possible.

3.4.2 DATA COLLECTION

The soils of an area of 1 462 ha were investigated using a 150 x 150 m grid, controlled by GPS and samples were collected for analysis at 19 sites.

The soils were investigated using a hand-held soil auger to a maximum depth of 1 200 mm, on a grid of 150 x 150 metres, which was established using a GPS. All the relevant soil properties (horizons, colour, structure, texture, calcareousness, drainage, etc.) at each observation point were noted and the soils were classified according to the South African Soil Classification System (Soil Classification Working Group, 1991). Similar soils were grouped together into mapping units. During this phase, the areas of wetlands, with their distinct soil patterns, were delineated. The soil mapping units, as well as the wetland areas, are shown on the soil map in the Appendix.

Following the delineation of the soil map units, each unit can then be allocated to a class of agricultural potential, as well as pre-mining land capability. Representative topsoil and subsoil (where present) samples were also collected.

The samples were analyzed for particle size, pH, cation exchange capacity (CEC) and exchangeable cations, organic carbon and P according to the standard prescribed methods (Non-Affiliated Soil Analysis Work Committee, 1990). In addition, during the soil survey phase, current land use was noted in order that a map of the distribution of the various land use types could be prepared.

3.4.3 RESULTS

In general, the soils are yellow-brown or red, and range from shallow through moderately deep to deep, with significant areas of surface rock outcrops.

The soils are of light texture, slightly sandy loam to loamy soils, are highly weathered, slightly to strongly acidic, with low to moderate organic carbon. The P and K levels are very low. The map units with the highest agricultural potential are the dHu and dCv map units. The other map units have moderate to very low agricultural potential.

Several soil map units were identified. A description of the most important soil characteristics of each unit, such as the dominant soil form and family, soil depth, topsoil texture and underlying material, is given in the soil legend shown in Table 11.

In general, the greater part of the area contains deep soils intermixed in certain areas with soils of varying depths from shallow to moderate; with predominantly yellow-brown and red (occasionally reddish-brown) colors. The soils are weakly structured to structureless across the entire area, with rock outcrops and surface stones in places. The south western portion of the site is dominated by shallower soils mixed with some moderately deep soils.

Wetland areas (including streams and dams) occur in the lower-lying positions in various portions of the site.

3.4.3.1 Soil Analysis Results

Samples of topsoil and subsoil were collected at 19 localities (S1 to S19). These points are marked on the soil map. The analysis results are shown in Table 12 to Table 15.

Table 11: Soil Map Legend

Map Unit (+ area)	Depth(mm)	Dominant Soil Form(s)	Sub-dominant Soil Form(s)	General description of soils occurring	Agric. Pot.
			Deep structureless soils		
dCv (286.52 ha)	800-1200	Clovelly 1200	Clovelly 1100, Avalon 1200 Longlands 2000	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown (occasionally grey), apedal, loamy sand to sandy loam subsoil, occasionally on mottled soft plinthite or weathering rock.	Very high
dHu (93.78 ha)	800-1200	Hutton 1200	Hutton 1100, Clovelly 1200, Bainsvlei 1200	Reddish-brown, apedal, loamy sand to sandy loam topsoil on red (occasionally yellow-brown), apedal, loamy sand to sandy loam subsoil, occasionally on mottled soft plinthite or weathering rock.	Very high
dHu/Cv (41.81 ha)	800-1200	Hutton 1200, Clovelly 1200	Hutton 1100, Clovelly 1100	Brown to reddish-brown, apedal, loamy sand to sandy loam topsoil on yellow-brown to red, apedal, loamy sand to sandy loam subsoil, on weathering rock.	Very high
dAv (24.63 ha)	800-1200	Avalon 1200	Avalon 1100, Glencoe 1200	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil, on a periodical wetting zone with mottled soil colors, occasionally cemented.	Very high
			Moderately deep structureless soils		
mdCv (186.07 ha)	450-800	Clovelly 1200	Clovelly 1100, Avalon 1200	Reddish-brown, apedal, loamy sand to sandy loam topsoil on red, apedal, loamy sand to sandy loam subsoil (often with concretions) on weathering rock.	Moderate
mdHu (20.59 ha)	450-800	Hutton 1200	Hutton 1100, Clovelly 1200	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil (often with concretions) on weathering rock.	Moderate
mdAv (66.94 ha)	450-800	Avalon 1200	Avalon 1100, Glencoe 1200	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil, on a periodical wetting zone with mottled soil colors.	Moderate
mdAv/Cv (80.16 ha)	450-800	Avalon 1200, Clovelly 1200	Avalon 1100, Glencoe 1200	Brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil, on weathering rock or mottled soft plinthite.	Moderate
mdCv/Lo (6.85 ha)	450-700	Clovelly 1200, Longlands 2000	-	Brown to greyish-brown, apedal, loamy sand to sandy loam topsoil on yellow-brown, apedal, loamy sand to sandy loam subsoil on weathering rock. In lower landscape positions, grey, loamy sand subsoils on mottled soft plinthite occur.	Moderate to low
mdKd (6.79 ha)	450-700	Kroonstad 2000	-	Dark brown, weakly structured, sandy clay loam topsoil on grey, mottled, weakly developed structured, sandy clay subsoil with signs of wetness. The lower horizon is saturated with water for	Very low

				long periods unless drained.	
Shallow soils					
sDr (392.77 ha)	200-400	Dresden 1100	Mispah 1000, Clovelly 1200, Hutton 1200	Brown to greyish-brown, apedal, loamy sand to sandy loam topsoil on cemented ferricrete or hard (occasionally weathering) rock. Yellow-brown and red topsoils also occur. Rock outcrops occur occasionally.	Very low
sDr/R (85.11 ha)	50-250	Dresden 1100	Mispah 1000, Rock	Brown to greyish-brown, apedal, loamy sand to sandy loam topsoil on cemented ferricrete or hard (occasionally weathering) rock. Rock outcrops occur throughout the map unit.	Very low
Wetlands					
W (118.75 ha)	0-200	Katspruit 2000	Sepane 1110	Dark grey to dark brown, structureless to weakly structured, sandy loam to sandy clay loam topsoils, on dark brown to black, mottled, structured sandy clay to clay subsoils, often wet. Occur in low-lying areas such as stream beds and valley bottoms. Soils are saturated with water year-round.	None
Dam (28.77 ha)	-	Dam		Water catchment areas.	None
Miscellaneous areas					
B (22.32 ha)	-	Buildings		Built up areas.	None
TOTAL AREA: 1 461.86 ha					

Table 12: Soil Analysis Results S1-S5

Sample Site No.	S1			S2			S3	S4		S5	
	0-300 mm	300-800 mm	800+ mm	0-300 mm	300-800 mm	800+ mm	0-300 mm	0-300 mm	300-1200 mm	0-300 mm	300-950 mm
Co-ordinates	25° 45’ 34.83” S 29° 58’ 10.61” E			25° 45’ 5.58” S 29° 58’ 15.99” E			25° 44’ 46.09” S 29° 58’ 37.53” E	25° 44’ 41.21” S 29° 58’ 59.06” E		25° 45’ 0.72” S 29° 59’ 25.97” E	
Soil Form	Av			Av			Dr	Cv		Gc	
Map Unit	mdAv/Cv			mdAv/Cv			sDr	dCv		dAv	
Sand (%)	78.0	72.0	72.0	64.0	66.0	66.0	68.0	68.0	64.0	74.0	78.0
Silt (%)	6.0	8.0	6.0	8.0	6.0	8.0	8.0	6.0	4.0	10.0	4.0
Clay (%)	16.0	20.0	22.0	28.0	28.0	26.0	24.0	26.0	32.0	16.0	18.0
Na (cmol (+) kg $^{-1}$)	0.037	0.041	0.035	0.030	0.044	0.052	0.056	0.042	0.039	0.046	0.074
K (cmol (+) kg $^{-1}$)	0.102	0.086	0.080	0.195	0.101	0.081	0.095	0.191	0.115	0.124	0.067
Ca (cmol (+) kg $^{-1}$)	0.179	0.187	0.547	0.575	0.152	0.094	0.118	1.088	0.644	1.164	0.283
Mg (cmol (+) kg $^{-1}$)	0.129	0.141	0.417	0.353	0.661	0.615	0.179	0.596	0.263	0.559	0.283
CEC* (cmol (+) kg $^{-1}$)	7.905	7.355	8.232	11.227	3.724	5.230	4.761	4.991	4.954	6.928	2.986
$P^{\#}$ (ppm)	3.31	1.26	0.83	2.71	1.25	0.65	2.51	4.30	0.68	1.43	1.01
pH_{WATER}	4.89	5.07	5.72	5.15	5.31	5.78	5.26	5.40	5.39	5.40	5.38
Org. Carbon %	1.13	0.82	0.40	1.05	0.58	0.39	1.16	0.95	0.47	2.56	0.40

Table 13: Soil Analysis Results S6-S10

Sample Site No.	S6		S7		S8			S9		S10	
	0-300 mm	300-900 mm	0-350 mm	350-800 mm	0-200 mm	200-650 mm	650+ mm	0-350 mm	350-1200 mm	0-300 mm	300-1000 mm
Co-ordinates	25° 44' 26.59" S 29° 59' 4.45" E		25° 44' 36.34" S 29° 59' 25.97" E		25° 46' 58.85" S 30° 0' 9.03" E			25° 43' 52.47" S 29° 59' 42.12" E		25° 44' 32.98" S 29° 59' 25.98" E	
Soil Form	Cv		Lo		Av			Hu		Cv	
Map Unit	dCv		dCv		mdAv			dCv		mCv	
Sand (%)	70.0	60.0	64.0	62.0	78.0	68.0	64.0	72.0	68.0	78.0	74.0
Silt (%)	6.0	8.0	10.0	6.0	4.0	6.0	10.0	4.0	4.0	2.0	6.0
Clay (%)	24.0	32.0	26.0	32.0	18.0	26.0	26.0	24.0	28.0	20.0	20.0
Na (cmol (+) kg $^{-1}$)	0.026	0.033	0.031	0.030	0.031	0.033	0.050	0.026	0.029	0.040	0.030
K (cmol (+) kg $^{-1}$)	0.209	0.156	0.290	0.095	0.418	0.471	0.550	0.172	0.100	0.088	0.066
Ca (cmol (+) kg $^{-1}$)	0.311	0.285	1.076	0.423	2.030	0.846	1.216	0.322	0.089	0.113	0.054
Mg (cmol (+) kg $^{-1}$)	0.183	0.177	0.439	0.337	0.634	0.398	0.565	0.179	0.085	0.160	0.156
CEC* (cmol (+) kg $^{-1}$)	4.804	3.828	8.435	2.556	4.284	3.828	2.847	3.948	5.751	3.883	2.883
$P^{\#}$ (ppm)	1.21	0.66	2.51	0.89	7.80	2.61	1.01	2.25	0.47	3.02	1.08
pH_{WATER}	5.22	5.30	5.27	5.58	6.00	5.25	5.35	5.36	5.07	4.88	4.99
Org. Carbon %	1.68	0.53	2.68	0.35	0.74	0.47	0.31	1.47	0.59	0.52	1.60

Table 14: Soil Analysis Results S11-S15

Sample Site No.	S11		S12		S13		S14		S15	
	0-200 mm	200-900 mm	0-300 mm	300-1000 mm	0-300 mm	300-1000 mm	0-300 mm	300-1200 mm	0-300 mm	300-1200 mm
Co-ordinates	25° 43' 8.6" S 29° 59' 42.65" E		25° 43'23.23" S 30° 0' 30.55" E		25° 44' 2.22" S 30° 0' 35.94" E		25° 43' 42.72" S 30° 1' 2.84" E		25° 43' 32.97" S 30° 1' 35.13" E	
Soil Form	Cv		Hu		Cv		Hu		Hu	
Map Unit	dCv		dHu		dHu/Cv		dHu/Cv		dHu	
Sand (%)	70.0	72.0	84.0	70.0	72.0	68.0	62.0	54.0	54.0	48.0
Silt (%)	10.0	4.0	4.0	6.0	10.0	6.0	14.0	10.0	12.0	28.0
Clay (%)	20.0	24.0	12.0	24.0	18.0	26.0	24.0	36.0	34.0	24.0
Na (cmol (+) kg $^{-1}$)	0.033	0.025	0.026	0.027	0.029	0.038	0.047	0.039	0.049	0.129
K (cmol (+) kg $^{-1}$)	0.157	0.080	0.252	0.193	0.109	0.083	0.405	0.143	0.125	0.075
Ca (cmol (+) kg $^{-1}$)	5.414	0.539	1.817	0.795	0.827	0.294	2.639	1.301	0.417	0.169
Mg (cmol (+) kg $^{-1}$)	1.377	0.307	0.517	0.339	0.570	0.510	1.213	0.777	0.267	0.121
CEC* (cmol (+) kg $^{-1}$)	10.245	4.639	2.556	7.902	7.860	3.174	9.197	10.482	0.858	9.979
$P^{\#}$ (ppm)	2.10	0.73	8.56	2.81	3.33	1.43	4.23	1.60	2.26	0.78
pH_{WATER}	6.25	5.35	6.80	5.30	5.40	5.37	5.65	5.90	4.70	5.05
Org. Carbon %	0.48	0.67	0.45	0.43	1.91	0.64	2.55	0.92	2.37	0.86

Table 15: Soil Analysis Results S16-S19

Sample Site No.	S16		S17		S18			S19	
	0-250 mm	250-650 mm	0-300 mm	300-1200 mm	0-350 mm	350-700 mm	700-1200 mm	0-300 mm	300-600 mm
Co-ordinates	25^o 43' 23.22" S 30^o 1' 8.22" E		25^o 42' 58.85" S 30^o 1' 24.36" E		25^o 42' 58.86" S 30^o 0' 57.46" E			25^o 42' 39.36" S 30^o 0' 57.45" E	
Soil Form	Hu		Hu		Hu			Hu	
Map Unit	mdHu		dHu		dHu			dHu	
Sand (%)	62.0	54.0	58.0	64.0	66.0	58.0	54.0	64.0	66.0
Silt (%)	8.0	8.0	20.0	8.0	10.0	12.0	6.0	10.0	8.0
Clay (%)	30.0	38.0	22.0	28.0	24.0	30.0	40.0	26.0	26.0
Na (cmol (+) kg $^{-1}$)	0.107	0.134	0.102	0.110	0.100	0.111	0.103	0.096	0.124
K (cmol (+) kg $^{-1}$)	0.075	0.050	0.229	0.067	0.357	0.071	0.105	0.199	0.170
Ca (cmol (+) kg $^{-1}$)	0.293	0.032	0.970	0.295	1.366	0.079	0.052	0.760	0.799
Mg (cmol (+) kg $^{-1}$)	0.309	0.166	0.828	0.553	0.745	0.504	0.341	0.595	0.928
CEC* (cmol (+) kg $^{-1}$)	10.020	14.552	12.357	6.088	7.957	6.872	7.915	8.173	8.727
$P^{\#}$ (ppm)	3.45	1.62	6.21	3.48	6.53	2.20	0.95	2.38	0.83
pH_{WATER}	4.94	5.28	5.33	5.74	5.52	5.38	5.44	5.30	5.41
Org. Carbon %	1.48	0.40	2.01	0.94	1.90	1.00	0.63	1.87	1.85

The analyses show the soil textures are loamy sand to sandy clay loam for the topsoils, usually becoming sandy loam to sandy clay loam in the subsoils. Generally, all of the soils are dystrophic (highly leached) with very low CEC values. Only samples S8, S14 and S19 are slightly above the dystrophic threshold. Generally the pH values are low, also indicating acidic conditions.

On average, the soils have very low P levels due to the low acidity of the soils, which in turn causes P to be fixed in the soil and thus render it unavailable for plant uptake. In addition, most the soils have not been previously/and or recently cultivated which will also contribute to the low P levels. The K levels are also extremely low for cultivation of crops, especially vegetables. Organic carbon levels are low to moderate, slightly higher in grassland areas that have not been recently cultivated and lower in the cultivated areas.

3.4.3.2 Agricultural Potential

The general agricultural potential of each map unit, and the main limiting factors, are given in Table 16 below. The area in hectares is given, with the percentage of the total survey area in red.

More than half the area comprises soils with moderate to high potential for agriculture. In addition, approximately 10% of the area comprises a wetland soils (also associated dams) and these occur throughout the area. For the areas that are best suited for grazing, the prevailing climatic and other conditions in the area mean that the approximate grazing capacity is around 7-8 ha/LSU (ARC-ISCW, 2004).

Table 16: Agricultural Potential

Agricultural Potential	Map unit	Area (ha) + %	Limitations
Very high	**dHu, dCv, dAv, dHu/Cv**	446.74 (30.56%)	Few to none
Moderate	**mdHu, mdCv, mdAv, mAv/Cv**	353.76 (24.20%)	Somewhat restricted depth in places, otherwise favourable
Moderate to low	**mdCv/Lo**	6.85 (0.47%)	Restricted depth and lower fertility of soils (Lo)
Very low	**mdKd, sDr, sDr/R**	484.67 (33.15%)	Shallow soil depth with some rockiness (sDr, sDr/R). High clay content and signs of wetness in subsoils (mdKd)
None	**W, Dams, B**	169.84 (11.62%)	Usually no soil available for use
Total		**1 461.86 (100%)**	

The average depth in metres of non-plinthic soil in each map unit was combined with the area of the map unit to calculate the volumes of soil available for post-mining rehabilitation. Within the study area, most of the soils have a small increase in clay content from the topsoil to the subsoil horizon, but some have little or no increase. In addition, the soil structure is similar and no duplex soils occur. It can therefore be stated that the entire soil volume, down to any limiting layer such as rock, clay or plinthite) will be available for rehabilitation.

The volumes calculated are as follows:

Table 17: Available Soil Volumes

Map Unit	Average Depth (m)	Area (ha)	Volume (m^3)
dCv	1.0	286.52	2 865 200
dHu	1.0	93.78	937 800
dCv/Hu	1.0	41.81	418 100
dAv	1.0	24.63	246 300
mdCv	0.625	186.07	1 162 937
mdHu	0.625	20.59	128 687
mdAv	0.625	66.94	418 375
mdAv/Cv	0.625	80.16	501 000
mdCv/Lo	0.575	6.85	39 387
mdKd	0.575	6.79	39 042
sDr	0.30	392.77	1 178 310
sDr/R	0.15	118.75	178 125

3.4.4 CONCLUSION

In general, the greater part of the area contains deep soils intermixed in certain areas with soils of varying depths from shallow to moderate; with predominantly yellow-brown and red (occasionally reddish-brown) colours. The soils are weakly structured to structureless across the entire area, with rock outcrops and surface stones in places. The south western portion of the site is dominated by shallower soils mixed with some moderately deep soils.

The analyses show the soil textures are loamy sand to sandy clay loam for the topsoils, usually becoming sandy loam to sandy clay loam in the subsoils. Generally, all of the soils are dystrophic (highly leached) with very low CEC values. Only samples S8, S14 and S19 are slightly above the dystrophic threshold. Generally the pH values are low, also indicating acidic conditions.

On average, the soils have very low P levels due to the low acidity of the soils, which in turn causes P to be fixed in the soil and thus render it unavailable for plant uptake. In addition, most the soils have not been previously/ and or recently cultivated which will also contribute to the low P levels. The K levels are also extremely low for cultivation of crops, especially vegetables.

Organic carbon levels are low to moderate, slightly higher in grassland areas that have not been recently cultivated and lower in the cultivated areas. More than half the area comprises soils with moderate to high potential for agriculture. In addition, approximately 10% of the area comprises of wetland soils) and these occur throughout the area. For the areas that are best suited for grazing, the prevailing climatic and other conditions in the area mean that the approximate grazing capacity is around 7-8 ha/LSU.

3.5 LAND USE

3.5.1 INTRODUCTION AND RELATED IMPACTS

Mining activities have the potential to affect land uses both within the surface use area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. The key related impacts are: loss of soil, loss of biodiversity, pollution of water, dewatering, air pollution, noise pollution, damage/destruction from blasting, visual impacts, loss of heritage resources, and the influx of job seekers with related social ills.

3.5.2 DATA COLLECTION

During the detailed soil mapping exercise undertaken and in conjunction with the results of the social impact study, current land uses was identified and plotted on a map indicating the distribution of various land use types that occur within the proposed mining area. Land uses where corroborated with I&AP's and supplemented by the GCS Sensitive Receptor.

3.5.3 RESULTS

The current land uses on site comprises of a mixture of commercial agriculture (arable and grazing), irrigation in the south-west for the Hadeco tulip nursery and farm homesteads for workers and stands of exotic plantations. Most of the commercial agriculture on site involves the farming of maize monoculture as well as grazing for livestock such as cattle, sheep, springbok, and blesbok. Some dams are present and used for trout fishing on a small commercial scale and recreationally by surface rights holders.

3.5.3.1 Hadeco Bulb Farming

Hadeco is an agricultural business specialising in flower production and holds a niche market in South Africa. Hadeco currently operates on Portions 29 and 40 of the farm Paardeplaats 380 JT within the proposed Paardeplaats mining area. As the major bulb producer in South Africa, Hadeco cultivates 48 different flower bulbs from 5 different families of flower bulbs. Different climates are required for optimal crop production. Three of the farms are in warm climates, three in temperate climates and one, namely the Paardeplaats operations, is in the cold climate.

At each location, very specific conditions are required for the production of each type of bulb. Specific conditions include soil temperature, water availability and quality as well as differences in minimum and maximum temperatures. The Paardeplaats operation is the only operation in the country where Hadeco are able to produce export quality tulips and daffodils due to the unique climate of the Belfast region. Paardeplaats is one of the coldest units in South Africa, at an altitude of 1 900m with long, cold winters and short, cool summers. Soil temperatures drop early in the year and do not suffer frost, while a 15 degree difference between the average minimum and maximum temperatures allow for an environment both unique and ideal for cold climate flower bulb farming specifically peonies, tulips, daffodils and ornithogalum. 58 ha of Portion 40 of the farm Paardeplaats 380 JT represents the coolest area of the operation facing west and south west and is the best climate for tulip and daffodil production

Portion 40 of the farm Paardeplaats 380 JT also contains expensive, specialised infrastructure in the form of stores, cold treatment rooms, bulb treatment pits, dams for irrigation water, houses, a staff village, pumping station and main irrigation lines. This infrastructure is also used to support the processing, treatment and storage of flower bulb crops produced in both warmer and temperate climates, specifically Hadeco's primary export - Hippeastrum. Operations on portions 34, 35 and 36 are also highly dependent on the infrastructure located on Portion 40.

In the last 30 years, Hadeco has undertaken extensive trials to determine the viability and suitability of cold climate flower bulb farming in other parts of the country but have found no suitable alternative to the Belfast region, except for the option of relocating the operation (and entire business) to New Zealand.

Water of good quality and regular irrigation is critically important to the farming practise. Hadeco obtains water of suitable quality from a large dam on the property which holds 373,000 cubic meters and is used to supply the bulb farming operation through specially laid furrows used for regular crop irrigation.

In 2005, the Department of Agriculture issued Hadeco with a quarantine directive due to the discovery of nematodes in daffodil bulbs of the operation. Nematodes are organisms that act as vectors for disease and result in infections of the flower bulb crop. Nematodes can be dispersed through soil movement and the movement of infected plant tissue. Nematodes have the potential to cause whole scale damage and eradicate bulb crops. As destructive vectors of disease, nematode infestations can result in reduced yields and downgrading of crops which are rendered unmarketable both locally and internationally.

Under instruction by the Department of Agriculture, Hadeco instituted expensive and strict quarantine controls, with which the operation still currently complies in order to control the spread of nematodes with other bulb farming operations and areas further afield.

The Hadeco operations also contribute directly toward tourism in Belfast by conducting open days, during which the public are allowed to visit the farm and view tulips in their different stages of bloom. This large tourism event and contributes to the local economy, town of Belfast and local community.

The Hadeco operations represent a highly specialised cold climate bulb farming operation. It is located near Belfast solely because of its unique climate and where extensive and expensive infrastructure development has occurred to support the operations at Paardeplaats and other

Hadeco operations. It is also a home to a quarantined holding area to prevent the dispersal of destructive nematodes, which represent a threat to crop production within the farm and surrounding areas. Based on extensive trialling undertaken by Hadeco, no other viable area exists within South Africa with the only option being relocation abroad.

3.5.4 CONCLUSION

The most sensitive current land use within the proposed mining area is the Hadeco cold climate bulb operation. These operations are highly specialised, require expensive infrastructure, rely upon a unique natural climate and provide supporting services to Hadeco's other operations. Besides the Hadeco operations other land uses currently on site include those identified above as well as NBC Glisa's mining operations.

3.6 LAND CAPABILITY

3.6.1 INTRODUCTION AND RELATED IMPACTS

The land capability classification is based on the soil properties and related potential to support various land use activities. Mining operations have the potential to significantly transform the land capability, often irreparably so.

3.6.2 DATA COLLECTION

The soils of an area of 1 462 ha were investigated using a 150 x 150 m grid, controlled by GPS and samples were collected for analysis at 19 sites. The soils were investigated using a hand-held soil auger to a maximum depth of 1 200 mm, on a grid of 150 x 150 m, which was established using a GPS. All the relevant soil properties (horizons, colour, structure, texture, calcareousness, drainage, etc.) at each observation point were noted and the soils were classified according to the South African Soil Classification System (Soil Classification Working Group, 1991). Similar soils were grouped together into mapping units. During this phase, the areas of wetlands, with their distinct soil patterns, were delineated. The soil mapping units, as well as the wetland areas, are shown on the soil map in Appendix M.

Following the delineation of the soil map units, each unit can then be allocated to a class of agricultural potential, as well as pre-mining land capability. Representative topsoil and subsoil (where present) samples were also collected.

The samples were analysed for particle size, pH, cation exchange capacity (CEC) and exchangeable cations, organic carbon and P according to the standard prescribed methods (Non-Affiliated Soil Analysis Work Committee, 1990).

3.6.3 RESULTS

The soil mapping units were also allocated to a class of pre-mining land capability (Chamber of Mines/Coaltech, 2007), as indicated in Table 18. While only one class of arable capability is suggested, the variation in soil characteristics (mainly depth, texture and structure) at virtually every mining site makes it desirable to divide this class into more than one sub-class.

Table 18: Land Capability

Capability Class	Map unit	Area (ha) + %
Arable, high	**dHu, dCv, dAv, dHu/Cv**	446.74 (30.56%)
Arable, moderate	**mdHu, mdCv, mdAv, mAv/Cv**	353.76 (24.20%)
Grazing	**mdCv/Lo, sDr**	392.77 (26.87%)
Wilderness	**sDr/R**	85.11 (5.82%)
Wetland	**mdKd, W, Dam**	154.31 (10.56%)
Other	**B**	22.32 (1.53%)
Total		**1 461.86** (100%)

The distribution of the land capability classes is shown in the map in Section 3.21 and Appendix M.

3.6.4 CONCLUSION

The current land capability of the proposed project area is a mixture of arable, grazing, wilderness, wetland and other land capability classes. Moderate and High arable potential are the most prevalent land capabilities within the area followed by grazing. The land capability of the area will be altered due to mining operations and the placement of infrastructure. As such, in the event that mining is permitted, strict impact management and rehabilitation planning are required to achieve acceptable post mining land capabilities.

3.7 SOCIO-ECONOMIC

3.7.1 INTRODUCTION AND RELATED IMPACTS

Mines have the potential to result in both positive and negative socio-economic impacts. The positive impacts are usually economic in nature with mines contributing directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, mines indirectly contribute to economic growth in the local and regional economies because the increase in the number of income earning people has a multiplying effect on the trade of other goods and services in other sectors.

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

- Influx of people seeking job opportunities which can lead to increased pressure on basic infrastructure (housing and roads), informal settlement development, increased crime, introduction of diseases and disruption to the existing social structures within established communities;
- A change to not only pre-existing land uses, but also the associated social structure and meaning associated with these land uses and way of life. This is particularly relevant in the closure phase when the economic support provided by mines ends, the natural resources that were available to the pre-mining society are reduced, and the social structure that has been transformed to deal with the threats and opportunities associated with mining finds it difficult to readapt; and
- Relocation of all or parts of communities where the impacts associated with mines are deemed to be highly significant. While the intension of these relocation exercises is often to mitigate environmental impacts, the relocation can itself present a separate range of social, economic and environmental impacts.

3.7.2 DATA COLLECTION

The information used in this study was based on the following:

- A literature review (see list provided in the References);
- Professional judgement based on experience gained with similar projects;
- Focus group and individual meetings with affected parties.

The data used for the socio-economic description was sourced from the Community Survey (CS) conducted by Statistics South Africa in 2007. The Community Survey is a large-scale household survey conducted by Statistics South Africa to bridge the gap between censuses. It served as a mini census and its purpose (www.statssa.gov.za) is to collect information on the trends and level of demographic and socio-economic data; the extent of poor households; access to facilities and services; levels of employment/unemployment; in order to assist government and private sector in planning, evaluation and monitoring of programmes and policies.

Fieldwork was conducted during October 2012. Respondents were selected as per the methodology discussed below. Representatives of the following stakeholder groups were interviewed using a qualitative methodology or consulted with:

- Hadeco management;
- Hadeco employees and residents of Hadeco Village;

- Employees of the eMakhazeni Local Municipality;
- Farmers on the proposed mining rights area as well as on adjacent properties;
- Farm workers;
- Representative of Wonderfontein Farmers Union;
- Residents of Siyathuthuka as well as members of the Community Development Forum;
- Small and micro business owners in the area;
- Residents of Belfast; and
- Representatives from Exxaro.

In line with international best practice in social research, where possible the identity and confidentiality of private individuals are protected.

Primary data was collected through personal interviews as well as through group interviews. Respondents for the interviews were selected by means of non-probability sampling techniques, more specifically a combination of judgemental and snowball sampling. The interviews took place individually or in a group. The mode of interviewing used depended on the availability and convenience of the particular respondent or group of respondents. An unstructured interviewing technique was used. This allowed for the respondent to communicate freely all information that he/she deemed relevant to the proposed development that may be missed in a more structured interviewing format. It also allowed for the interviewer to probe and to clarify issues.

The data gathered from the interviews were analysed and interpreted using qualitative techniques such as content analysis and triangulated with other data sources for assessment purposes.

For the economic analysis the following information was obtained:

- The latest Mine Works Plan and SLP of the proposed mine on Paardeplaats were obtained and studied;
- Hadeco's management was interviewed and the site was visited to obtain first-hand information of its business operations;
- The surrounding farms were visited to understand the farming activities and other economic information;
- Modelling on a GDP per employee basis was undertaken for Nkangala.
- Property values for the surrounding farms were obtained using online property search engines;

- Macro-economic statistics and multipliers were obtained from Quantec Services, a reputable service provider.
- The alternative land-use analysis was undertaken using Excel spread sheets to calculate various options.

3.7.3 RESULTS

The proposed mine will be located in the eMakhazeni Local Municipality that forms part of the Nkangala District Municipality in Mpumalanga Province. The baseline description of the environment will include these areas.

3.7.3.1 The Mpumalanga Province

The Mpumalanga Province is located in the north eastern part of South Africa and covers an area of approximately 82 333 km^2 (www.mputopbusiness.co.za). It borders the Limpopo Province, Gauteng, the Free State, KwaZulu-Natal and internationally Swaziland and Mozambique. The word Mpumalanga means “place where the sun rises”.

The province consists of three district municipalities, namely Gert Sibande, Nkangala and Ehlanzeni. Nelspruit is the provincial capital and other major towns include Barberton, Delmas, Ermelo, Hazyview, Komatipoort, Malelane, Mashishing (Lydenburg), Middelburg, Piet Retief, Sabie, Secunda, Standerton, Volksrust, White River as well as eMalahleni (Witbank) (www.mpumalanga.com).

Mpumalanga Province is South Africa’s major forestry production area and is also the world’s largest producer of electrolytic manganese metal. Six major industrial clusters have been identified in Mpumalanga Province (Mpumalanga PGDS) in which numerous investment opportunities exists, namely:

- Stainless steel;
- Agri-processing;
- Wood products;
- Chemical industry and chemical products; and
- Agri-products and tourism.

Extensive mining is done in the province. Minerals found include:

- Gold;
- Platinum group metals;
- Silica;

- Chromite;
- Vanadiferous magnetite;
- Argentiferous zinc;
- Antimony;
- Cobalt;
- Copper;
- Iron;
- Manganese;
- Tin;
- Coal;
- Andalusite;
- Chrysotile asbestos;
- Kieselguhr;
- Limestone;
- Magnesite; and
- Shale.

Mpumalanga Province also accounts for 83% of South Africa's coal production. Ninety per cent of South Africa's coal consumption is used for electricity generation and the synthetic fuel industry. Coal-fired power stations are situated close to the coal deposits.

The Mpumalanga province mainly exports primary products from its mining and agricultural activities with little value addition. Mpumalanga Province will be able to increase its share of export contribution towards the provincial GDP by adding value to its export products through beneficiation (Mpumalanga Economic Profile).

3.7.3.2 The Nkangala District Municipality

The Nkangala District Municipality (NDM) is one of the three district municipalities in Mpumalanga. Local municipalities forming part of the Nkangala DM are Delmas, Dr. JS Moroka, eMalahleni, eMakhazeni, Steve Tshwete, and Thembisile, as well as the Mdala District Management Area.

The district is approximately 17 000 km^2 and consists of about 165 towns and villages, with eMalahleni and Middelburg being the primary towns. The Nkangala DM has a population of approximately 1.1 million people, which constitutes almost a third of Mpumalanga's population.

According to the municipality's website, the Nkangala DM is at the economic hub of Mpumalanga and is rich in minerals and natural resources. The district's economy is dominated by electricity, manufacturing and mining. Community services, trade, finance, transport, agriculture and construction (www.nkangaladm.org.za) are also important sectors. Nkangala's Integrated Development Plan (IDP) states that the district has extensive mineral deposits, including chrome and coal.

Another important economic activity in Nkangala is agriculture. The southern regions of the municipality are suitable for crop farming, specifically for fresh produce such as maize and vegetables, while cattle and game farming occur in the northern regions.

In terms of the population profile of the Nkangala DM, the majority of its inhabitants are extremely poor and do not have access to mainstream economic activities. The main poverty concentration is amongst the communities residing in Dr. JS Moroka and Thembisile Local Municipalities. The most important employment centre for these communities is the City of Tshwane, reducing their reliance on NDM. Daily commuting by means of public transport is a necessity (Nkangala IDP 2008/2009).

3.7.3.3 The eMakhazeni Local Municipality

The eMakhazeni Local Municipality is at the heart of the Mpumalanga Province and is bordered by the Greater Groblersdal, Thaba-Chweu, Steve Tshwete, Albert Luthuli and Mbombela Local Municipalities. The municipality is strategically located between the Pretoria/Johannesburg complex in Gauteng and Nelspruit in Mpumalanga Province and is situated on the N4 Maputo corridor.

The dominant economic activity in the area is farming (eMakhazeni Local Municipality IDP 2012-2013). Farming occupies the largest part of the physical area. There are a number of small towns in the area that serve as service centres for the agricultural sector, namely:

- eMakhazeni (Belfast) and Siyathuthuka;
- Dullstroom and Sakhelwe;
- Entokozweni (Machadodorp) and Emthonjeni; and
- Waterval-Boven and Emgwenya.

The area has a high environmental and aesthetical value with numerous wetlands and sensitive environmental areas, particularly around Dullstroom. The area is popular for fly-fishing that attracts a large number of tourists to the area. There are four nature reserves in the area, namely the Tullach-Mohr Reserve, the Dullstroom Nature Reserve, the Verloren Valley Nature Reserve and the Ntsinini Nature Reserve. The eMakhazeni LM sees the town of eMakhazeni as the tourism gateway for attractions in the eMakhazeni area as well as the Lowveld areas (eMakhazeni Local Municipality IDP, 2011-2016) and is of the opinion that it should be promoted as such. The area between eMakhazeni, Dullstroom, Lydenburg, Entokozweni and Waterval-Boven was earmarked as the “Trout Triangle.” This initiative has been incorporated into the Spatial Development Framework and should be supported through local initiatives.

Several minerals can be found in the region, for example gold and black granite. The viability of the diamond deposits in the area is currently being investigated. There are two coal mines in the vicinity, namely the eMakhazeni and Glisa mines that are operated as open quarry mines. A large coal deposit has been discovered towards the south of eMakhazeni. The presence of lime deposits in the municipal boundaries has also been indicated. Other minerals found in the area include copper, nickel, cobalt, arsenic, platinum, zinc, silver, and flint clay.

3.7.3.4 Hadeco Operations

The Hadeco cold climate bulb farming operations are labour intensive and employ people with low level skills including a high number of women. The average years of service to the operation on the properties under application are 21 years and the average age of employees approximately 50 years.

Most of Hadeco’s employees live in the Hadeco Village situated on the farm. At present there are 36 families which reside in the village totalling 195 people. Approximately 10 of these families are ex-Hadeco employees. The Village is provided with running water, sanitation and electricity heavily subsidised by Hadeco.

In addition to the village, there is also a primary school that is run by the Mpumalanga Department of Education. The school is home to approximately 155 learners from both the village and neighbouring areas such as Sunbury. Also on the Hadeco property are eleven clay houses in which 37 people reside. These homes have been purpose built by the residents themselves.

From a social perspective, the employees and residents of Hadeco are deemed sensitive as they work and reside on the property within the proposed application area. These people have also established long lived livelihoods working for the operation.

3.7.4 CONCLUSION

The Nkangala District Municipality (NDM) is one of the three district municipalities in Mpumalanga. Local municipalities forming part of the Nkangala DM are Delmas, Dr. JS Moroka, Emalahleni, eMakhazeni, Steve Tshwete, and Thembisile, as well as the Mdala District

Management Area. The district is approximately 17 000 km^2 and consists of about 165 towns and villages, with Emalahleni and Middelburg being the primary towns. The Nkangala DM has a population of approximately 1.1 million people. The district's economy is dominated by electricity, manufacturing and mining. Community services, trade, finance, transport, agriculture and construction) are also important sectors. Nkangala's Integrated Development Plan (IDP) states that the district has extensive mineral deposits, including chrome and coal. Another important economic activity in Nkangala is agriculture. The southern regions of the municipality are suitable for crop farming, specifically for fresh produce such as maize and vegetables, while cattle and game farming occur in the northern regions. In terms of the population profile of the Nkangala DM, the majority of its inhabitants are extremely poor and do not have access to mainstream economic activities. The main poverty concentration is amongst the communities residing in Dr. JS Moroka and Thembisile Local Municipalities. The most important employment centre for these communities is the City of Tshwane, reducing their reliance on NDM and daily commuting by means of public transport is a necessity.

3.8 CULTURE AND HERITAGE

3.8.1 INTRODUCTION AND RELATED IMPACTS

Mining activities have the potential to destroy, damage, or disturb cultural and heritage resources. These resources include graves, cemeteries, palaeolithic features and structures that are more than 60 years old.

3.8.2 DATA COLLECTION

PGS visited the study area over a period of three consecutive days. The staff traversed the area via vehicle and conducted a controlled-exclusive surface survey by foot at various selected points. The survey was guided by the possible sites located during the initial archival and desktop research phase (Fourie and Kitto, 2012). GPS coordinates were taken of all identified heritage sites and the identified sites were recorded photographically and categorised accordingly.

3.8.3 RESULTS

The background information used drew heavily on the results of the archival and desktop research undertaken for the Scoping Level Report produced for EIMS in June 2012 (Fourie and Kitto, 2012). This report showed that the study area and surrounding areas have a rich historical and archaeological history and that there was potential for archaeological and historical sites and material to exist within the study area (including grave sites).

The evaluation of topographical maps and satellite imagery for the Scoping Level report indicated the presence of numerous farmsteads, ruins and farm workers housing. Furthermore, the examination of the relevant literature indicated that archaeological sites and material (structures and man-made features older than 100 years) are very common in the general area. Although the existence of graves and cemeteries was not indicated during the archival research; based on previous experience, it was expected that such sites would be identified during the field survey.

Utilising the archival study completed for the HIA as a guide, the field work identified a total of 32 heritage sites adjacent to and within the site boundary, including 22 heritage structures, 7 cemeteries and 3 areas with historical mining shafts as indicated in the table below.

Table 19: Heritage structures

Areas	Heritage Features Present
Portion 30 only	2 heritage structures; and 1 informal cemetery with 2 graves.
Full Mining Area	10 heritage structures; 1 possible rock art site; 5 informal cemeteries with a total of 136 graves; and 1 historical mine shaft.
Surrounding Area	8 heritage structures; 1 informal cemetery with 39 graves; 2 formal cemeteries in Belfast; and 2 historical mine shafts.

Each of the heritage resources was allocated a unique identifier from PP 001 to PP 032. A description of each of these resources is provided below and Figure 6 shows their location in relation to the study area.

- PP 001: A farmstead with its associated buildings was identified at this location. The main house and other buildings were still intact. The main house consists of an original core building with thick external walls and wooden floors and ceilings. It also has a chimney for a coal stove. A kitchen and more rooms were added later to the back of the building. This would indicate that the core building is likely to be 60 years or older.

- The associated buildings comprise four sheds, three of which are brick-built and one which was originally built with stone and had a brick section added later. The brick sheds are likely to be 60 years or older and the stone shed may be between 60-100 years old.
- PP 002: A cluster of four informal graves is situated in between a gravel road and a fence. The graves are placed next to each other along the fence and are orientated from west to east. One grave has a rectangular shaped cement outline as a dressing, with an inscribed granite headstone. This seems to be a double child's grave as the headstone has two inscriptions painted on. Another grave is a double adult grave with a square shaped cement outline and an inscribed granite headstone. The fourth grave has an informal, elongated oval shaped mound of packed rocks as a dressing, without an inscribed headstone. The headstone inscriptions date the graves from the late 1960's and the 1970's and all the names on the graves are of the Mtweni family.
- PP 003: Two informal graves were identified at this location. The graves are crudely fenced and have large oval shaped outlines of packed rock as dressings. A flat rock serves as head stone for one grave. A plastic bottle and ceramic cup were placed on the graves as grave goods. The graves are not maintained and are overgrown with grass and other vegetation. The graves belong to the Maseko family, but their age was not known (local informant). The Maseko family apparently lives on the farm in the farmworkers houses located behind the farmstead (PP 001). Such graves are treated as being of 60 years or older unless evidence is obtained to the contrary.
- PP 004: An informal cemetery with approximately 81 graves was identified at this location. The cemetery is not fenced and is located in the open veld next to the boundary line of the property. Most of the graves have informal oval or rectangular shaped mounds or outlines of packed rocks as dressings. Some graves have granite inscribed headstones and one grave has a formal granite dressing with an inscribed granite headstone. However, the majority of the graves do not have inscribed headstones or dates. The few dates that are present date to the 1960's and one dates to 1986. Names on the graves include Skosana, Ngwenya, and Mhlanga. The informal graves with no dates should be assumed to be likely to be 60 years or older.
- PP 005: An informal cemetery with approximately 40 graves was identified at this location. The cemetery is not fenced and is located amongst a plantation of blue-gum trees. Most of the graves have informal oval or rectangular shaped mounds or outlines of packed rocks as dressings. Some graves have inscribed granite headstones and some graves have painted metal markers as headstones. The names on the inscribed headstones/markers include several marked as Nkosi and Masina. Since most of the

graves are informal and don’t have inscribed headstones, it is likely that they are 60 years or older.

- PP 006: The remains of an old cattle kraal were identified at this location. The structure was built with stone and mortar and measures approximately 20 m x 25 m in size. Three families had used parts of the old kraal structure to build their own homesteads. These families were working on the farm. The age of the kraal is not known. However, due to its construction of stone and mortar, it is likely that it is 60 years or older.
- PP 007: This site comprises a large storeroom or shed, mostly constructed with sandstone blocks and mortar. However, some sections had been constructed or repaired with mud-bricks. This building is still in use. There is a small, square sandstone-built structure situated next to the large shed. This structure is also built with sandstone blocks and mortar and is in a ruined state. The age of the kraal is not known. However, due to its construction of stone and mortar, it is likely that it is 60 years or older.
- PP 008: The remains of a multi-roomed farm house are located a short distance (50/60m) away from the structures at PP 007. The building was constructed with a combination of sandstone blocks and mortar and brick. A wrought iron fireplace with red tile surround was still in situ, which could date the building to approximately the 1910’s to 1930’s [Edwardian period, http://www.c20fireplaces.co.uk/information/history-twentieth-century-fireplaces-1905-1939]. Another sandstone building is situated approximately 40m to one side of the farmhouse. This building was constructed with sandstone blocks and mortar and was probably used as a shed. It is highly likely that these buildings are 60 years or older and they could be the original buildings for the Hadeco company. This could make them of local significance, specifically to the Hadeco Company.
- PP 009: The remains of a small, square sandstone structure were identified. The structure has no roof and has only one entrance with no windows. It also has a gravel floor. The function and age of this structure is unknown, although the fact that the mortar has been ‘pointed’, indicates that it is likely to be 60 years or older.
- PP 010: A single, informal grave was identified at this location. The grave is situated approximately 40m from a farmstead, which has been identified as site PP 011. The grave has an oval shaped outline of packed rocks as dressing a single rock is placed upright at the western end to serve as a headstone. The age and name of the grave is unknown. It is likely that it could be 60 years or older.
- PP 011: A farmstead which consists of two adjacent brick-built houses was identified at this location. Various other structures are associated with the farmstead. A large brick-built storeroom or shed is located near to the farmstead. Two cement and mud-brick silos

are situated next to this shed. A third brick house, which has been extended several times, is located on the other side of the shed/store. The remains of a cattle kraal were also identified near the houses. The kraal was built with sandstone blocks and mortar. Only the foundations of some of the walls remain. The sandstone blocks of the kraal indicate that the farm buildings may be 60 years or older. The remains of a double-rondawel was also identified, located a short distance away from the other buildings. The two rondawels, built of cement bricks and plastered, are joined by a brick curtain wall. The rondawel may be associated with the single grave

- PP 012: An abandoned coal mine shaft was identified at this location. The shaft is an incline shaft. A second tunnel/shaft extended from the main shaft and its roof had collapsed at the end of this shaft/tunnel. Most of the shaft is flooded with water. The age of this abandoned mine is not known. However, it is likely that it dates to over 100 years.
- PP 013: Another abandoned incline mine shaft was identified at this location. Most of the shaft is flooded with water. The age of this abandoned mine was not known. However, as noted above, it probably dates to the historical period
- PP 014: A possible rock art site was identified at this location. The possible art is very faded and is situated on the southern side of an exposed rock bank which formed a slight overhang. An unusual isolated reddish marking, which could be the faded remains of two possible figures was identified. However, the marking was not very clear.
- PP 015: The remains of a mud brick homestead together with a stone walled cattle kraal were identified at this location. The remains of the mud brick homestead consist of the foundations of two rectangular structures and a circular structure
- PP 016: The remains of a mud brick homestead with a stone walled cattle kraal were identified at this location. The remains of the mud brick homestead consist of the foundations of one rectangular structure, a multi-roomed rectangular structure, and a circular structure. Two informal graves were also identified next to the kraal. The graves have oval shaped mounds of packed rocks as dressing, with no headstones.
- PP 017: An abandoned incline shaft was identified at this location. Most of the shaft is flooded with water. The age of this abandoned mine is not known but it is likely to be of historical date.
- PP 018: An old animal drinking trough was identified at this location. The trough is constructed with sandstone blocks and cement and is plastered. No other structures or features are associated with the trough. The age of the trough is not known, although it could be 60 years or older.

- PP019: The ruin of a stone-walled cattle kraal was identified at this location. Most of the sandstone blocks used in the walls of the kraal have been removed and only one wall remains.
- PP020: A brick and cement, circular dam was identified at this location. A square brick-built building is situated next to the dam. The building is plastered and has a wooden door frame. The building is in a dilapidated condition. The age of these structures is not known but they may be 60 years or older.
- PP 021: The remains of a mud brick homestead were identified at this location. The remains of the mud brick homestead consist of the foundations of one rectangular structure and a multi-roomed l-shaped structure. A further circular structure probably indicates the cooking hut.
- PP 022: The remains of a mud brick homestead were identified at this location. The homestead consists of the foundations of one rectangular multi-roomed structure, two rectangular shaped structures and a square room. A further circular structure probably indicates the cooking hut.
- PP 023: The remains of an old sandstone building were identified at this location. Most of the remains of the building had been removed and only the sandstone blocks which formed the foundations of the building are left. These remains are probably parts of an old farm house, which were broken down and removed over the past years. It is probable that this structure could be 60 years or older.
- PP 024: The ruin of the Sunbury railway station building was identified at this location. The structure is constructed of red brick that was plastered and painted. It has been stripped of its roof, doors, windows and all other features. Only a few of its walls remain. The age of the station building is unknown but it could be 60 years or older.
- PP025: The remains of farm labourer quarters were identified at this location. The structure is brick-built and plastered and measures approximately 10 m x 5 m in size. The roof, doors, windows and frames have been removed from the building. The building consisted of two rooms and a bathroom. A warm water system (donkey) is situated next to the bathroom of the building. A midden was also identified approximately 20 m from the structure. The remains of a cattle or pig shed were also identified approximately 50 m to the west of the labourer quarters. A brick and cement drinking trough was identified near the remains of the cattle/pig shed.
- PP 026: The remains of a mud brick homestead which consists of the foundations of two square structures and a multi-roomed rectangular structure as well as a circular structure.

- PP 027: The remains of a rectangular building constructed with sandstone blocks without mortar or cement. The structure was most probably a shed or a storeroom. The remains of a stone walled kraal were identified next to the ruined sandstone structure. Only the foundations of the walls remain. These two structures are likely to be 60 years or older.
- PP028: A small informal cemetery with eight graves was identified at this location. The cemetery is fenced and is situated in the open veld. Seven of the graves have informal, oval shaped outlines of packed rocks which are filled with soil. One grave has a formal granite dressing and an inscribed granite headstone which provides a date (1961) and a name (Skhosana). However, the other graves are likely to be 60 years or older
- PP 029: The remains of an extended mud brick settlement, which .cover an area of approximately 200 m x 200 m. At least nine different homesteads or structures were identified, which formed part of the larger settlement. Most of the structures survive only as foundation traces and were very difficult to identify.
- PP 030: A farmstead with its associated buildings was identified at this location. The main house and other buildings are intact and are currently occupied. The main house has been extended over the years and several extensions are visible. According to the owner, Mr. Wilkie (whose family has owned the property since before the South Africa War of 1899) the main house is more than a hundred years old. A second house that was built later is situated opposite the original old house. This house is brick-built, with a front stoep and corrugated iron roof with two chimneys. The original house has been joined to a more recent addition. The style and materials used indicate that the original house is probably 60 years or older. Two storerooms or sheds were also identified. They building are built with sandstone blocks and mortar and are located next to each other. These sheds are probably between 60-100 years old
- PP 031: An informal cemetery with approximately 39 graves was identified at this location. The cemetery is not fenced and is located in a ploughed and planted field. Most of the graves have informal oval or rectangular shaped mounds or outlines of packed rocks as dressings. Some graves have granite inscribed headstones and one recent grave has a formal granite dressing and an inscribed granite headstone.
- PP 032: The remains of another mud brick homestead were identified at this location. The remains consist of the foundations of four square structures, and a circular structure.

Two historical mining shafts are located on portion RE of Paardeplaats 425 JS, which is indicated as not being affected by mining activities. These two sites should therefore be retained in situ. One historical mining shaft is located on portion 2 of the Paardeplaats 425 JS.

Archival research has indicated that mining activities were taking place in the Belfast area between 1895 and 1911 by the Transvaal Consolidated Coal Mines Limited, and it is likely that these mining shafts are over 100 years old. This would qualify them as archaeological sites and therefore a permit would have to be obtained from SAHRA before they could be destroyed. SAHRA will require that all the shafts be mapped before a destruction permit can be issued.

There is evidence of possible rock art within the study area. It is recommended that the site be demarcated as a no-go area and that a specialist on rock art be contracted to evaluate and confirm the existence of the rock art and if confirmed develop further management recommendations for the site.

PGS was requested to investigate the possible impact of the existing blasting activities (Glisa Coal Mine) and future blasting activities on the graves at the Belfast Municipal Cemetery and the Concentration Camp Cemetery.

Evidence of damage to gravestones at both the Municipal Cemetery and Concentration Camp Cemetery was visible. It is not clear whether the damage may be due to existing blasting activities or to other causes. Although, the fact that the Municipal Cemetery is located very close to the entrance of the Glisa Mine and that there is clear evidence of damage to many graves in this cemetery could be indicative of a link.

The fossil coal floras of South Africa are of international interest, and represent an important part of our local heritage. Any loss of this heritage due to mining or construction activities is permanent, and should be regarded as a highly significant negative impact.

Alternatively, discovery of fossils during excavation, followed by effective mitigation in collaboration with a palaeontologist, would result in the curation of new and important fossil material – therefore the development could potentially have a positive, beneficial impact on South Africa's palaeontological heritage.

In palaeontological terms any destruction of fossils is a permanent negative impact and must be regarded as potentially high impact significance. New taxa are fairly regularly encountered in plant fossil studies, and destruction of well-preserved, undescribed fossil beds could represent a heavy loss in terms of our understanding of historical biodiversity.

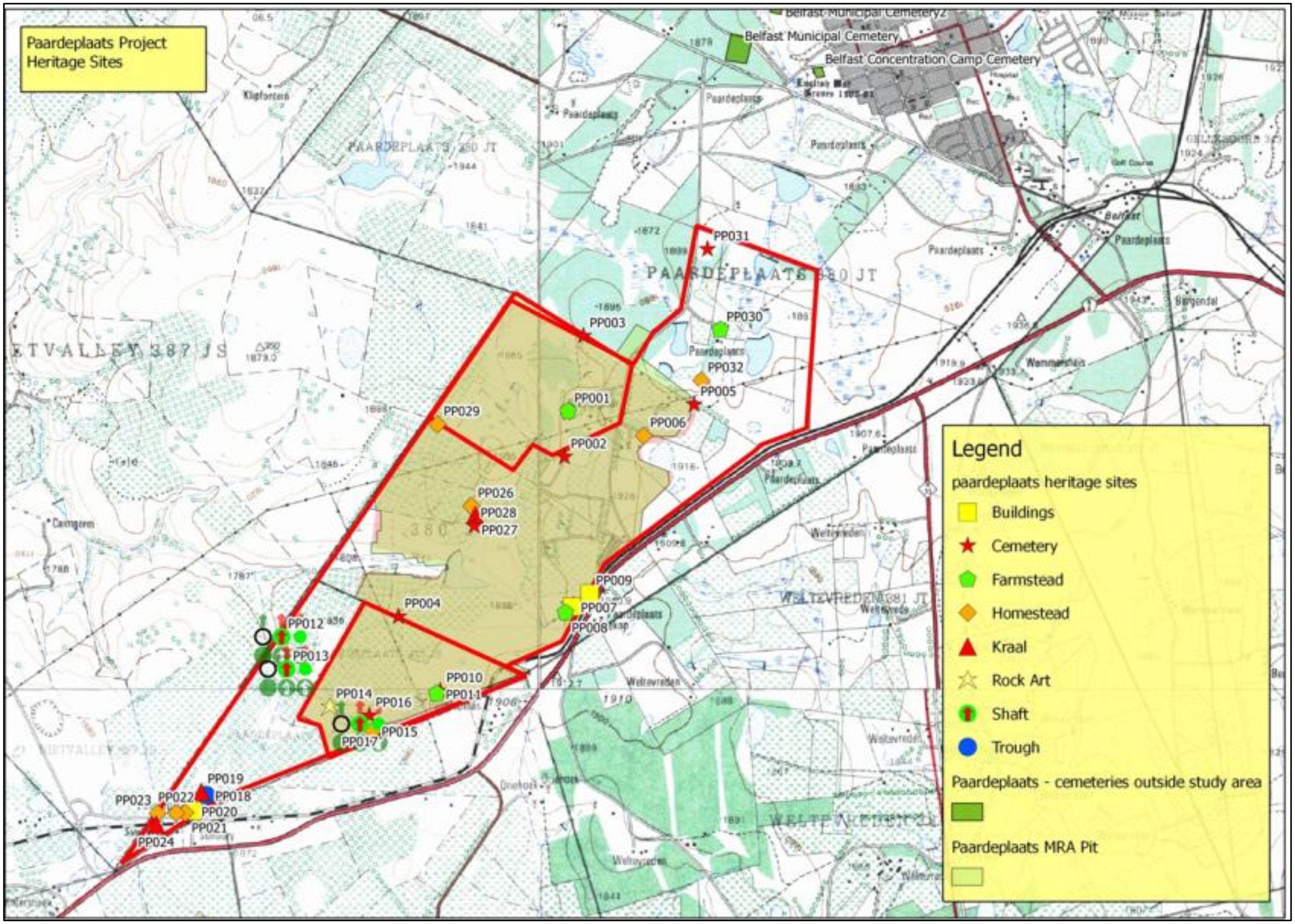

Figure 6: The heritage features in relation to the study area

3.8.4 CONCLUSION

The proposed Paardeplaats operation is located within an area rich in heritage and cultural features which range from graves, historical structures, a potential rock art site, and historic mining shafts.

3.9 FLORA

3.9.1 INTRODUCTION AND RELATED IMPACTS

Mining activities and the establishment of supporting infrastructure have the potential to result in loss of vegetation, habitat disruption, loss of ecosystem functionality, habitat transformation, spread of alien invasive species and ultimately a reduction in overall of biodiversity.

3.9.2 DATA COLLECTION

The flora assessment made use of the Braun-Blanquet approach, which is the national standard for vegetation description and mapping in South Africa. Thirty (30) plots were sampled during February 2011, with a follow up winter survey to those plots with the most, least and average plots in July 2011. The thirty (30) plots were placed pro rata, randomly based on slope, aspect and wetness based on a Digital Terrain Model (DTM) derived from 5 m contours.

3.9.3 RESULTS

A study focused only on the study area without taking into consideration the broad environment and adjacent land use, would be contrary to the goals of the National Environmental Management Act, 1998. Therefore the environmental overview was based on the quaternary catchment. The quaternary catchment was selected, as it is the smallest unit for which biophysical data is available from DEAT's ENPAT series. Quaternary catchment were used in the National Spatial Biodiversity Assessment rivers component to assess the status of rivers in South Africa and highlights the importance of quaternary catchments as a unit to measure the influence of human activities on water and the catchment areas they depend on (Nel *et al*., 2004).

Quaternary catchment B41A in which the study area occurs is located in the Olifants River primary catchment. It forms part of the Olifants Water Management Area. According to the National Spatial Biodiversity Assessment's River component, between 75% and 95% of the Olifants Water Management Area's mainstem are critically endangered or endangered. Therefore conservation and restoration of drainage lines in this area should be a priority. Quaternary catchment B41A is classified as having rehabilitation potential therefore the prevention of additional degradation should be a priority as well as the restoration and protection of remaining ecosystems whether terrestrial or aquatic.

The internal catchments within the Quaternary catchment are indicated in the figure below.

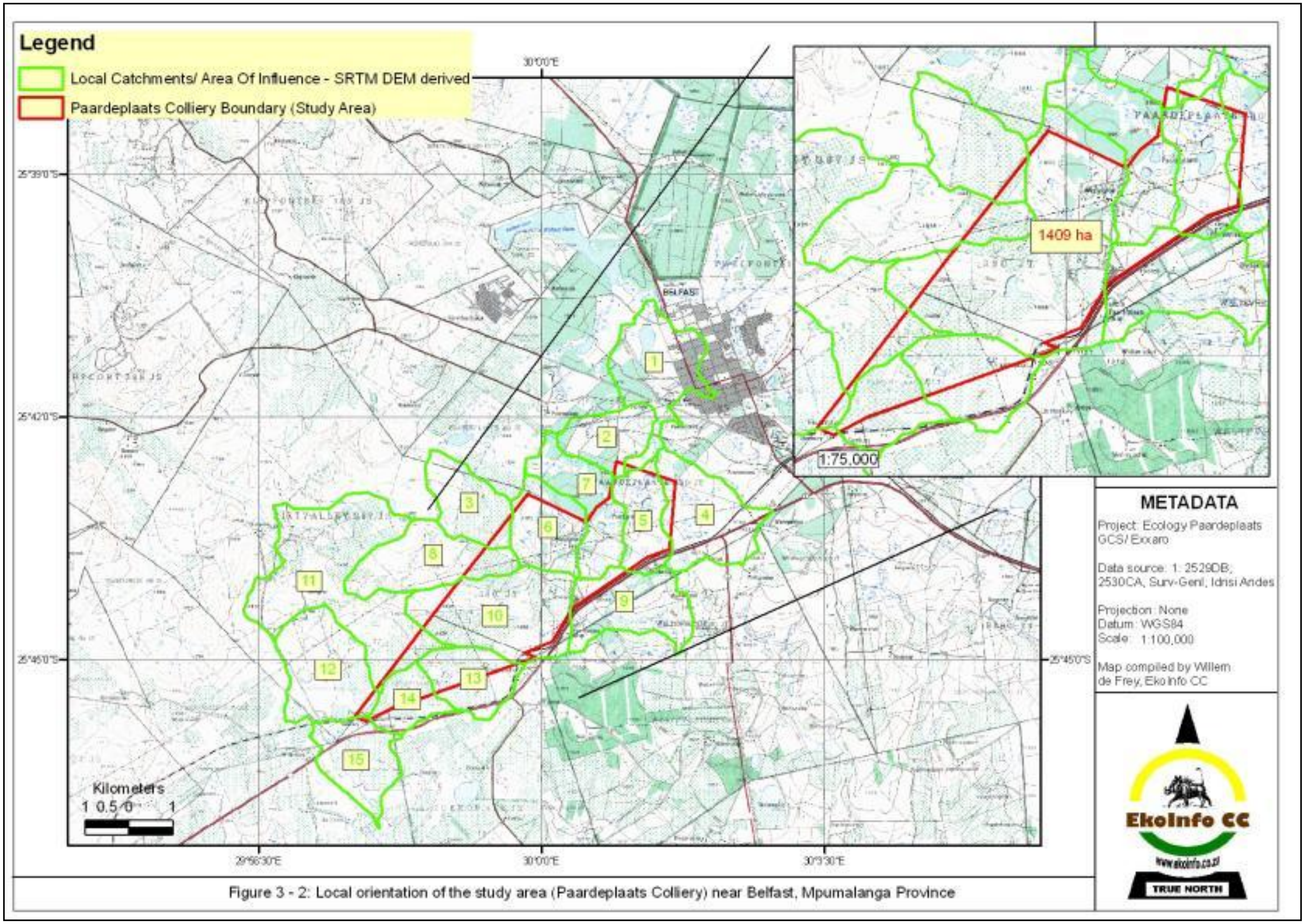

Figure 7: Internal catchments of the study area

The study area is located in the Grassland Biome of South Africa, across one regional vegetation unit, namely the Eastern Highveld Grassland (Rutherford & Mucina 2006). This regional vegetation unit is classified as Endangered. There is also the presence of a small portion (23 ha or 2%) of the vulnerable Lydenburg Montane Grassland (Mapping unit GM18 – Rutherford & Mucina 2006). The small/insignificant extent of the presence of this vegetation within the study area does not warrant a comprehensive description of this unit, as most of the mining influence would be within the Eastern Highveld Grassland.

Regionally according to the 2000 land cover classification, 74% of the landscape still represents natural vegetation (habitat), with only 26% being transformed. This implies that most of the landscape is still well connected and fragmentation is a minor issue (Turner, Gardner & O'Neill, 2001; Wiens, Moss, Turner & Mladenoff, 2006)

According to the Mpumalanga Parks Board Biodiversity Assessment (Version 1, 2006) more than 50% of the study area is highly significant in terms of the province’s conservation priority. Less than 40% presents transformed land with no conservation significance.

In terms of the latest nationally available land cover 2000 dataset, 77% of the study area is considered to be natural and 20% is transformed. This implies that within the study area currently connectivity is not an issue as the threshold for connectivity is 25% or more transformation (Turner, Gardner & O'Neill, 2001; Wiens, Moss, Turner & Mladenoff, 2006).

Therefore it can be concluded that based on the available small scale datasets, the study area represents an intact portion of an overall natural landscape. It is expected that the remaining natural flora and fauna at a local scale within the study area will reflect this natural/pristine state.

Based on the summer survey (February 2011) results, it was possible to map five vegetation communities within the study area, of which four present primary vegetation communities and one secondary vegetation community. The main drivers of the distribution and extent of the five vegetation communities were altitude, soil conditions (wet/dry, sandy/clay, shallow/deep) and human influences (grazing, cultivation, forestry). At the time of the vegetation survey, a detail soil map was not available, and the change in species composition because of the exploitation of the area, made it difficult in spite of using GIS modelling and satellite imagery (Landsat 7 July 2005) to accurately and with high confidence map the extent and distribution of the vegetation communities in the remaining natural vegetation.

Figure 8 indicates the spatial extent of the five vegetation communities.

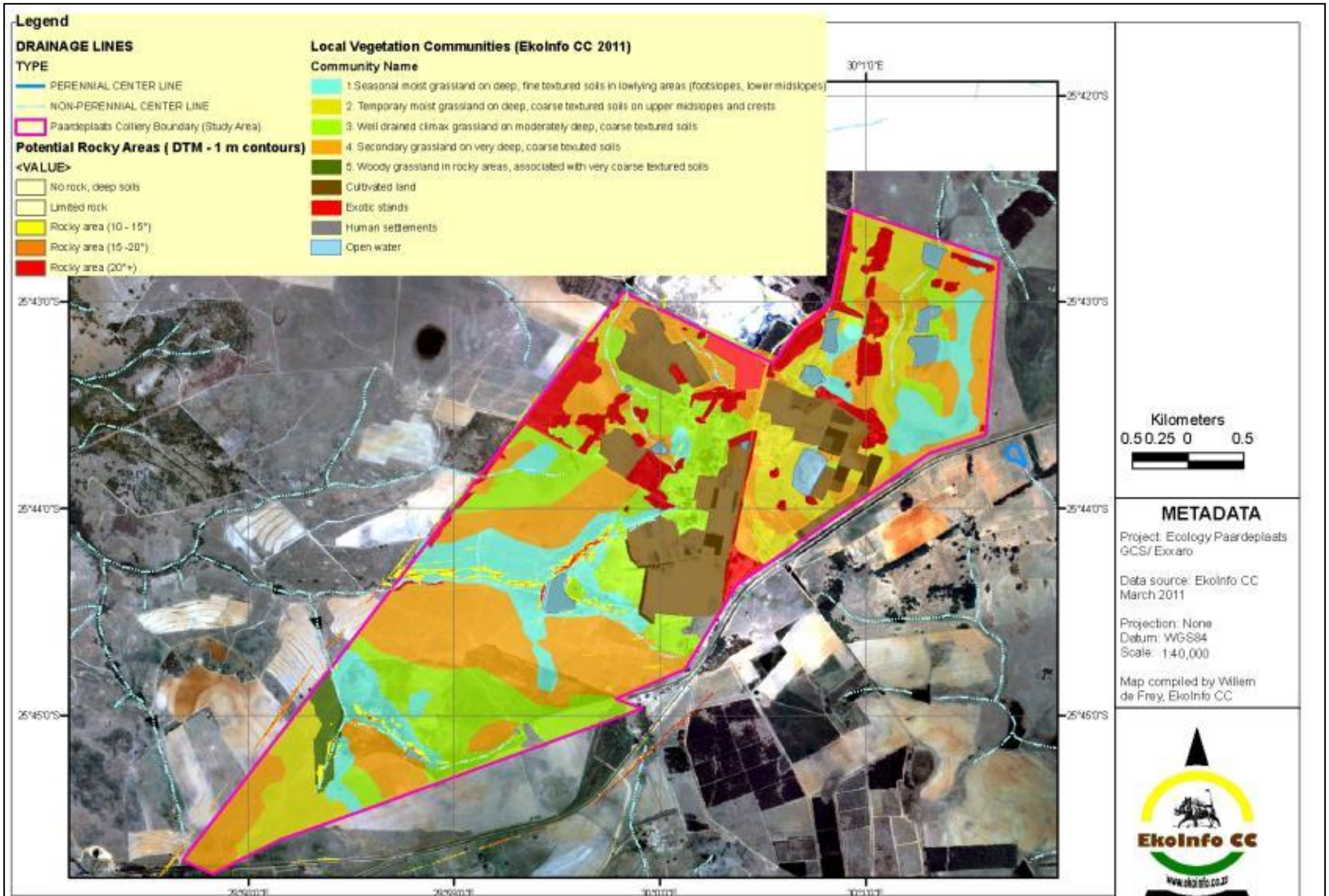

Figure 4 - 3: Vegetation communities mapped at Paardeplaats (study area) during March 2011

Figure 8: Vegetation communities identified in the study area

The most species rich community is community five associated with the outcrops, the species poorest community is community four, which represent the secondary grassIands (old fields, felled forestry areas). No threatened Red Data flora was recorded within the study areas, but a number of provincially protected, medicinal and alien invasive plants were recorded. All of the plant communities have a high floral sensitivity, with the exception of the secondary grasslands (community four) which is moderately sensitive. Approximately 500 ha (37%) of the study area presents persistent grassland and these area should be given very high conservation priority, especially the area to the northeast (internal catchment 5) and the area adjacent to the Steelpoort river (internal catchment 10).

Should mining be allowed in the area, it is recommended that underground rather than open cast mining should be the preferred method, with the mining activities and infrastructure focused within internal catchment 6, which is close to an existing mining operation and of which most of the area had been historically transformed through intensive farming practices.

It should be noted that the remaining natural vegetation within the study area has high conservation status, with the following environmental liabilities being present:

- Alien invasive species;
- Erosion;
- Exploited vegetation;
- Provincially protected plants; and
- Wetlands.

The study area is located within the Mpumalanga Conservation Plan (C Plan) Area. The area has been highlighted by the Mpumalanga Parks and Tourism Agency as of high conservation value. The map below indicates the location of the study area in relation to the Mpumalanga C Plan.

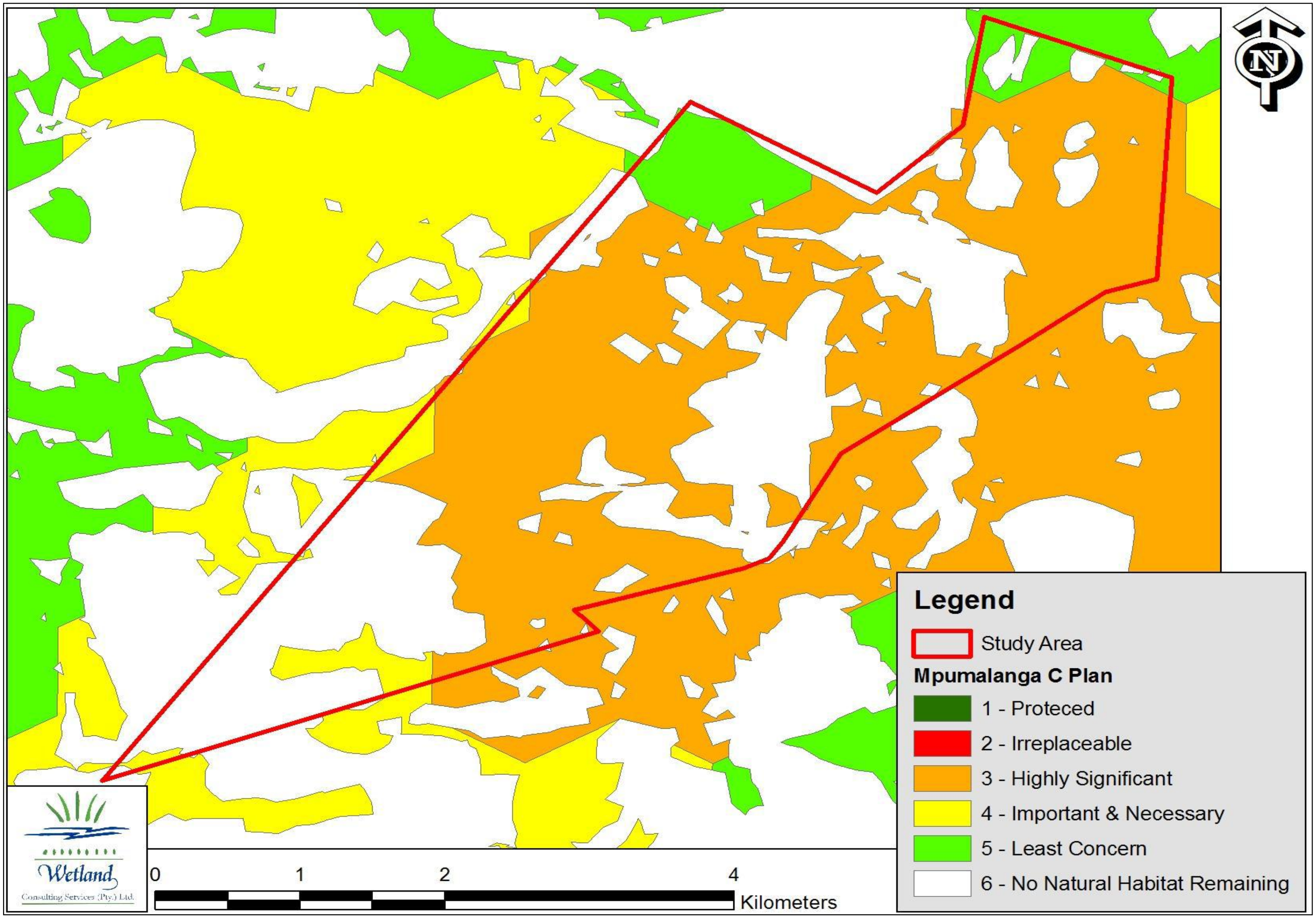

Figure 9: Mpumalanga C-Plan in relation to the study area

None of the threatened (Vulnerable, Endangered, Critically Endangered) species of Mpumalanga Province was recorded within the study area. The majority of the species recorded are least concern in terms of the latest Red Data flora publication of SANBI, with only the geophyte *Eucomis autumnalis* being flagged as declining, which was recorded within community two and three.

Six (6) species in terms of the Mpumalanga Conservation Act were recorded: *Agapanthus inapertus*, *Eucomis autumnalis*, *Gladiolus crassifolius, Habenaria epipactidea*, *Scilla nervosa*, *Zantedeschia albomaculata*. The majority of the protected species was recorded in community two, the transitional community between the moist and dry grassland. Please note that all species within either the family or genera are protected in terms of the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998).

No listed protected species in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) were recorded within the study area; however the ecosystem, namely Eastern Highveld Grassland is listed as vulnerable under the NEMBA.

3.9.4 CONCLUSION

Based on the results of the study it is concluded that 651 ha (46%) of the study area represents natural vegetation. This remaining vegetation is under severe pressure from grazing which is changing the species composition, to the detriment of decreaser (climax, palatable) species and the benefit of increaser (pioneer, successional) species. The vegetation community associated with the outcrops (community five) contains the highest species richness, but in the context of study area all the remaining natural vegetation has a high sensitivity and therefore high conservation significance. In terms of persistent grassland within the study area two areas are of very high conservation significance, the area to the north-east associated with internal catchment 5 and the area along the Steelpoort River (internal catchment 10).

It is therefore recommended that should mining be authorised in this area, that underground mining rather than open cast mining should be considered, specifically in relation to internal catchments 5 and 10. These two catchments cover approximately 700 ha, internal catchment 5 with 219 ha and internal catchment 10 with 552 ha. If mining activities and infrastructure are kept out of these two internal catchments, it would affect approximately 50% of the study area. Preferably mining activities and infrastructure should be concentrated into a single internal catchment to reduce fragmentation and pollution risk. Internal catchment 6 could qualify for this purpose as it is already located next to existing mining activities and the area within this catchment has experienced extensive transformation due to intensive farming activities.

3.10 FAUNA

3.10.1 INTRODUCTION AND RELATED IMPACTS

Sensitive faunal habitats are by their very nature, highly complex. Wetlands, ridges and drainage lines and intact patches of connected grassland, irrespective of their ecological condition, represent the most sensitive faunal habitats. The establishment of infrastructure and mining operations have the potential to result in damage to habitat, loss of biodiversity, introduction of foreign animals, direct and indirect mortality of animal species, and the loss of or damage to Red Data and protected species.

3.10.2 DATA COLLECTION

The following methods of data collection were utilised in the faunal assessment.

3.10.2.1 Avifauna Data Collection

A desktop and literature review of the area under investigation was commissioned to collate as much information as possible prior to the fieldwork exercise. These included the following (although not limited to):

- Hockey *et al*. (2005) was consulted for general information on bird identification and life history attributes;
- Barnes (1998) was consulted for information regarding the biogeographic affinities of selected bird species;
- Barnes (2000) and the IUCN Red List of Threatened Species, Version 2011.1 (2011) were consulted for information regarding the conservation status of selected bird species;
- Distributional data was sourced from the South African Bird Atlas Project (SABAP1) and verified against Harrison *et al*. (1997) for species recorded from the quarter-degree grid cell (QDGC) 2529DB Languitsig, 2530CA Belfast and 2529DD Arnot. The SABAP1 data provides a “snapshot” of the abundance and composition of species recorded within a quarter degree grid cell (QDGC) which was the sampling unit chosen. It should be noted that the atlas data makes use of reporting rates that were calculated from observer cards submitted by the public as well as citizen scientists. It therefore provides an indication of the thoroughness of which the QDGCs were surveyed between 1987 and 1991; and
- Additional distributional data was also sourced from the SABAP2 database (http://www.sabap2.adu.org.za). Since bird distributions are dynamic (based on landscape changes such as fragmentation and climate change), SABAP2 was born (and launched in 2007) from SABAP1 with the main difference being that all sampling is done

at a finer scale known as pentad grids (5 min lat x 5 min long, equating to 9 pentads within a QDGC). Therefore, the data is more site-specific, recent and more comparable with observations made during the site visit (due to increased standardisation of data collection).

A site survey was undertaken during 21 – 22 July 2011, 27 – 31 October 2011 and 12 November 2011. During the survey, bird species was identified, and where necessary, verified using Roberts Birds of Southern Africa, VIIth ed. (Hockey *et al.,* 2005). The presence of bird species was also verified by means of their calls and other signs such as nests, discarded egg shells (Tarboton, 2001) and feathers. Particular attention was paid to suitable roosting, foraging and nesting habitat for Red Data species, in particular the "vulnerable" African Grass Owl (*Tyto capensis*).

The potential occurrence of elusive species was verified by the playback of their respective calls. This technique is highly effective and was used to evaluate the presence of Broad-tailed Warbler (*Schoenicola brevirostris*) and Striped Flufftail (*Sarothrura affinis*) on the study site.

All areas consisting of apparent suitable African Grass Owl (*Tyto capensis*) habitat were surveyed on foot by means of dragging a 60 m rope. Although seemingly unethical, rope-dragging is considered to be the most reliable and rapid method to establish the presence of Grass Owls when time is limited or when large areas of habitat are to be screened.

In order to obtain information on the composition and dominant/typical taxa present, data was collected from 38 point counts (Buckland *et al.,* 1993) representing the different habitat types on the study site. At each point count the number of bird species observed within a 100 m radius was recorded, as well as their respective abundances. Each point count lasted approximately 10 minutes. To ensure the independence of observations, points were at least 200 m apart. The data generated from the point counts was analysed according to Clarke & Warwick (1994) based on the computed percentage contribution (%) of each species including the consistency (calculated as the similarity coefficient/standard deviation) of its contribution to each habitat type. Hierarchical Agglomerative Clustering (a cluster analysis based group-average linkages; Clarke & Warwick, 1994) was performed to assign associations between samples with the aim to objectively delineate groups or communities. Therefore, sampling entities that group together (being more similar) are believed to have similar compositions.

Species richness was measured for each community (as delineated above) by calculating the total number of species recorded (S), the total number of individuals (N) and the Shannon-Weaver diversity index (H' (loge)).

The use of point counts is advantageous since it is the preferred method to use for cryptic or elusive species. In addition, it is the preferred method to line transects counts where access is problematic, or when the terrain appears to be complex. It is a good method to use, and very efficient for gathering a large amount of data in a short space of time (Sutherland, 2006).

In addition, all observations were processed for submission to the South African Bird Atlas Project (SABAP2).

3.10.2.2 Invertebrate Data Collection

The invertebrate survey was divided into two parts, consisting of a (1) qualitative taxon-specific survey and a (2) quantitative survey of the arthropod diversity and abundance on grassland types that differ in succession. The objective of the quantitative survey was to evaluate the arthropod diversity on the study site by adopting a similar approach (albeit slightly modified according to prevailing environmental conditions) used by Zilihona *et al.* (1998) and Zilihona and Nummelin (2001).

Surveys dealing with invertebrate groups impose significant problems especially when dealing with a huge global taxonomic impediment. Perhaps a better alternative in addressing developmental issues is to limit the number of taxa to a few species or target groups – often referred to as indicator groups. For example, data from field surveys aimed at inquiring for signals or “thresholds” that will inform environmental changes at hand – e.g. changes to the abundance and distribution of target species or groups. Therefore, to address any question about the health or integrity of an ecosystem, a surrogate (or “shortcut”) is needed, which in itself plays an integral part of the system. In addition, any responses reflected in the target group should also be reflected on other species forming part of the system.

For an indicator or target group/species to be successful, it should meet the following criteria (Feinsinger, 2001):

- It must be easy to sample objectively;
- It should be a group/species that can be sampled efficiently;
- The target group must provide large numbers per unit effort;
- Sampling should be cost-effective;
- The target group/species should be well-known (familiar);
- The scale at which the target group operates should correspond to the scale of the question raised (e.g. study site);
- The target group should be sensitive to factors of conservation concern;
- The target should respond consistently to environmental change over time and space, in either a similar or opposite direction;

- The target should be active at all seasons when sampling might occur; and
- The target should preferably be of interest to a wide spectrum of communities (e.g. the rural community).

Butterflies, like birds and mammals are charismatic and obvious in nature. They qualify as a valid target group, but seldom do so as a biodiversity indicator since their responses to habitat variables and human activities are complex (Feinsinger, 2001). The latter is partly explained by the difference in lifestyles and resource requirements between larvae and adults. In addition, some species could be vagrants, which is sometimes difficult to distinguish from visiting species. However, butterflies were included in the study since they are one of the few insect groups that are globally assessed in terms of the IUCN criteria. They are widespread, relatively diverse and easy to identify in the field (being day-flying and conspicuous). Butterflies are also one of a few groups of invertebrates that are taxonomically well known and many species exhibit precise ecological requirements and are thus known to respond to particular changes in the environment (New, 1997). In conclusion, they are undoubtedly useful to include in habitat assessments conducted on a local spatial scale.

Quantitative surveys (based on pitfall trap results and sweepnetting) provide an indication of the arthropod and Coleopteran diversity by comparing two major habitat types (primary grassland vs. secondary grassland) with each other. Specific reference was made to the Coleoptera diversity because it is a diverse group of insects that are relatively easy to identify to the family level, and plays an important role in ecosystem functioning (Hanski & Cambefort, 1991).

A total of 20 simple 2 litre buckets per sampling site were used as pitfall traps. Only grassland seres with high forb richness (primary) and with a grazed (secondary) composition were sampled and compared. The buckets were dug into the soil with the opening level with the soil surface. Each container was then half-filled with preservative. The traps were left in situ for three weeks before they were removed.

Order-, morpho-species- and Coleopteran family level diversities were estimated using the Shannon-Weaver index (H') (in Zilihona and Nummelin, 2001) while the Bray-Curtis similarity coefficients of the software package PRIMER for Windows, Ver. 5.2.2 was used to compare arthropod and Coleopteran taxa and abundance distributions between the different habitat types. A cluster analysis based on Bray-Curtis similarity coefficients (Clarke & Warwick, 1994) was used to estimate the similarity of the taxa involved and the different habitat types. A cluster analysis is used to assign associations between samples with the aim to objectively delineate groups or assemblages with similar compositions and abundance values. Therefore, sampling entities that group together (being more similar) are believed to have similar compositions which also provide an indication on the reliability of the sampling effort per habitat type.

The effect of each habitat type was compared using the Shannon-Weaver Index and the number of families (S) in each habitat type.

Sweepnetting was used to collect invertebrates from above-ground foliage pertaining to grassland seres. A total of 30 sweep samples were taken whereby the grassy layer was brushed back and forth to dislodge invertebrates up to a height of 1 m above the ground. A sweep sample consisted of a linear transect of approximately 100 sweeps. Sweepnet sampling took place during 14 – 17 February 2011.

3.10.2.3 Herpetofauna Data Collection

During the summer survey (25 - 31 October 2011), three funnel trap drift fence arrays were placed within the selected areas where herpetofauna diversity was expected to be greatest within a particular habitat and where possible (depending on the soil conditions and slope). These sites were selected through ground-truthing inspection of several potential sites during the scoping winter survey. Pitfall traps are very effective in trapping small reptiles, particularly lizards, small snakes and amphibians (Corn & Bury, 1990; Branch, 1998; Crosswhite *et al.,* 1999). The efficacy of pitfall trap arrays are increased by the addition of funnel traps along the drift fences (e.g. Masterson *et al.,* 2009). The funnel-trap drift fence arrays (designed by L. Verburgt) allow for the placement of traps where it is not possible to sink a 25 litre bucket (e.g. rocky or boggy ground) and provide greater trapping success (L. Verburgt, pers. obs.). Traps were inspected daily in the morning and all captured specimens were photographed and released away from the traps.

Reptiles were searched for on foot within the study area during the day. Active searching for reptiles involved:

- Photographing active reptiles from a distance with a telephoto lens;
- Lifting up and searching under debris or rocks (rocks was returned to their original position);
- Excavation of suitable burrows that appeared to be in use;
- Scanning for any signs of reptiles such as shed skins, the positive identification of which were taken as an observation of that species; and
- Catching any observed reptile by hand. All captured reptiles were photographed and released unharmed.

Nocturnal snakes were searched for by driving very slowly on the roads at night. Amphibians (frogs and toads) are nocturnal and were searched for by torchlight at night along dam/pond edges and in wetland areas. Each amphibian species encountered at a particular site was photographed. Positive identification of acoustic signals (males call to attract females) was also used as a means of identifying amphibians. Acoustic signals were recorded with high-precision recording equipment where possible and identification confirmed with existing recordings (Du Preez & Carruthers, 2009). Remote sound recording equipment was deployed at suitable sites for amphibians and was set to record for 4 hours during each night. Recordings were analysed post hoc to identify any species calling that were not directly observed during active searching.

All available books providing information on distribution ranges and/or conservation status of South African herpetofauna were utilised to make predictions of occurrence in the area (see reference list). The South African red data book – Reptiles and amphibians (Branch, 1988) is outdated and therefore the conservation status of the reptiles must be interpreted cautiously. The Southern African Reptile Conservation Assessment (SARCA, 2011) is currently taking action to generate a new Red data book but is still in preparation. Nevertheless, the SARCA website (http://vmus.adu.org.za/) makes all information available to the public and was utilised as the most current distribution authority for snakes and lizards. Reptile species nomenclature follows SARCA (2011). A complete guide to frogs of southern Africa (Du Preez & Carruthers, 2009) was used as the primary identification guide and species nomenclature follows this reference. Online information was obtained from the Southern African Frog Atlas Project (SAFAP; http://vmus.adu.org.za/). The IUCN website (www.iucnredlist.org) was utilised to provide the most current account of the global conservation status of reptiles and amphibians while the National Environmental Management: Biodiversity Act (NEMBA, 2004) was consulted for local conservation status. All reptile and amphibian species accounts recorded will be submitted to SARCA and SAFAP respectively

3.10.2.4 Mammal Data Collection

Skinner and Chimimba (2007) was consulted for general information on the distribution and habitat requirements of mammal species; Liebenberg L. (2005) as well as Stuart and Stuart (1998) provided on site reference material to spoor and animal sign identifications; and the conservation status of mammal species was acquired from the Endangered Wildlife Trust, 2004, Red Data Book of the Mammals of South Africa and cross-referenced with Skinner and Chimimba (2007) and the IUCN.

During the winter survey period, Sherman traps were placed in trap lines of 15, within 3 sites in the study area for a period of 5 nights. The lines were placed in pre-determined sampling points around the study area in order to gain a representative sample of the rodent assemblages within the study area. Bait used is a combination of peanut butter, sardines, vegetable oil and oats as recommended by Chimimba (pers. comm.). The use of Sherman traps to sample small mammal populations are necessary in order to comply with minimum sampling requirements for regional and international conservation authority standards.

There are various levels of information that may be obtained from the use of intensive small mammal Sherman trapping.

- The diversity of the small mammals in the area can be used to indicate the impacts of mining disturbance. Assemblages can be directly compared to disturbance in order to indicate the effects of the activities on populations and diversity.
- System health can be indicated by the average percentage trap success and/or species diversity for a given trap line.

Spoor tracking is considered to be the world's oldest science, enabling detailed sampling of mammalian species without the need for trapping or direct observation. All spoors, including footprints, den sites, burrows, hairs, scrapings and diggings was recorded and documented by detailed photography.

The use of camera trapping has long been considered as a valuable ecological census tool in southern Africa. This method has been primarily used as a passive technique, which is confounded by the above influences, thereby creating a negative sample bias. This method can be strongly improved by increasing attention to camera site selection as well as the use of bait, i.e. active sampling.

An initial reconnaissance was carried out in the area before camera deployment, in order to determine the suitability of possible bait station locations. Bait stations are chosen based on available cover around the area, the location of the site on the properties and the presence of any promising signs (e.g. tracks, scats, tree scrapings) and the likelihood of possible habitat for important species.

Once suitable sites were located, the cameras were mounted and baits deployed. The baits used were mostly a combination of oil and fish remains. All bait used will be acquired locally. The suspended bait is designed to negate the effects of animals removing the fish carcasses to outside the range of the camera, as well as to allow air movement to spread the scent of the decomposing fish further. Five cameras were deployed in winter for a period of 28 nights. Seven cameras were deployed in summer for 5 nights and then six cameras were deployed for a further 17 nights.

Cameras are set to record one images every time an animal enters the station (known as an event) followed by a 30 second video, which can record both the animals behaviour as well as eliminates much of the data loss which occurs when the animal is out of the camera range. After each trigger, there is a 1-minute delay between events. The initial bait station locations was chosen to cover as much of the study area as possible (especially with regards to habitat types as well as spatial representation).

It is imperative to note that a small number of cameras (e.g. 2 or 3) are wholly insufficient to sample an area of 1000 hectares or more. In order to account for the home range movements of animals, prevailing changes in weather conditions and the total area affected by the influence of the bait, areas were saturated with bait stations. The total number of winter trap nights (28x5) totalled 140, whilst the total number of summer trap nights (7x5 plus 6x17) equalled 137. This totalled 277 trap nights, which is the equivalent to leaving one baited camera on site for approximately 9 months.

3.10.3 RESULTS

The study area falls within the Mpumalanga Conservation Plan (C Plan) Area and also falls on the boundary of the Steenkampsberg Important Bird Area (IBA). The study area is located in the Grassland Biome of South Africa, across one regional vegetation unit, namely the Eastern Highveld Grassland (Rutherford & Mucina, 2006). This regional vegetation unit is classified as Endangered. The site is therefore considered to be in a high conservation area. Specific results are provided below per faunal grouping.

3.10.3.1 Avifauna

Eight habitat types were identified, ranging from primary to secondary grasslands, exotic plantations and cultivated land. The *Tristachya leucothrix – Alloteropsis semialata* climax grassland, the seasonal and temporary moist grasslands and the various impoundments were found to be important habitat types since they sustain bird species of “conservation importance” or high invertebrate richness values;

A total of 226 bird species are likely to occur on the study site and 156 species were confirmed during the survey. Six bird species of special conservation concern were recorded on the study site. These include the Blue Crane (*Anthropoides paradiseus*), Southern Bald Ibis (*Geronticus calvus*), Secretarybird (*Sagittarius serpentarius*), Lesser Kestrel (*Falco naumanni*), African Marsh Harrier (*Circus ranivorus*) and the Broad-tailed Warbler (*Schoenicola brevirostris*);

The study site was represented by five avifaunal communities consisting of (1) a highveld community partial to exotic plantation species, (2) a species-poor community confined to high-altitude grassland, (3) a species-rich community restricted to areas of open surface water and associated shoreline habitat, (4) a community restricted to moist grassland and (5) an unspecified community representing highveld taxa with opportunistic life-histories.

The figure below indicates the study area in relation to the Steenkampsberg IBA.

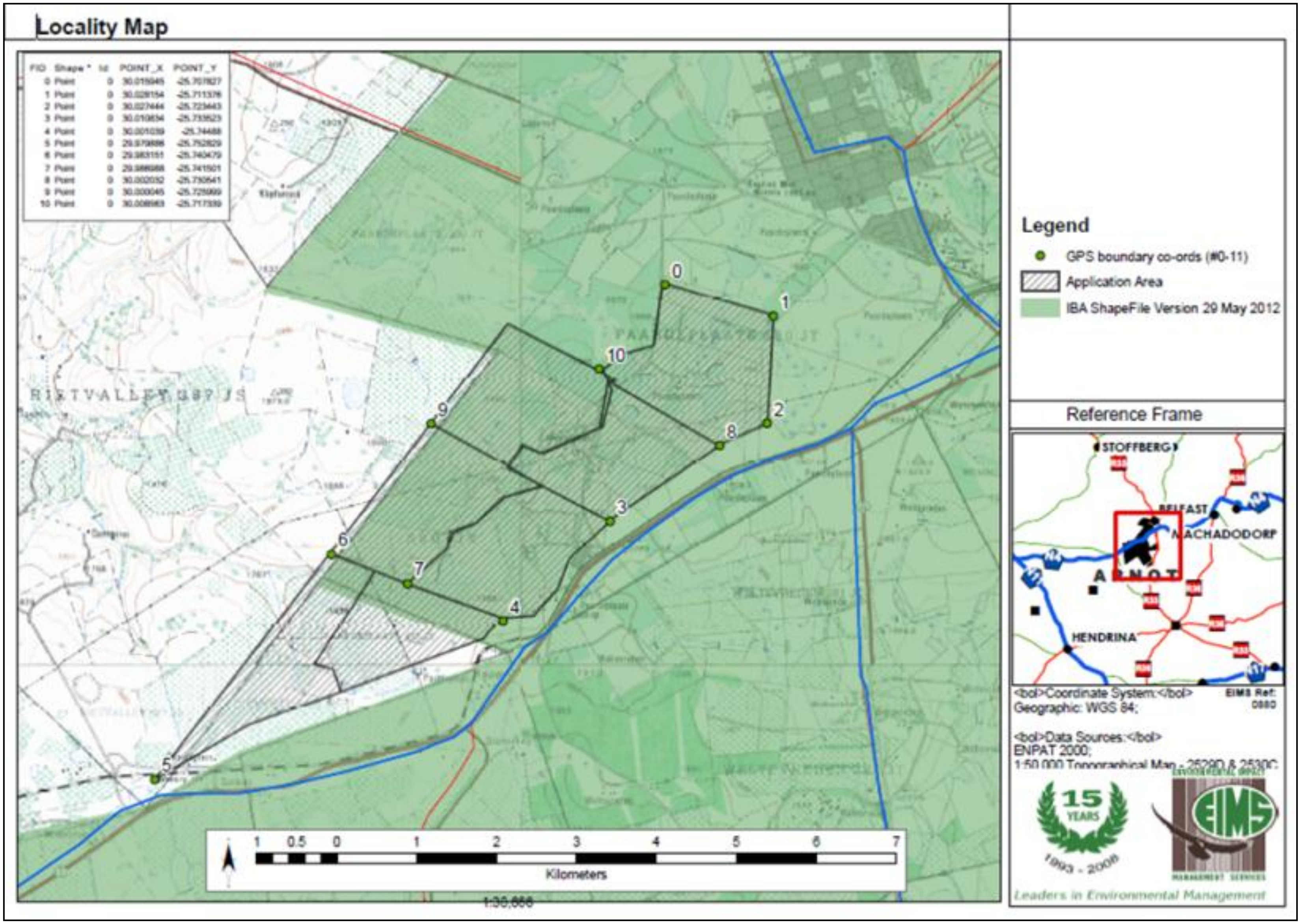

Figure 10: Steenkampsberg IBA and Paardeplaats area

The ecological importance of the study site for bird species:

- The hillslopes seeps, moist grassland units and Steelpoort River are linear in configuration and act as important dispersal corridors for many terrestrial bird species (especially skulking taxa such as rails, flufftails and crakes). These units are important daily flight routes for wading birds and waterfowl (mainly herons, cranes, cormorants, ibises, ducks and geese) between foraging and roosting sites. Some sections even provide potential breeding and foraging habitat for threatened bird species, in particular the African Grass Owl (*Tyto capensis*) and African Marsh Harrier (*Circus ranivorus*);
- The impoundments, although artificial, conform to an interconnected system of dams and water features with high variability among each other in terms of depth and water levels. These systems are highly dynamic and experience frequent turnover of species. They often provide refuge for large congregations of waterfowl, especially during moulting; and
- The grassland units on the central and northern section of the study site (mainly intact grasslands of large surface area) have the inherent potential to provide habitat for a number of threatened and conservation important bird species, in particular terrestrial taxa such as the Blue Korhaan (*Eupodotis caerulescens*), Secretarybird (*Sagittarius serpentarius*) and Southern Bald Ibis (*Geronticus calvus*). These units are the preferred non-breeding foraging habitat for the “vulnerable” Lesser Kestrel (*Falco naumanni*).

Table 20 below lists the bird species of special conservation concern that could potentially utilise the study area.

Table 20: Bird species of "special conservation concern" that could utilise the study site based on their known distribution range and the presence of suitable habitat. Species highlighted in grey were confirmed on the study site. * - denotes species that are restricted to the Afrotropical highlands (Barnes, 1998). Red list categories according to the IUCN (2011) ** and Barnes (2000) *.**

Species	Global Conservation Status**	National Conservation Status***	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Potential Likelihood of Occurrence
Alcedo semitorquata (Half-collared Kingfisher)	–	Near-threatened	Yes	No	Prefers fast-flowing and well-vegetated streams.	Unlikely to occur.
Anthropoides paradiseus (Blue Crane)	Vulnerable	Vulnerable	Yes	No	Prefers open pristine grasslands, as well as wetland habitats.	Regarded as an uncommon foraging visitor on the study site.
Balearica regulorum (Grey Crowned Crane)	Vulnerable	Vulnerable	Yes	Yes	Upland grassland in close association to wetland systems.	An uncommon foraging visitor on the study site. A regular visitor on the nearby Glisa Coal Mine.
Bugeranus carunculatus (Wattled Crane)	Vulnerable	Critically Endangered	Yes	No	Restricted to extensive upland sponges in montane grassland (at least in South	A very rare foraging visitor – probably unlikely to occur.

Species	Global Conservation Status**	National Conservation Status***	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Potential Likelihood of Occurrence
					Africa).	
Ciconia nigra (Black Stork)	-	Near-threatened	Yes	No	Forages in and around large permanent wetlands and roost and breeds in remote mountainous areas (cliffs).	Vagrant on the study site.
Circus ranivorus (African Marsh Harrier)	-	Vulnerable	Yes	No	Restricted to permanent wetlands with extensive reedbeds.	A regular non-breeding visitor on the study site – mainly confined to the upper catchment and source of the Steelpoort River.
Eupodotis senegalensis (White-bellied Korhaan)	-	Vulnerable	Yes	No	Prefers transitional habitat between grassland and savanna (e.g. Bankenveld).	Unlikely to occur.
Eupodotis caerulescens	Near-threatened	Near-threatened	Yes	No	Prefers extensive open short grassland and cultivated	An uncommon to fairly common foraging visitor on

Species	Global Conservation Status**	National Conservation Status***	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Potential Likelihood of Occurrence
(Blue Korhaan)					land.	the central parts of the study site. Regularly observed from the pristine grasslands on the nearby Glisa Coal Mine.
Falco biarmicus (Lanner Falcon)	-	Near-threatened	Yes	Yes	Varied, but prefers to breed in mountainous areas	An occasional visitor on the study site.
Falco naumanni (Lesser Kestrel)	Vulnerable	Vulnerable	Yes	Yes	The open grassland patches provide foraging habitat.	A fairly common summer visitor on the study site. Confined to the undulating grassland on the south-central section of the site.
Geronticus calvus (Southern Bald Ibis)*	Vulnerable	Vulnerable	Yes	Yes	A species restricted to montane grassland (especially when burned) and breed/nest on steep	An occasional foraging visitor on the study site (especially in winter).

Species	Global Conservation Status**	National Conservation Status***	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Potential Likelihood of Occurrence
					cliffs.	
Hemimacronyx chloris (Yellow-breasted Pipit)*	Vulnerable	Vulnerable	Yes	No	High-altitude grassland rich in forb species.	Unlikely to occur.
Lissotis melanogaster (Black-bellied Bustard)	-	Near-threatened	Yes	No	Tall grassland in open woodland.	Unlikely to occur.
Neotis denhami (Denham’s Bustard)	Near-threatened	Vulnerable	Yes	No	Primary upland grassland, particularly on hilly terrain.	Unlikely to occur.
Phoenicopterus minor (Lesser Flamingo)	Near-threatened	Near-threatened	Yes	No	Restricted to large alkaline pans and other inland water bodies.	Vagrant on the study site.
Phoenicopterus ruber (Greater Flamingo)	Near-threatened	Near-threatened	Yes	No	Restricted to large saline pans and other inland water bodies.	Vagrant on the study site.

Species	Global Conservation Status**	National Conservation Status***	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Potential Likelihood of Occurrence
Sagittarius serpentarius (Secretarybird)	Vulnerable	Near-threatened	Yes	No	Prefers open grassland or lightly wooded habitat.	Regarded as an uncommon foraging visitor on the study site.
Sarothrura affinis (Striped Flufftail)*	-	Vulnerable	No	No	Moist upland grassland on slopes – partial to areas invaded by *Pteridium aquilinum.*	Vagrant on the study site.
Sarothrura ayresi (White-winged Flufftail)	Endangered	Critically Endangered	Yes	No	Upland cyperoid-dominated wetlands and seep (especially high altitude wetlands with a high frequency of peat).	Vagrant on the study site – a possible overlooked species during passage (southern part of the site).
Schoenicola brevirostris (Broad-tailed Warbler)	-	Near-threatened	Yes	No	Tall rank grassland along vleis – mainly in upland areas.	A rare and localised resident.

Species	Global Conservation Status**	National Conservation Status***	Recorded during SABAP1	Recorded during SABAP2	Preferred Habitat	Potential Likelihood of Occurrence
Tyto capensis (African Grass Owl)	-	Vulnerable	Yes	No	Prefers rank moist grassland that borders drainage lines or wetlands.	Probably absent - historical resident but displaced by indiscriminate grazing and trampling by livestock.
Vanellus melanopterus (Black-winged Lapwing)	-	Near-threatened	Yes	No	Short undulating grassland, preferably in montane regions.	An uncommon foraging visitor.

3.10.3.2 Invertebrates

A total of 20 butterfly species were recorded from the study site. The study area was lacking in butterfly richness with an obvious absence of peculiar high-altitude species. A large depression located on the Hadeco property provides suitable habitat for the “Vulnerable” Marsh Sylph butterfly (*Metisella meninx*).

The various sandstone outcrops provide habitat for the Ischnurid scorpion (*Opistacanthus validus*) – a protected species; and a definite predator (e.g. spiders and assassin bugs) and primitive group of phytophagous invertebrate taxa are prevalent on the primary grasslands, which were numerically less abundant on the secondary grasslands. The primary (natural) grassland units, based on their limited exposure to frequent disturbance events, have provided a platform for arthropod guild diversification (based on the high expected floristic richness in forb species).

3.10.3.3 Herpetofauna

The following herpetofauna habitat types were identified on the study site:

- Grassland;
- Wetlands;
- Open water;
- Rocky ridges; and
- Alien plantations (Wattle, Pine, Bluegums).

This was based on the assumption that different herpetofauna communities can be hosted by each of these different habitats. The grassland areas and rocky ridges (found within the grassland) are of very high conservation value from a herpetofauna perspective. The general lack of refugia in the Highveld grassland means that rocky ridges become hotspots for herpetofauna as they seek shelter under the fragmented rocks or hide in crevices. Most of the herpetofauna were found on these rocky ridges which were situated in grassland (with scattered termitaria) and leading down to a drainage line or wetland. It is this habitat diversity within a relatively small area that makes these sites of conservation importance. The remaining primary grasslands are all adjacent to wetlands allowing for a rich diversity of herpetofauna (amphibians colonizing the wetlands attract a host of predators). All wetlands and open water are of major conservation importance from both a faunal and water quality aspect (same for Glisa). The large number of amphibians in the wetlands and the open water areas provide an important source of food for predacious reptiles, birds and mammals and are crucial for the healthy function of the ecosystem. The agricultural areas (cultivated land and exotic tree stands) are of low conservation value due to low herpetofauna densities and diversity.

While a very similar herpetofauna community was expected during this study compared to that for Glisa, the lesser degree of habitat degradation and fragmentation lead to a greater observed species diversity and abundance. In fact, several species were added to the expected herpetofauna list due to the great success of the summer survey and the consequently improved understanding of the herpetofauna of the region.

Table 21: Reptile and Amphibian species likely to occur in the study area

Biological Name	Common Name	Likelihood
Acontias breviceps	Short-headed legless skink	Confirmed
Acontias plumbeus	Giant legless skink	Expected
Afrotyphlops bibronii	Bibron's blind snake	Confirmed
Agama aculeata distanti	Distant's ground agama	Expected
Agama atra	Southern rock agama	Expected
Amplorhinus multimaculatus	Many spotted reed snake	Not expected
Aparallactus capensis	Black-headed centipede-eater	Expected
Bitis arietans arietans	Puff adder	Expected
Bitis atropos	Berg adder	Not expected
Causus rhombeatus	Night adder	Expected
Chamaeleo dilepis	Flap-neck chameleon	Not expected
Chamaesaura aenea	Coppery grass lizard	Expected
Cordylus vittifer	Common girdled lizard	Expected
Crotaphopeltis hotamboeia	Red-lipped snake	Expected
Dasypeltis scabra	Rhombic egg-eater	Expected
Dispholidus typus typus	Boomslang	Not expected

Biological Name	Common Name	Likelihood
Duberria lutrix	South African slug-eater	Expected
Gerrhosaurus flavigularis	Yellow-throated plated lizard	Expected
Hemachatus haemachatus	Rinkhals	Expected
Homoroselaps lacteus	Spotted harlequin snake	Expected
Lamprophis capensis	Brown house snake	Expected
Lamprophis inornatus	Olive house snake	Expected
Lamprophis swazicus	Swazi rock snake	Not expected
Leptotyphlops scutifrons	Peters' thread snake	Confirmed
Lycodonomorphus rufulus	Brown water snake	Confirmed
Lycophidion capense capense	Cape wolf snake	Expected
Lygodactylus nigropunctatus	Black-spotted dwarf gecko	Expected
Lygodactylus ocellatus	Spotted dwarf gecko	Not expected
Naja annulifera	Snouted cobra	Expected
Nucras lalandii	Delalande's sandveld lizard	Expected
Nucras ornate	Ornate sandveld lizard	Expected
Pachydactylus affinis	Transvaal gecko	Expected
Pachydactylus capensis	Cape gecko	Not expected
Pachydactylus vansoni	Van Son's gecko	Expected
Panaspis walbergii	Whalberg's snake-eyed skink	Expected
Pedioplanis lineoocellata	Spotted sand lizard	Expected

Biological Name	Common Name	Likelihood
Philothamnus hoplogaster	Green water snake	Expected
Philothamnus natalensis occidentalis	Natal green snake	Confirmed
Philothamnus semivariegatus	Spotted bush snake	Expected
Platysaurus orientalis orientalis	Common flat lizard	Not expected
Psammophis crucifer	Cross-marked grass snake	Expected
Psammophylax rhombeatus	Spotte grass snake	Confirmed
Psammophylax tritaeniatus	Striped grass snake	Expected
Pseudaspis cana	Mole snake	Confirmed
Pseudocordylus melanotus	Drakensburg crag lizard	Not expected
Rhinotyphlops schlegelii schlegelii	Delalande's beaked blind snake	Expected
Scelotes mirus	Montane dwarf burrowing skink	Expected
Tetradactylus breyeri	Breyer's long-tailed seps	Expected
Trachylepis capensis	Cape skink	Expected
Trachylepis punctatissima	Speckled rock skink	Confirmed
Trachylepis varia	Variable skink	Confirmed
Varanus niloticus	Water monitor	Expected
Amietia angolensis	Common river frog	Confirmed
Amietia fuscigula	Cape river frog	Confirmed
Amietophrynus garmani	Eastern olive toad	Expected
Amietophrynus gutturalis	Guttural toad	Confirmed

Biological Name	Common Name	Likelihood
Amietophrynus maculatus	Flat-backed toad	Expected
Amietophrynus rangeri	Racous toad	Expected
Breviceps adspersus	Bushveld rain frog	Confirmed
Breviceps mossambicus	Mozambique rain frog	Expected
Cacosternum boettgeri	Common caco	Confirmed
Hyperolius marmoratus	Painted reed frog	Not expected
Hyperolius semidiscus	Yellow-striped reed frog	Not expected
Kassina senegalensis	Bubbling kassina	Confirmed
Phrynobatrachus natalensis	Common puddle frog	Expected
Ptychadena porosissima	Striped grass frog	Expected
Pyxicephalus adspersus	Giant bullfrog	Expected
Schismaderma carens	Red toad	Not expected
Semnodactylus wealii	Rattling frog	Confirmed
Strongylopus fasciatus	Striped stream frog	Confirmed
Strongylopus grayii	Clicking stream frog	Confirmed
Tomopterna cryptotis	Tremolo sand frog	Expected
Tomopterna natalensis	Natal sand frog	Expected
Tomopterna tandyi	Tandy's sand frog	Expected
Xenopus laevis	African clawed frog	Confirmed

3.10.3.4 Mammals

A strong mammalian assemblage is present within the study area. Twenty six mammal species were recorded within the study area, with healthy representations of various trophic levels. This is indicative of an intact to semi-intact mammalian system.

Four red-data species were located on site, namely serval, side striped jackal, South African hedgehog and brown hyaena. Of these species, side-striped jackal and South African hedgehog are out of their normal distributions.

The wetland areas of the study site are the most ecologically important from a mammalian perspective. The wetland systems and associated drainage lines provide the basis for the trophic chain as well as essential movement corridors. In addition, the ridge areas shall fall under protection in any future management plans.

The strong presence of carnivores within the study area suggests that the area is exhibiting an overall sound system health. Preliminary evidence suggests that up to eight servals (IUCN Near Threatened) are resident on the study area and in the neighbouring Glisa coal mine. It is the primary recommendation that a carnivore monitoring program be implemented in order to quantify and qualify the conditions that have given rise to such an exceptional meso and small carnivore assemblage.

A full, in season small mammal baseline should be redone prior to construction phase. This will provide adequate baseline data to be used for rehabilitation, as small mammals are excellent environmental indicators.

Table 22: Mammalian species likely to occur in the study area

Common name	Scientific name	IUCN	Likelihood	Notes
Serval	*Leptailurus serval*	NT	Confirmed	Strong local population
Side-striped Jackal	*Canis adustas*	NT	Confirmed	Out of distribution, requires investigation
Brown hyena	*Parahyaena brunnea*	NT	Confirmed	Transient species
South African Hedgehog	*Atererix frontalis*	NT	Confirmed	Confirmed
Cheetah	*Acinonyx jubatus*	VU	Low	Vagrant seen in 2010
Robust Golden Mole	*Ablysomus robustus*	EN	Low	Data deficient

Common name	Scientific name	IUCN	Likelihood	Notes
Highveld Golden Mole	*Ambylosomus septentrionalis*	NT	Medium	Confirmed at neighbouring Glisa Coal Mine
Rough-haired Golden Mole	*Chrysospalax villosus*	CR	Low	Data deficient
Maquassie Musk Shrew	*Crocidura maquassiensis*	VU	Low	Out of distribution
Water Rat	*Dasymys incomtus*	NT	High	Confirmed at neighbouring Glisa Coal Mine
Spotted-necked Otter	*Lutra maculicollis*	NT	Medium	Confirmed on neighbouring areas
Pangolin	*Manis temminckii*	VU	Low	Sub-optimal habitat
Honey Badger	*Mellivora capensis*	NT	High	Confirmed on neighbouring areas
White-tailed Rat	*Mystromys albicaudatus*	EN	Low	Rare vagrant
Juliana’s Golden Mole	*Neamblysomus juliane*	VU	Low	Out of distribution
Oribi	*Ourebia ourebi*	EN	High	Confirmed on neighbouring areas
Sharp’s Grysbok	*Raphicerus sharpel*	NT	Low	Out of distribution

3.10.4 CONCLUSION

The study site sustains a remarkably high diversity of bird species including many with strong highveld affinities. However, anecdotal evidence suggests that the long-term effect of the current grazing regime in the region will be detrimental for the persistence of conservation-dependant bird species on the site. It is therefore recommended that the grazing regime be revised to preclude any future degradation of the avifaunal diversity.

In addition, the richness values for invertebrate taxa can be improved by adaptive management principles. During the survey, it was noticed that the primary grassland seres were moribund or structurally dense, a condition which will invariably discourage the colonisation of ground-dwelling epigaeic taxa. However, apterous predators, mainly caraboid taxa (*Anthia thoracica* and *Lophyra spp*.) associated with high trophic levels were observed on the study site in low numbers. These species are important apex predators and their occurrence is often linked to "healthy" systems. Their numbers can be improved if the grassland structure is correctly managed. These species, being apterous (wingless and thus showing limited dispersal abilities), are often the first taxa to disappear when environmental conditions change

The herpetofauna survey conducted during summer (25-31 October 2011) was very successful; 60 reptiles (9 species) and >164 amphibians (10 species) were observed. This was partly due to the suitable climatic conditions experienced and partly due to the existence of relatively intact stretches of suitable habitat, especially grassland with rocky ridges and drainage lines. Three of the herpetofauna species expected to occur on the study area are of conservation concern namely *Acontias breviceps* (Short-headed legless skink), *Tetradactylus breyeri* (Breyer's long-tailed seps) and *Pyxicephalus adspersus* (Giant bullfrog).

This study area has two distinct areas of high herpetofauna sensitivity which should be avoided for development if at all possible as it is likely that the three species of conservation concern may occur here. If development is intended in either of the areas it is strongly recommended that a comprehensive management plan with mitigation measures be compiled with the input from a herpetologist in order to minimize the impact from development. In conclusion, the baseline situation on the property from a herpetofauna perspective is one of relatively natural conditions where high diversity and densities are observed.

A strong mammalian assemblage is present within the study area. Twenty six mammal species were recorded within the study area, with healthy representations of various trophic levels. This is indicative of an intact to semi-intact mammalian system. The wetland areas of the study site are the most ecologically important from a mammalian perspective. The wetland systems and associated drainage lines provide the basis for the trophic chain as well as essential movement corridors. In addition, the ridge areas shall fall under protection in any future management plans.

3.11 AQUATIC ECOLOGY

3.11.1 INTRODUCTION AND RELATED IMPACTS

The aquatic habitats form the template of the biological composition of any system. If the habitat components are undisturbed, and in good condition, the biological composition of the system can be expected to be normal and one can expect a high biodiversity within the system. If the habitat components are however degraded, due to human activities, the biota of the system will reflect this by a loss, firstly of the most intolerant species (Davies & Day, 1998). The proposed mining activities have the potential to result in a loss of aquatic ecosystems, a loss of biodiversity, alteration of the hydrological regime, the spread alien fish species, a decline in water quality, and erosion and sedimentation of water courses.

3.11.2 DATA COLLECTION

Aquatic macro invertebrates were assessed using the SASS5 (South African Scoring System) methodology. SASS5 is based on the presence or absence of sensitive aquatic macro invertebrates collected and analysed according to the methods outlined in Dickens and Graham (2002). A high relative abundance and diversity of sensitive taxa present indicates a relatively healthy system with good water quality. Disturbance to water quality and habitat results in the loss of sensitive taxa. As this method was developed specifically for rivers, the methods of collection and analysis were modified for wetlands and pans. This meant sampling vegetation and substrate biotopes only, as no stone biotopes were available, and interpreting the PES for aquatic macro invertebrates in terms of overall diversity and assemblage patterns, rather than according to guidelines derived from SASS5 scores in rivers (Dallas 2007).

The aquatic habitats form the template of the biological composition of any system. If the habitat components are undisturbed, and in good condition, the biological composition of the system can be expected to be normal and one can expect a high biodiversity within the system. If the habitat components are however degraded, due to human activities, the biota of the system will reflect this by a loss, firstly of the most intolerant species (Davies & Day, 1998). An evaluation of habitat quality and availability to biota is therefore critical to any assessment of ecological integrity and should be conducted at each site at the time of biological sampling. On site habitat assessments were conducted by using existing habitat evaluation indices. Seven sites were selected to be representative of all the surface water ecosystems within the study area and are presented in Figure 11 below.

The general characteristics of the site and its immediate surroundings were described. The composition and ability of the habitats to meet the requirements of different fish species was broadly based on the Habitat Cover Rating method (Kleynhans, 1997). This approach was developed to assess habitats according to different attributes that are surmised to satisfy the habitat requirements of various fish species (Kleynhans, 1997). At each site, the following velocity-depth classes were identified, namely:

- Slow (<0.3 m/s), Shallow (<0.5 m) (SS) - Shallow pools and backwaters.
- Slow (<0.3 m/s), Deep (>0.5 m) (SD) - Deep pools and backwaters.
- Fast (>0.3 m/s), Shallow (<0.3 m) (FS) - Riffles, rapids and runs.
- Fast (>0.3 m/s), Deep (>0.3 m) (FD) - Usually rapids and runs.

The study area was visited in April 2011 and fish sampling of representative sites and habitats was performed using a SAMUS battery operated electro-fisher. All fish species were identified to species level and returned to their natural habitats. The latest version of the Fish Response Assessment Index (FRAI) (DWAF, 2008) was used to determine the present ecological status (PES) of the streams in the study area.

3.11.3 RESULTS

According to the Mpumalanga Biodiversity Conservation Plan (Ferrar & Lotter, 2006), the following aspects relate to the Paardeplaats study area:

In terms of aquatic biodiversity, the Steelpoort sub-catchment draining to the west, as well as the upper reaches of the Langspruit, draining northwards, are classified as “Highly Significant” (Migration is rated as low importance, while refugia and species richness are rated as low to moderate).

Figure 11: Aquatic sampling sites for the Paardeplaats baseline survey

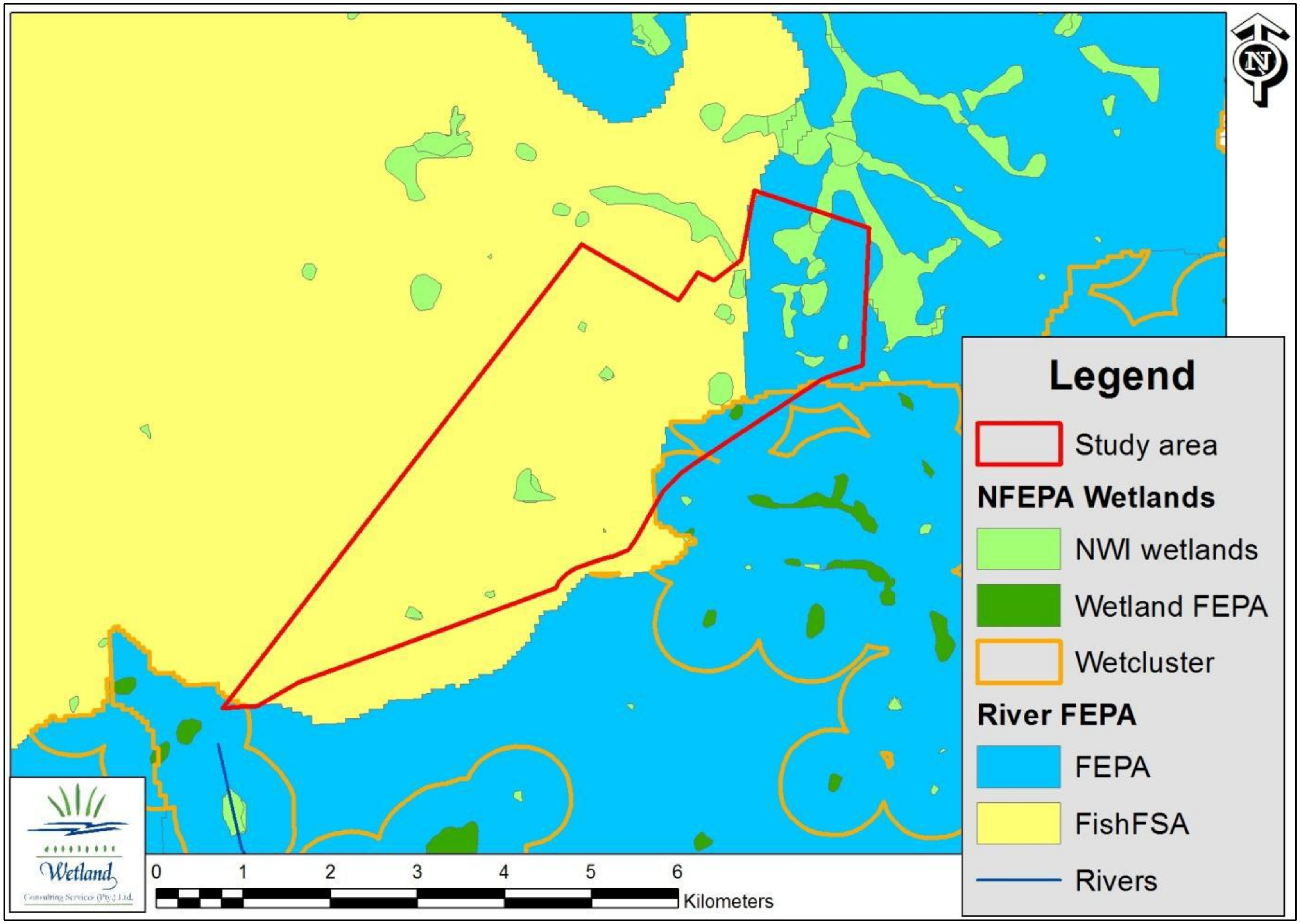

Figure 12: Extract of the Atlas of Freshwater Ecosystem Priority Ares in South Africa (Nel *et al.,* 2011).

In terms of the Atlas of Freshwater Ecosystem Priority Areas (Nel *et al.,* 2011), the area falls within a Fish Support Area for the Steelpoort River, while the northern tributary falls within a NFEPA for fish (Figure 12). River FEPAs achieve biodiversity targets for river ecosystems and threatened/near threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological) category. This FEPA status indicates that the subcatchment should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources. Fish Support Areas are sub-quaternary catchments that are required to meet biodiversity targets for threatened and near threatened species. River reaches within fish support areas need to be maintained to support the associated populations of threatened species.

Most of the fish species expected or observed in the study area are all classified as potadromous[1] in terms of migratory life history. *Labeobarbus polylepis, Barbus anoplus, Barbus neefi, Clarias gariepinus, Chiloglanis pretoriae* and *Tilapia sparrmanii* all require movement between reaches, while *Pseudocrenilabrus philander* and *Amphilius uranoscopus* primarily migrate within a reach.

[1]Potadromous: Truly migratory species whose entire life cycle is completed within freshwater and that undertake migrations within freshwater zones of rivers for a variety of reasons, such as for spawning, feeding, dispersion after spawning, colonisation after droughts, for over-wintering, etc.

Currently, migration of the fish in the study area is influenced by the presence of various existing dams and road crossings. It is recommended that all redundant dams should be removed from streams in the study area (and region where applicable) and no new instream dams should be constructed. The streams within the Paardeplaats area are source zones and therefore of low importance in terms of connectivity (including migration for fish).

No fish were sampled during the present baseline study within the Paardeplaats area, and since no long term data or historical data is available, it is not possible with any degree of confidence to estimate the pre-disturbance fish assemblage of this area. Based on the location of the study area, being at the source of these streams, there is a probability that fish may have been absent from this area even under natural conditions. Should it however be assumed that some species have occurred here under natural conditions, but have now disappeared (based on no fish sampled during the current study) as a result of human activities, then the biotic integrity of the Paardeplaats area, based on fish, can be described as critically modified from natural conditions (ecological category F). Based on the available information this would be a very low confidence assumption.

The biotic integrity, based on fish of the reaches downstream of the study area seems to also have been reduced from reference state. The absence of fish from site 2 in the northern stream may reflect poor biotic integrity (possibly also a category F) prevailing in this stream downstream of the Paardeplaats area. The presence of only a single fish species out of a possible seven other fish species that can possibly be expected in this stream, can also indicate largely modified biotic integrity prevailing at present (ecological category D/E). Due to the present (and possibly natural) absence of fish from the Paardeplaats area, as well as the scarcity of fish directly downstream of the Paardeplaats study area, it is estimated that fish are of limited use as indicators of biotic integrity of the streams of this area. More emphasis may have to be placed on other biota, such as aquatic macro-invertebrates and diatoms, to determine the present ecological status of these aquatic ecosystems.

Compared with other pans and dams sampled in the Mpumalanga Highveld, the diversity of aquatic macro invertebrates at Paardeplaats was relatively high. A total of 31 macro invertebrate SASS5 taxa were sampled. It should be noted that, with the exception of site 7 which was a channelized drainage line, wetlands (including dams) cannot be interpreted according to SASS5 guidelines which are based on flowing water. However, the interpretation guidelines (Dallas, 2007) for lower zones were used as an approximate guide for eco-classification.

Assemblage patterns of aquatic macro invertebrates reflect the geohydrological regime of the site. Dam sites all showed a similar macro invertebrate assemblage with a high diversity of air-breathing hemipterans associated with marginal vegetation. Site 1A (a seasonal pan immediately south of Site 1) reflected seasonal conditions with a relatively low diversity of aquatic biota but a greater abundance of crustaceans adapted to seasonal waterbodies (cladocera, ostracods and copepods). Finally, the aquatic biota at site 7 reflected flowing waters with an abundance of rock and riffle habitats, thus having fewer air-breathing hemipterans but more crab, flatworms (Turbellaria), hydropsychiae and tipulid flies.

The wetland system draining to the north into the Langspruit and northwest towards Glisa Coal Mine had a high overall biodiversity with 23 taxa (collected from 3 sites). The seasonal depressions connected with this system increase the overall biodiversity within this area of the study area (although this site cannot be compared to the other sites in terms of diversity and sensitivity). This system was considered Largely Natural/Moderately Modified for aquatic macro invertebrates (Category B/C). The dam at Site 1 had a relatively high diversity and ASS5 score compared to similar dams sampled within the Highveld, this indicating good water quality conditions (Category B/Largely Natural).

The dam at Site 4, draining towards Glisa Coal Mine, was considered Largely Natural (Category B) for macro invertebrates. The taxon richness (diversity) was greatest at this site, and it had the highest number of taxa sensitive to water quality deterioration. This suggests that the site was relatively undisturbed in terms of water quality. Otter spoor and scats were observed at this site, as well as owl pellets.

Dam 5 had the lowest diversity and fewest sensitive taxa compared with other dams sampled. It was classified as Category D (Largely Modified) for aquatic macro invertebrates. In addition to habitat changes, runoff from Hadeco cultivated fields may have compromised water quality. Site 7 was the only site with running water, albeit non-perennial under natural conditions, this necessitating judicious interpretation in terms of SASS5 guidelines. The ASPT of 5.13 for this site suggests a higher prevalence of taxa sensitive to changes in water quality. More than two species of baetid mayfly as well as leptophlebiid mayflies were present, indicating relatively good water quality. As such, the site was considered Largely Natural (Category B) for aquatic macro invertebrates.

3.11.4 CONCLUSION

It is expected that any mining within the Paardeplaats study area will impact upon the extensive wetlands on site as well as water quality leaving the site. Biotic integrity within the headwaters of the Steelpoort catchment was found to currently be relatively high (PES B – C). The mining footprint is likely to result in the permanent loss of a range of aquatic habitats and associated biota. Mining is also likely to cause a decline in water quality (in terms of acidity, salts and soluble metals) and habitats, as a result of erosion and sedimentation, within downstream reaches. This may impact negatively upon sensitive species, including rare or threatened fish species within downstream reaches of the Steelpoort River. The area most sensitive to this impact occurs downstream of site 7 as there are no apparent mining impacts within this system at present. Impacts to this system may therefore set the stage for future mining downstream. This tributary is also most sensitive to changes in habitats available to fish and invertebrates, especially those that prefer cobbled substrates, riffle habitats and higher flow rates, such as *Amphilius uranoscopus* and *Chiloglanis pretoriae*. Sedimentation as a result of mining activities, in addition to water quality impacts, will compromise both habitat availability and suitability within this stream, with a potential loss of species. It is therefore recommended that mining within the vicinity of this tributary be avoided if possible. Confining mining to portion 30 will generate similar impacts but will have less of an effect on sensitive habitats and biota, as water draining off this site flows directly into the adjacent Glisa Colliery. Nevertheless, mining portion 30 will result in the permanent loss of aquatic ecosystems with a relatively good water quality, habitat integrity and biotic diversity (PES B). Loss of wetland habitats and biota is likely to impact on animals higher up in the food chain (i.e. frogs, birds and otter, all recorded from portion 30).

The only way to effectively mitigate these impacts is to avoid mining altogether (i.e. no-go option). If mining is to proceed, it is strongly recommended that biodiversity offset measures are considered, preferably by formally protecting intact systems with similar ecosystem components. It is further recommended that an effective bio-monitoring programme be implemented as soon as possible. This should include quarterly monitoring of aquatic macro invertebrates and water quality (including metals, salts, pH and electrical conductivity).

3.12 WETLANDS

3.12.1 INTRODUCTION AND RELATED IMPACTS

The presence of wetlands in the landscape can be linked to the presence of both surface water and perched groundwater. Wetland types are differentiated based on their hydro-geomorphic (HGM) characteristics; i.e. on the position of the wetland in the landscape, as well as the way in which water moves into, through and out of the wetland systems. Mining activities have the potential to damage, destroy, and/or disturb wetland habitat, deterioration of water quality, erosion, increased transport and sedimentation in wetlands, increased alien vegetation, increased surface run-off, and deterioration of water quality due to Acid Mine Drainage.

3.12.2 DATA COLLECTION

Wetlands were identified and delineated according to the delineation procedure as set out by the "A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas" document, as described by DWAF (2005). Using this procedure, wetlands were identified and delineated using the Terrain Unit Indicator, the Soil Form Indicator, the Soil Wetness Indicator and the Vegetation Indicator.

For the purposes of delineating the actual wetland boundaries use is made of indirect indicators of prolonged saturation, namely wetland plants (hydrophytes) and wetland soils (hydromorphic soils), with particular emphasis on hydromorphic soils. It is important to note that under normal conditions hydromorphic soils must display signs of wetness (mottling and gleying) within 50cm of the soil surface for an area to be classified as a wetland (A practical field procedure for identification and delineation of wetlands and riparian areas, DWAF (2005).

The delineated wetlands were then classified using a hydro-geomorphic classification system based on the system proposed by Brinson (1993), and modified for use in South African conditions by Marneweck and Batchelor (2002).

A functional assessment of the wetlands on site was then undertaken using the level 2 assessment as described in "Wet-EcoServices" (Kotze *et al.,* 2005). This method provides a scoring system for establishing wetland ecosystem services. It enables one to make relative comparisons of systems based on a logical framework that measures the likelihood that a wetland is able to perform certain functions.

A PES and EIS assessment was conducted for every hydro-geomorphic wetland unit identified and delineated within the study area. This was done in order to establish a baseline of the current state of the wetlands and to provide an indication of the conservation value and sensitivity of the wetlands in the study area.

For the purpose of this study, the scoring system as described in the document "Resource Directed Measures for Protection of Water Resources. Volume 4. Wetland Ecosystems" (DWAF, 1999) was applied for the determination of the PES and EIS.

3.12.3 RESULTS

The results of the wetland study are presented below.

3.12.3.1 Functional Assessment

For the purpose of the functional assessment and the PES and EIS assessments which follow, the delineated wetlands on site were grouped into functional wetland units based on a sub-catchment approach. The identified wetland units are illustrated in Figure 13 below.

Within the study area the wetlands represent the most extensive areas of remaining natural vegetation within a landscape otherwise largely altered by agriculture and mining. As such, all of the wetlands are expected to play a role in biodiversity support to a greater or lesser degree.

Numerous other functions are typically attributed to wetlands, which include nutrient removal (and more specifically nitrate removal), sediment trapping (and associated with this is the trapping of phosphates bound to iron as a component of the sediment), stream flow augmentation, flood attenuation, trapping of pollutants and erosion control. Many of these functions attributed to wetlands are wetland type specific and can be linked to the position of wetlands in the landscape as well as to the way in which water enters and flows through the wetland. Thus not all wetlands can be expected to perform all functions, or to perform these functions with the same efficiency.

Based on the hydro-geomorphic wetland type, which classifies wetlands on the way that water moves through the wetland as well as the position of the wetland within the landscape, certain assumptions on the functions supported by wetlands can be made.

The results of the WET-EcoServices assessment (Kotze *et al.,* 2004) are summarised in Table 23 below. The functions that scored the highest and would appear to be the most important functions performed by the wetlands on site are highlighted in red. Note however that no consultation with local residents was undertaken to provide additional information in terms of direct use benefits of the wetlands or possible cultural significance of the wetlands.

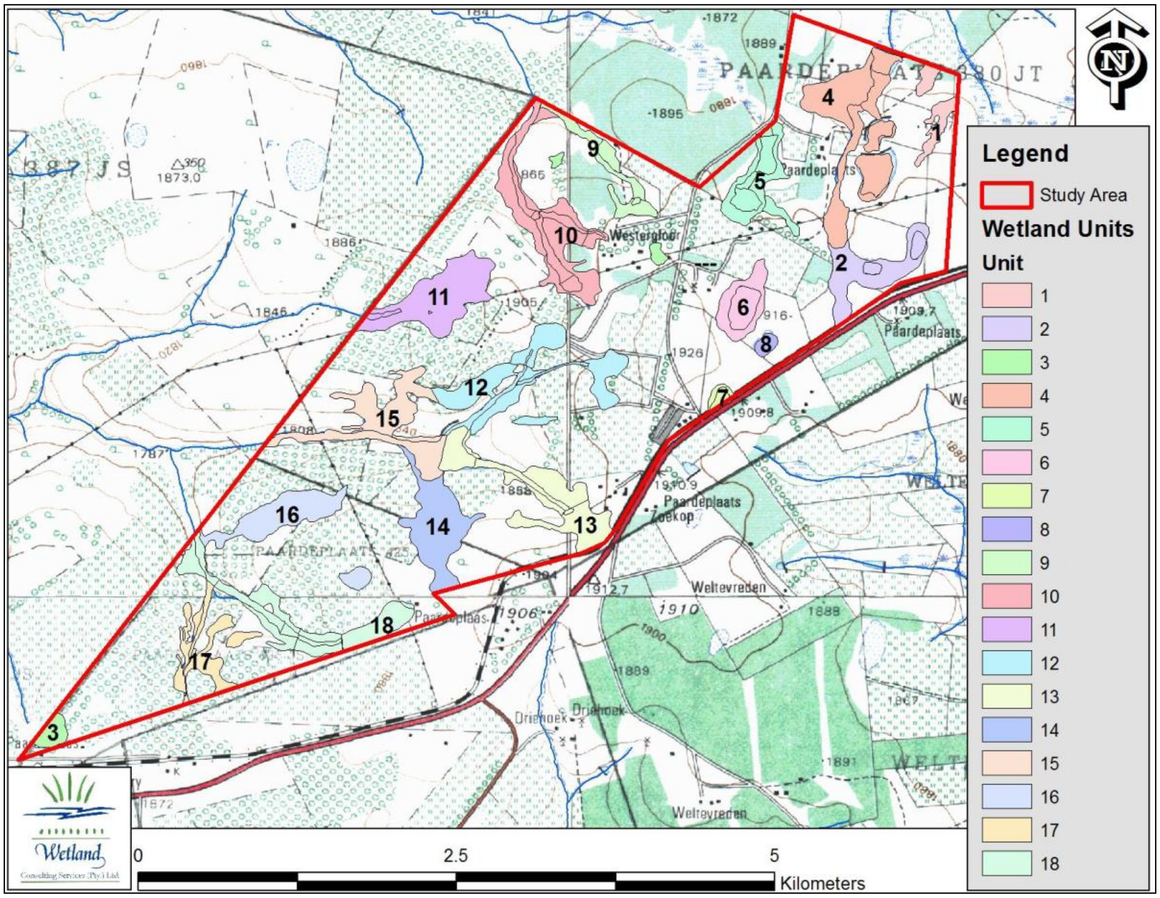

Figure 13: Wetland units as used for the functional assessment and PES and EIS assessments.

It is clear from the results in Table 23 that the wetlands on site play an important role in the maintenance of biodiversity. The wetlands represent the most extensive natural habitat remaining on site, and are thus likely to provide the main refuge for a number of species. In addition, the wetlands are located within a vegetation type listed as Vulnerable, and within an area classified as “Important & Necessary” in the Mpumalanga Biodiversity Conservation Plan. A number of the wetlands on site have however been impacted by anthropogenic activities mostly related to agriculture that have resulted in a loss of biodiversity associated with the affected wetlands. Most notably the central regions of the site are impacted by intensive agriculture, while large portions of the site also previously formed part of plantations.

The water quality enhancement functions also rated highly in terms of nitrate, phosphate and toxicant removal, as well as sediment trapping. Especially the hillslope seepage wetlands and the unchannelled valley bottom wetlands that are characterised by extended residence time of flows within the wetlands due to the slow, diffuse nature of flows through the wetland provide good opportunity for water quality enhancement. In this regard the wetlands located downslope of intensive agricultural areas, e.g. wetland units 5 and 13, are especially important in terms of water quality enhancement.

Table 23: Summarised results of the WET-EcoServices assessment

Function	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15	Unit 16	Unit 17	Unit 18	Average
Maintenance of biodiversity	3.00	3.50	1.75	3.25	2.80	1.06	1.75	1.63	3.25	3.25	3.50	3.75	3.8	2.00	3.75	2.19	3.50	3.50	**2.84**
Nitrate removal	2.75	2.95	2.80	2.90	2.95	1.85	2.15	2.25	2.00	2.10	2.85	2.70	2.7	2.55	2.65	2.50	2.50	2.85	**2.56**
Erosion control	2.88	2.96	2.25	3.08	2.92	2.21	2.08	2.46	2.54	2.38	2.38	2.25	2.3	2.17	2.58	2.08	2.42	2.50	**2.47**
Phosphate trapping	2.24	2.40	2.81	2.92	2.76	1.95	2.01	2.24	2.05	2.17	2.80	2.56	2.4	2.35	2.38	2.46	2.15	2.59	**2.40**
Toxicant removal	1.92	2.62	2.55	3.00	2.91	2.03	2.08	2.29	2.14	2.07	2.57	2.38	2.4	2.05	2.47	2.26	2.09	2.47	**2.35**
Sediment trapping	2.12	2.29	2.58	2.51	2.39	2.46	2.21	2.13	1.54	1.83	2.70	2.42	2.3	2.25	2.37	2.49	2.29	2.52	**2.30**
Streamflow regulation	2.33	2.67	1.67	2.67	2.83	1.33	1.50	1.50	2.00	2.00	2.50	2.67	2.7	2.50	2.67	1.83	2.67	2.67	**2.26**
Flood attenuation	2.17	2.37	2.40	2.26	2.09	2.03	2.03	2.03	2.07	1.90	1.87	2.20	2.2	1.80	2.07	2.24	2.07	2.21	**2.11**
Carbon storage	1.33	2.00	0.67	2.00	2.33	2.00	1.33	2.33	1.67	1.67	1.67	1.67	1.7	1.33	2.00	1.67	2.00	2.00	**1.74**
Tourism and recreation	1.14	1.86	1.00	2.43	2.71	1.86	0.71	1.00	1.43	2.00	1.43	1.57	2.4	1.43	2.14	0.71	1.71	2.00	**1.64**
Education and research	1.75	1.75	1.25	1.25	1.50	0.75	0.75	0.75	1.25	1.25	1.25	1.00	0.8	0.75	1.00	0.75	1.25	1.25	**1.13**
Water supply for human use	0.39	0.78	0.28	0.94	1.14	1.22	0.75	0.75	0.67	0.67	0.58	0.78	1.9	0.58	1.94	0.47	0.78	0.78	**0.86**
Natural resources	0.20	0.20	0.20	0.20	0.40	0.20	0.00	0.00	0.80	0.80	0.00	0.40	0.6	0.40	0.60	0.20	0.20	0.20	**0.31**
Cultivated foods	0.00	0.00	0.40	0.40	0.00	0.00	0.00	0.40	0.40	0.40	0.00	0.40	0.4	0.40	0.00	0.00	0.00	0.00	**0.18**

Cultural significance	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	**0.00**

Hydrological functions performed by the wetlands include the functions of flood attenuation and streamflow augmentation. Wetlands are able to play an important role in flood attenuation given their location in the landscape were flows accumulate and slow down due to lower gradients. The surface roughness of the wetlands, due to increased plant cover and vigour, further aids in slowing down flood flows and attenuating floods. The extensive hillslope seepage wetlands on site are however expected to play only a minor role in flood attenuation; at the start of the wet season large volumes of water infiltrate the soils and the wetlands can play a role in flood attenuation. However, later in the rainy season when the soils in the seepage wetlands are already saturated, these areas encourage surface run-off and enhance floods rather than attenuate them. The main hydrological function of the hillslope seepage wetlands is the slow, diffuse release of water into downslope wetlands that extends from the wet season well into the dry season, highlighting the importance of these systems in stream flow augmentation.

3.12.3.2 Present Ecological Status (PES) Assessment

The wetlands on site have been subjected to a range of anthropogenic activities, mostly related to agriculture and construction of infrastructure such as roads, which have resulted in the degradation of the wetland systems on site. This degradation is reflected in the results of the PES assessment, Table 24, Table 26 and Figure 14.

Table 24: Table showing the results of the PES assessment (all figures are in hectares).

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Unit 11	Unit 12	Unit 13	Unit 14	Unit 15	Unit 16	Unit 17	Unit 18
Hydrologic																		
Flow modification	4	4	2	3	2	2	2	2	3	3	4	3	2	3	2	2	3	3
Water quality modification	4	4	3	3	2	2	2	2	3	3	4	3	3	3	2	3	4	4
Sediment load modification	4	4	2	3	2	2	2	1	2	3	4	2	2	2	2	2	3	3
hydraulic/geomorphic/ physical																		
Canalization	5	4	3	3	3	4	4	4	3	3	4	2	2	4	3	3	3	3
Impounding	5	5	3	3	2	2	2	4	3	3	4	4	2	4	2	3	3	2
Topographic alteration	4	5	3	3	3	2	2	3	4	3	4	3	3	4	3	4	4	4
Modification of key driver or keypoint	4	4	3	3	2	2	2	2	3	3	4	3	3	3	2		3	3
Biota																		
Change in species composition and richness	3	3	2	3	3	2	2	2	3	3	3	3	2	2	3	2	2	3
Invasive plant encroachment	4	4	2	3	3	3	3	3	2	3	3	2	2	2	3	2	2	3

Over utilization of biota	3	3	2	3	3	3	3	2	3	3	4	3	3	2	3	2	3	3
Land-use modification	3	3	2	3	2	3	3	2	3	3	4	2	2	2	3	2	3	3
TOTAL	43	43	27	33	27	27	27	27	32	33	42	30	26	31	28	25	33	34
MEAN	**3.9**	**3.9**	**2.5**	**3.0**	**2.5**	**2.5**	**2.5**	**2.5**	**2.9**	**3.0**	**3.8**	**2.7**	**2.3**	**2.7**	**2.5**	**2.5**	**3.0**	**3.1**
PES	**B**	**B**	**D**	**C**	**D**	**D**	**D**	**E**	**C**	**C**	**B**	**C**	**D**	**D**	**C**	**D**	**C**	**B**

Table 25: Table showing the rating scale used for the PES assessment.

Mean*	Category	Explanation
Within generally acceptable range		
>4	A	Unmodified, or approximates natural condition
>3 and <=4	B	Largely natural with few modifications, but with some loss of natural habitats
>2.5 and <=3	C	Moderately modified, but with some loss of natural habitats
<=2.5 and >1.5	D	Largely modified. A large loss of natural habitat and basic ecosystem function has occurred.
Outside generally acceptable range		
>0 and <=1.5	E	Seriously modified. The losses of natural habitat and ecosystem functions are extensive
0	F	Critically modified. Modification has reached a critical level and the system has been modified completely with almost complete loss of natural habitat.

Table 26: Summary of the PES results by area.

PES	Area (ha)	% of wetland area
B	78.42	23.20%
C	149.99	44.37%
D	107.80	31.89%
E	1.84	0.54%
TOTAL	338.05	100.00%

The majority of the wetlands on site were classed as either Moderately Modified (44.4%) or Largely Modified (31.9%), though a significant proportion of the wetlands are still considered to be in a Largely Natural (23.2%) condition.

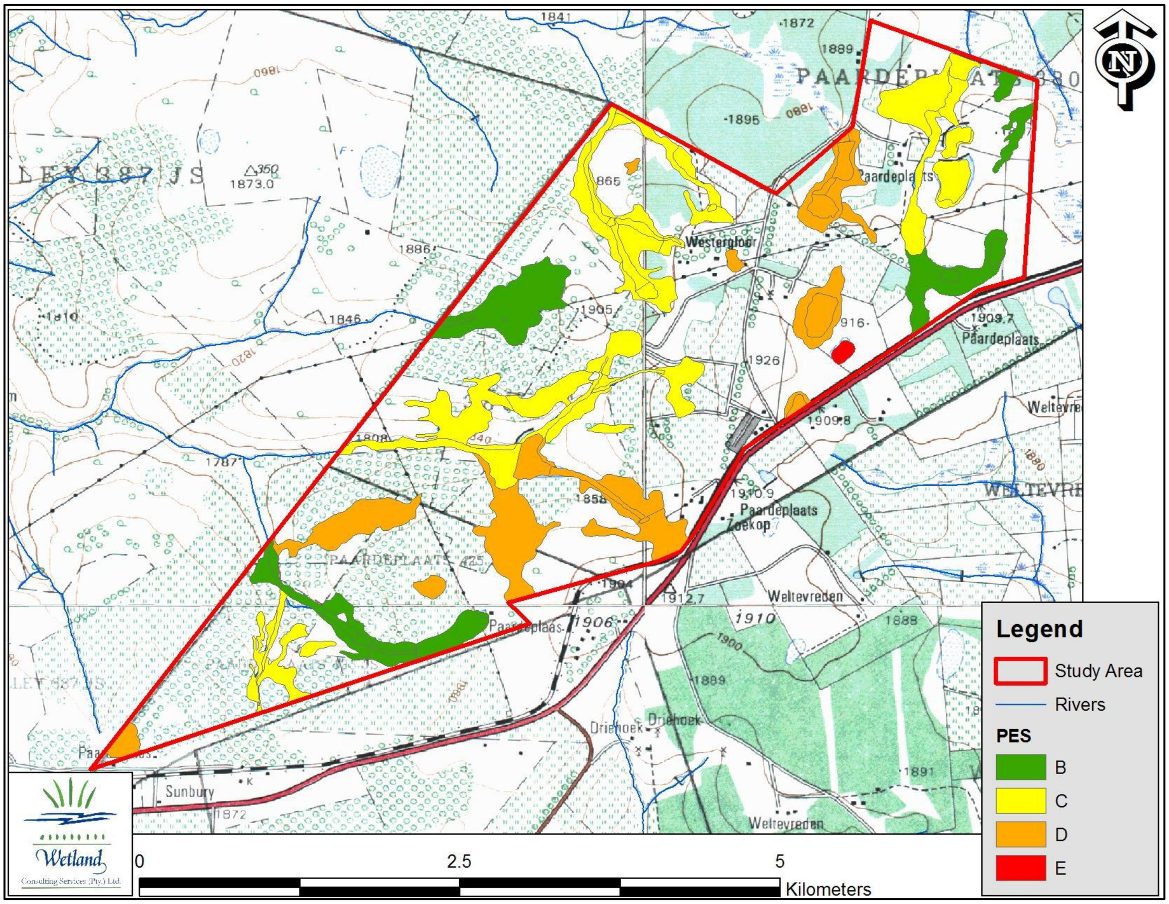

Figure 14: Map showing the results of the PES assessment.

3.12.3.3 Ecological Importance and Sensitivity (EIS) Assessment

Ecological Importance and Sensitivity is a concept introduced in the reserve methodology to evaluate a wetland in terms of:

- Ecological Importance;
- Hydrological Functions; and
- Direct Human Benefits

These scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze *et al.* (2008) on the assessment of wetland ecological goods and services (the WET-EcoServices tool).

The results of the EIS assessment are summarised in Table 27 and Table 28. From Table 28 it is clear that the wetlands on site are mostly considered to be important from an ecological and hydrological perspective and that the provision of direct human benefits generally is only of minor importance. An exception to this however is the provision of water for irrigation and also livestock watering purposes in the central regions of the study area, and the use of wetlands for tourism purposes in the north-east of the study area (dams have been built in the wetlands to provide opportunity for trout fishing).

Table 27: Summary of the EIS results by area.

EIS	Area (ha)	% of wetland area
B	144.51	42.75%
C	141.24	41.78%
D	52.30	15.47%
TOTAL	338.05	100.00%
EIS	**Area (ha)**	**% of wetland area**

Roughly an equal proportion of wetlands are considered of High (42.75%) and Moderate (41.78%) ecological importance and sensitivity, and only 15% of the wetlands on site are considered to be of Low importance and sensitivity – these are mostly hillslope seepage wetlands that have been cultivated in their entirety at some stage.

Table 28: Table showing the results of the EIS assessment

ECOLOGICAL IMPORTANCE AND SENSITIVITY:																		
Ecological Importance	Unit1	Unit2	Unit3	Unit4	Unit5	Unit6	Unit7	Unit8	Unit9	Unit10	Unit11	Unit12	Unit13	Unit14	Unit15	Unit16	Unit17	Unit18
Biodiversity support	1.00	1.83	0.83	2.17	2.00	1.00	1.00	0.67	2.17	1.55	2.00	1.67	1.83	0.50	1.83	0.50	1.67	2.17
Presence of Red Data species	1.50	2.00	0.50	2.50	2.00	0.50	1.00	0.50	3.00	2.50	2.50	2.00	2.00	0.50	2.00	0.50	2.00	2.00
Populations of unique species	1.00	1.00	1.50	1.50	1.50	0.50	0.50	0.50	2.00	0.15	2.50	1.50	1.50	0.50	1.50	0.50	1.50	2.00
Migration/breeding/feeding sites	0.50	2.50	0.50	2.50	2.50	2.00	1.50	1.00	1.50	2.00	1.00	1.50	2.00	0.50	2.00	0.50	1.50	2.50
Landscape scale	1.40	1.60	0.80	1.50	1.30	1.10	0.90	0.80	1.40	1.60	1.80	1.70	1.30	0.90	1.60	0.80	1.50	1.90
Protection status of the wetland	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Protection status of the vegetation type	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Regional context of the ecological integrity	3.00	3.00	1.00	2.00	1.00	1.00	1.00	0.50	2.00	2.00	3.00	2.00	0.50	0.50	2.00	1.00	2.00	3.00
Size and rarity of the wetland type/s present	1.00	1.50	0.50	1.50	1.50	1.00	0.50	0.50	1.50	2.00	2.50	2.00	2.00	1.00	2.00	0.50	1.50	2.00
Diversity of habitat types	1.00	1.50	0.50	2.00	2.00	1.50	1.00	1.00	1.50	2.00	1.50	2.50	2.00	1.00	2.00	0.50	2.00	2.50
Sensitivity of the wetland	1.67	1.83	0.83	2.00	1.17	1.00	0.83	0.83	1.67	1.83	1.83	1.50	1.17	1.00	2.00	1.00	1.50	2.00
Sensitivity to changes in floods	2.00	2.50	1.50	2.50	1.50	1.00	1.00	1.00	2.00	2.50	2.50	1.50	1.50	2.00	2.00	2.00	1.00	2.50
Sensitivity to changes in low flows/dry season	1.00	1.00	0.50	1.50	1.50	1.50	1.00	1.00	1.50	1.50	1.00	1.50	1.50	0.50	2.00	0.50	2.00	2.00

Sensitivity to changes in water quality	2.00	2.00	0.50	2.00	0.50	0.50	0.50	0.50	1.50	1.50	2.00	1.50	0.50	0.50	2.00	0.50	1.50	1.50
HYDROLOGICAL-FUNCTIONAL IMPORTANCE																		
Flood attenuation	1.00	1.50	0.50	2.50	2.50	1.50	1.00	1.00	1.50	2.00	1.00	1.50	2.00	1.00	2.00	0.50	1.50	2.50
Streamflow regulation	2.00	2.00	0.50	2.50	2.00	1.00	-	-	1.50	2.00	2.00	2.50	2.50	1.50	2.50	1.00	2.00	2.50
Sediment trapping	1.00	1.00	1.00	2.00	2.50	1.50	1.50	1.50	2.00	2.00	1.50	2.00	2.00	1.50	2.00	1.00	1.50	2.00
Phosphate assimilation	1.00	1.00	2.00	2.00	2.50	1.50	1.50	1.50	1.50	1.50	1.00	2.00	2.00	1.00	1.50	1.00	1.00	1.00
Nitrate assimilation	1.00	1.00	2.00	2.00	2.50	1.50	1.50	1.50	1.50	1.50	1.00	2.00	2.00	1.00	1.50	1.00	1.00	1.00
Toxicant assimilation	1.00	1.00	2.00	2.00	2.50	1.50	1.50	1.50	1.50	1.50	1.00	2.00	2.00	1.00	1.50	1.00	1.00	1.00
Erosion control	2.50	2.50	0.50	2.00	2.00	1.00	0.50	0.50	2.00	2.00	1.00	2.00	2.00	1.00	2.00	1.00	1.00	2.00
Carbon storage	0.50	1.00	0.50	1.50	1.50	1.50	1.00	1.00	1.00	1.00	0.50	1.00	1.00	0.50	1.00	0.50	1.00	1.50
IMPORTANCE OF DIRECT HUMAN BENEFITS																		
Water for human use	0.50	0.75	0.25	1.00	1.00	1.25	0.75	0.75	0.75	0.75	0.50	0.75	2.00	0.50	2.00	0.50	0.75	0.75
Harvestable resources	0.25	0.25	0.25	0.25	0.50	0.25	-	-	1.00	1.00	-	0.50	0.50	0.50	0.50	0.25	0.25	0.25
Cultivated foods	-	-	0.50	0.50	-	-	-	0.50	0.50	0.50	-	0.50	0.50	0.50	-	-	-	-
Cultural heritage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tourism and recreation	1.00	1.50	1.00	2.50	2.50	1.50	0.50	1.00	1.50	2.00	1.50	1.50	2.50	1.50	2.00	0.50	1.50	2.00
Education and research	1.00	1.00	1.00	1.00	1.00	0.50	0.50	0.50	1.00	1.00	1.00	0.50	0.50	1.00	0.50	0.50	1.00	1.00
ECOLOGICAL IMPORTANCE &	**1.67**	**1.83**	**0.83**	**2.17**	**2.00**	**1.10**	**1.00**	**0.83**	**2.17**	**1.83**	**2.00**	**1.70**	**1.83**	**1.00**	**2.00**	**1.00**	**1.67**	**2.17**

SENSITIVITY																		
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	**1.25**	**1.38**	**1.13**	**2.06**	**2.25**	**1.38**	**1.06**	**1.06**	**1.56**	**1.69**	**1.13**	**1.88**	**1.94**	**1.06**	**1.75**	**0.88**	**1.25**	**1.69**
IMPORTANCE OF DIRECT HUMAN BENEFITS	**0.46**	**0.58**	**0.50**	**0.88**	**0.83**	**0.58**	**0.29**	**0.46**	**0.79**	**0.88**	**0.50**	**0.63**	**1.00**	**0.67**	**0.83**	**0.29**	**0.58**	**0.67**
OVERALL IMPORTANCE	**1.67**	**1.83**	**1.13**	**2.17**	**2.25**	**1.38**	**1.06**	**1.06**	**2.17**	**1.83**	**2.00**	**1.88**	**1.94**	**1.06**	**2.00**	**1.00**	**1.67**	**2.17**
	C	C	D	B	B	C	D	D	B	C	B	C	C	D	B	D	C	B

Table 29: Table explaining the scoring system used for the EIS assessment

Ecological Importance and Sensitivity categories	Range of Median	Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these floodplains may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.	>2 and <=3	B
Moderate Wetland that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.	>1.2 and <=2	C
Low/marginal Wetlands that is not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1.2	D

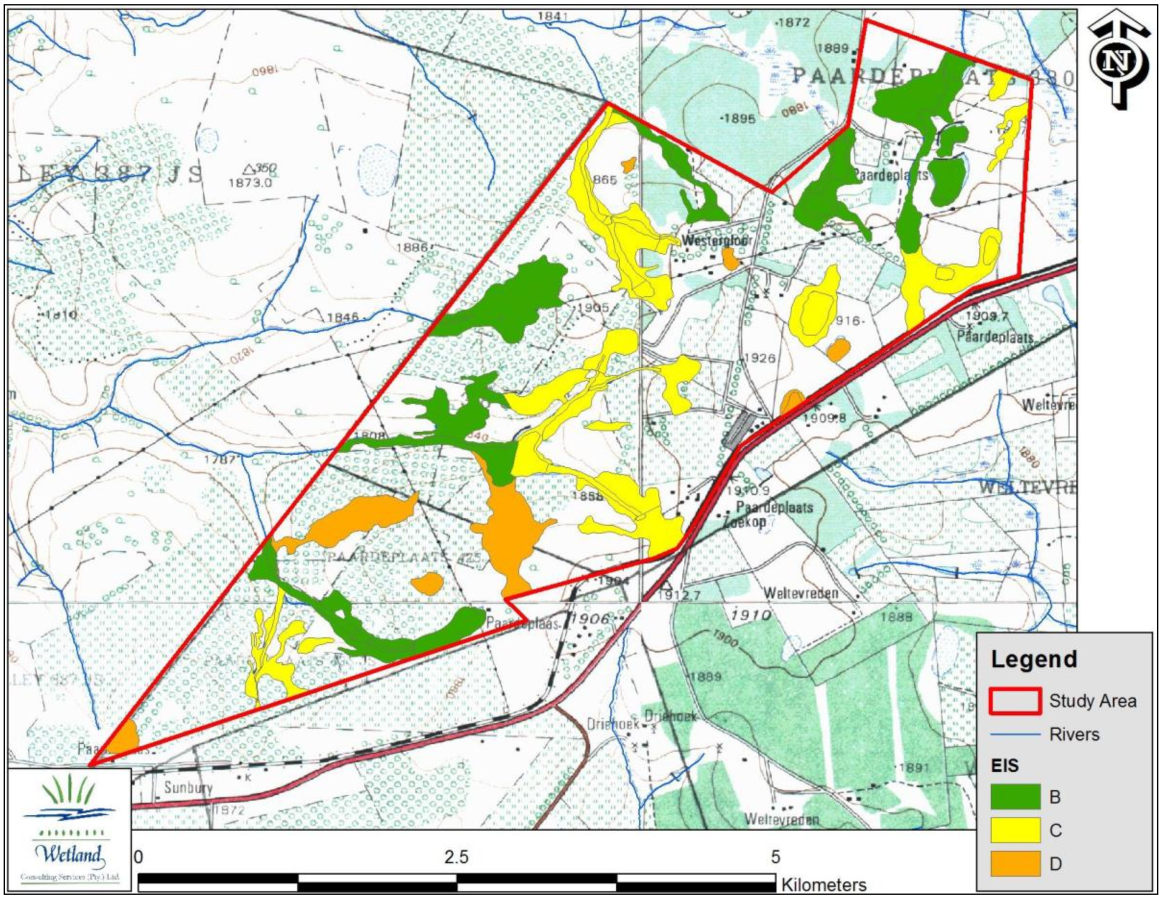

Figure 15: Map showing the results of the EIS assessment.

3.12.4 CONCLUSION

From a water quality and quantity perspective, all of the wetlands on site are considered highly sensitive. However, the wetlands are merely an expression of water moving through the landscape and are dependent on landscape, or rather catchment, scale processes. As such, if the wetlands are considered sensitive, the entire wetland catchment should in effect also be considered sensitive. This is captured in part by the inclusion of the 100 m and 500 m buffer in the sensitivity mapping, though catchment boundaries extend beyond the 500 m buffer in some instances. From a biodiversity perspective, those wetlands that are characterised by natural vegetation and are considered important from a biodiversity support perspective are considered sensitive, while those wetlands that have been completely cultivated are considered less sensitive; though still being sensitive as the water discharging from these wetlands supports downstream ecosystems.

All wetlands on site are considered sensitive and, as a result of this, most of the site is considered to be, at best, of low suitability for mining development. This is based on the value of the water that the wetlands represent as well as the requirements of legislation (National Water Act, NEMA, GN704, GN1199 etc.) and other guideline documents (e.g. Mpumalanga Biodiversity Conservation Plan) which require that all wetlands are considered as sensitive and that any activity within a wetland or within 500 m of a wetland requires authorisation. The varying sensitivities ascribed to the wetlands on site, ranging from Restricted to Low Sensitivity, are based on the varying degrees of degradation of the wetlands on site.

Recognising that mining is an important part of the economy, and that the current approach to power generation relies heavily on the mining of coal, should mining within the Paardeplaats area be authorised, it is recommended that Alternative 3 be selected above Alternative 2 for the following reasons.

- There will be significantly less direct loss of wetland habitat. Alternative 3 will result in the loss of roughly 46 ha of wetland, while Alternative 2 will destroy more than 220 ha of wetlands;
- The loss of wetland habitat under Alternative 3 will mostly be restricted to a sub-catchment already heavily impacted by mining at Glisa Colliery, while Alternative 2 will impact on a number of sub-catchments currently not impact by mining activities;
- The significantly smaller size of Alternative 3 implies that the duration of impacts, especially operational impacts, will be significantly shorter than for Alternative 2;
- Water quality impacts associated with Alternative 3 will impact on a system already impacted by mining activities and thus already requiring water quality management interventions. Alternative 2 will lead to water quality impacts within a number of sub-catchments not yet impacted by mining and make water management more difficult as it will be spread over a number of systems;
- The larger pit size of Alternative 2 implies that larger volumes of polluted water are likely to decant from Alternative 2 than from Alternative 3, thus leading to more serious and far-reaching water quality concerns; and
- The smaller size of the Alternative 3 pits implies that potential mitigation measures such as a wetland offset strategy and/or a water treatment plant are more likely to be feasible and successful.

Should mining proceed as per the Alternative 3 mine plan, the loss of wetland habitat cannot be successfully mitigated and it is likely that offsets will need to be considered. Table 30 illustrates estimates of the extent of wetland area that might be required as an offset depending on the offset multiplier required. In our opinion a multiplier of 5:1 would be realistic. What Table 30 indicates is that should an offset multiplier of 3:1 or 5:1 be applied, the remaining wetland extent within the Paardeplaats study area should prove sufficient as an offset target, though the goals for each specific wetland type might not necessarily be met (i.e. insufficient unchannelled valley bottom wetlands remain on site).

Table 30: Wetland offsets

Wetland Type	Total wetland area on site	Wetland area in Portion 30 reserve	Wetland area remaining after Alternative 3	Offset ratio 3:1	Offset ratio 5:1	Offset ratio 30:1
Channelled valley bottom	23.20	3.21	19.99	9.63	16.05	96.30
Hillslope seepage	277.09	30.11	246.98	90.33	150.55	903.30
Pan	6.21	0.00	6.21	0.00	0.00	0.00
Sheet rock wetlands	2.28	0.00	2.28	0.00	0.00	0.00
Unchannelled valley bottom	37.04	11.55	25.49	34.65	57.75	346.50
Dam	30.04	1.52	28.52	4.56	7.60	45.60
TOTAL	375.86	46.39	329.47	139.17	231.95	1391.70

3.13 SURFACE WATER

3.13.1 INTRODUCTION AND RELATED IMPACTS

Surface water resources includes rivers, streams, drainage lines, flow paths of storm water runoff as well as water collection and channelling through the use of irrigation furrows, canal, channels and dams. Mining activities have the potential to alter surface water drainage patterns through actual mining methods employed as well as the placement of infrastructure. In addition, these activities also have the potential to result in the pollution and/or contamination of surface water resources through geological exposure, seepage, spillages and waste streams both mineralised and non-mineralised.

3.13.2 DATA COLLECTION

Three hydrocensus investigations were available namely:

- GCS (2011) hydrocensus for Glisa EMPR;
- Aqua Earth hydrocensus August 2012;

- Aqua Earth hydrocensus September 2012.

Wetland Consulting Services (WCS) conducted wetlands baseline assessment on behalf of Exxaro Glisa Mine for Portions 1, 2, 13, 24, 28, 29 and 30 of the Farm Paardeplaats 380 JT during September 2011. The results of study indicated that approximately 27% of the Paardeplaats study area is covered by wetlands, making up a combined wetland extent of over 338 ha. A number of different wetland types were identified, with hillslope seepage wetlands being the dominant wetland type and making up more than 70 % of the wetland area on site. Several dams were also identified within the wetlands, totalling just over 27 hectares.

Subsequently, Aqua Earth Consulting (AEC) conducted hydrocensus study in 2012 for extension of the Exxaro Glisa Mine. The hydrocensus included sampling of existing dams and streams located in and around the Mine. Twenty (20) surface water points were located and water samples collected from the surface points and submitted to the accredited laboratory for analyses. The surface water monitoring points are indicated in Figure 16.

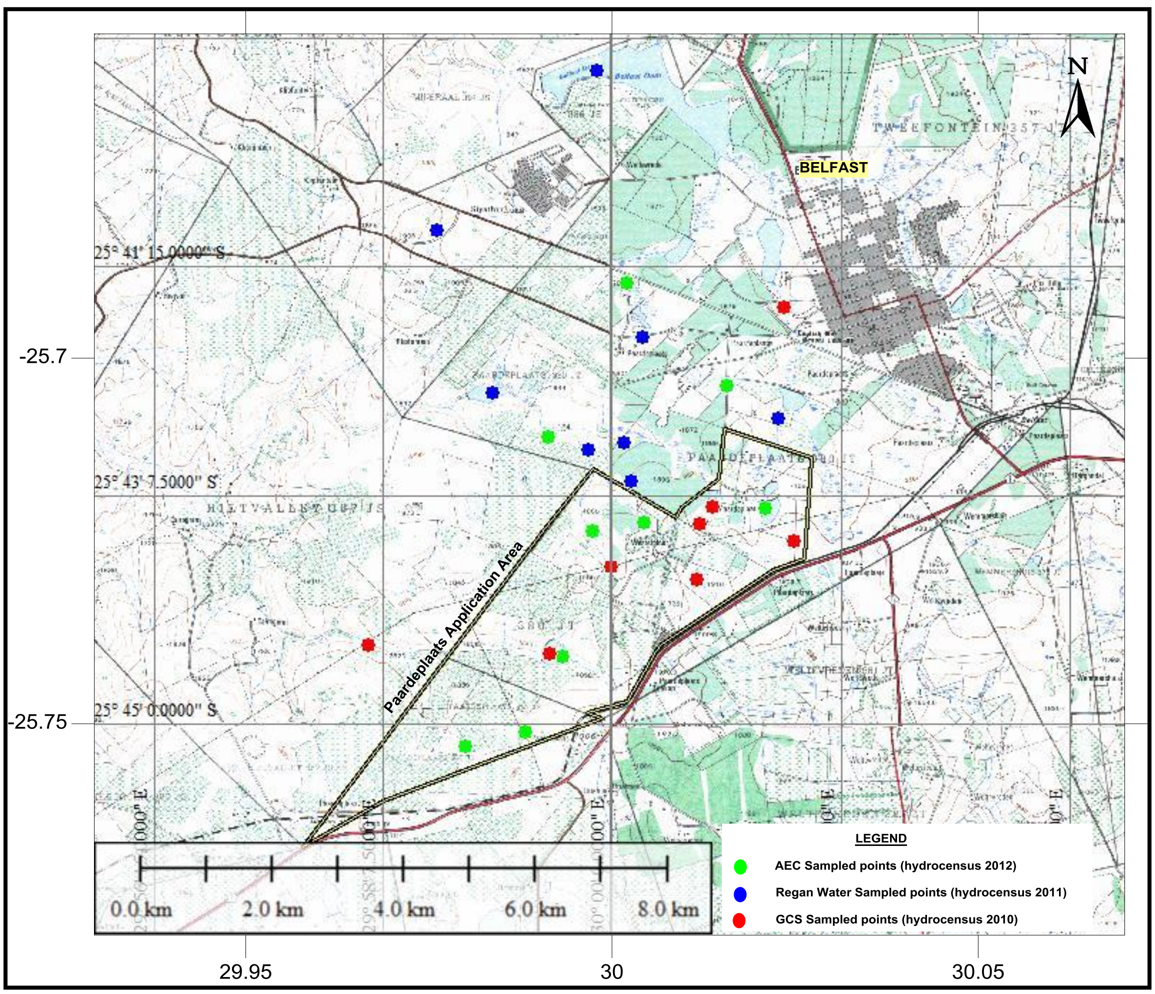

Figure 16: Location of surface water monitoring points

3.13.3 RESULTS

3.13.3.1 Catchment Delineation, Characterisation and Properties

The proposed coal mine is located on quaternary B41A of the Olifants River catchment (Primary catchment B). A small part of the area of investigation falls into quaternary catchment X11D of the Crocodile/ Komati Catchment (Primary Catchment X). The area forms the headwaters of two river systems, one flowing to the northwest (Steelpoort River) and the other to the south (Komati River). The topographic elevation ranges from 1800 to 1905 metres above mean sea level (mamsl). A number of small sized dams are located on the streams feeding onto major rivers within the area. The area is characterised by a diverse land use including urban development, game reserve, farming, agriculture and mining.

Table 31: Information concerning quaternary catchment

Catchment	B41A	X11D
Area (km²)	1687	531
Mean annual runoff (mm/a)	64.7	87.8
Study area % of catchment	1.75	0.08

The quaternary catchments in relation to the study area are indicated in the figure below.

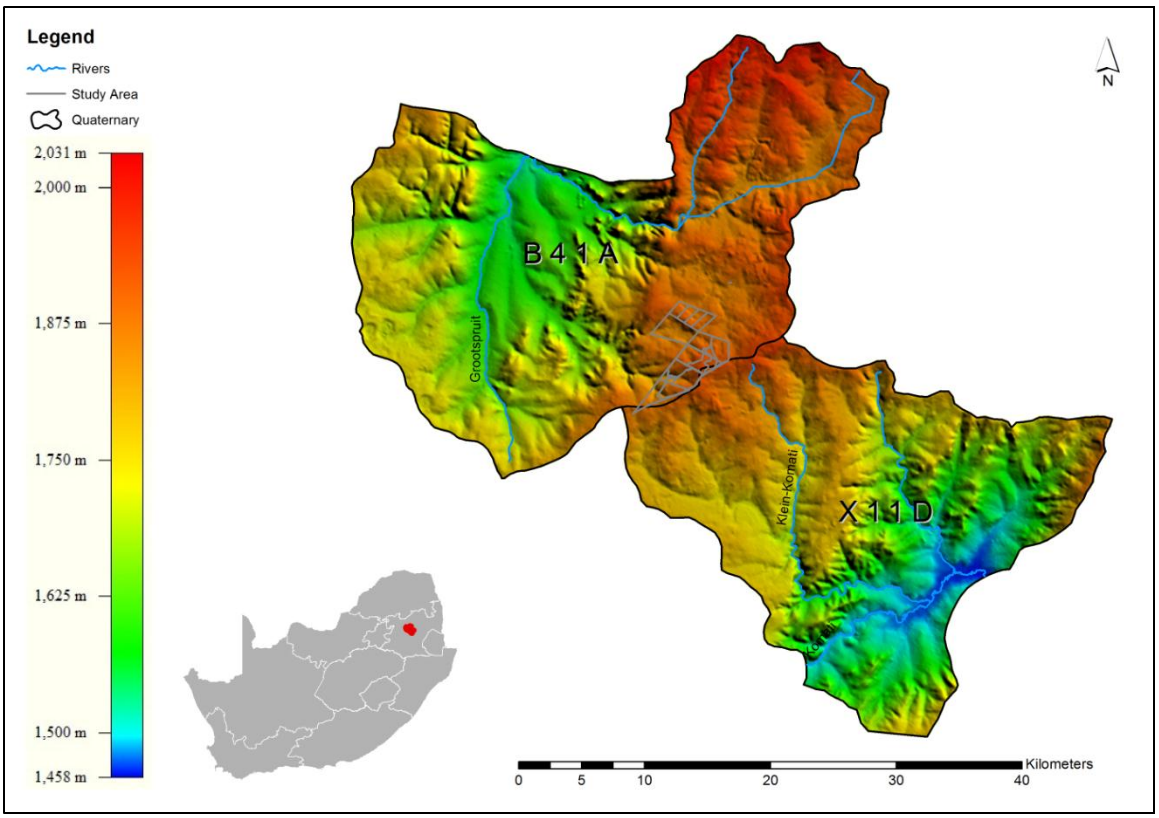

Figure 17: Quaternary catchments

3.13.3.2 Normal Dry Weather Flow

A normal dry weather flow (NDWF) of 19.94 million cubic meters (mcm) was used to describe the dry period flow of surface water over the quaternary catchment B41A. Based on an area and volume relationship, this NDWF was used to obtain a site specific NDWF and of all the sub-catchments.

Two rain gauges (B4E003 and B4E004) were selected to represent dry and wet conditions for the site. The wet conditions are represented by B4E004 and the dry conditions are represented by B4E003. The daily simulated flows for Portion 30 representing wet and dry weather flows are shown in Figure 18.

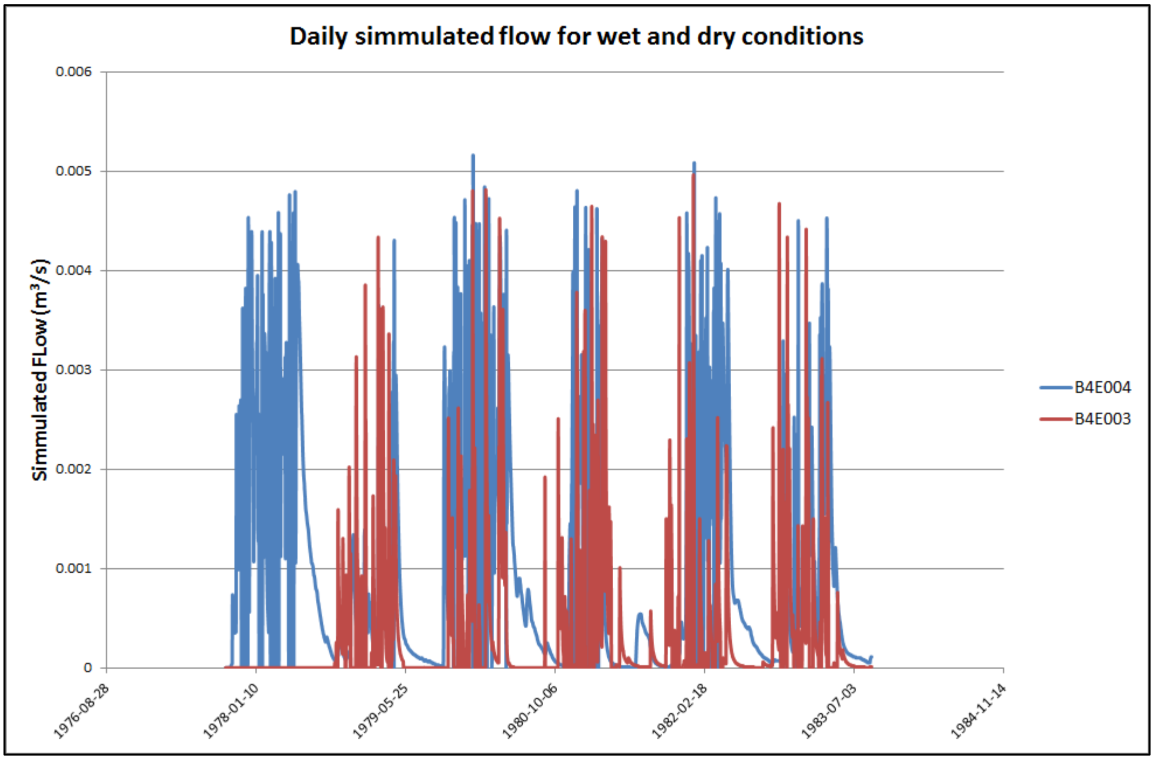

Figure 18: Daily wet and dry weather flows for Portion 30

The monthly averages for the wet and dry conditions are shown in Figure 19.

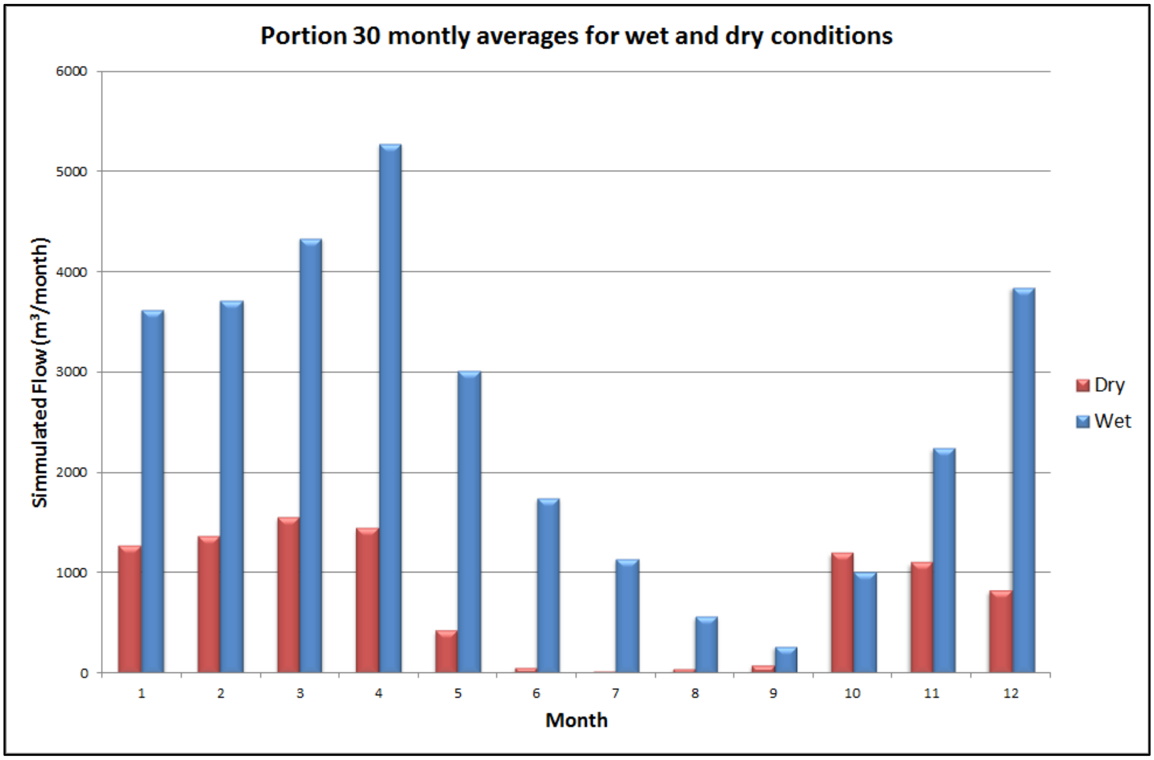

Figure 19: Monthly averages for wet and dry weather conditions for Portion 30

3.13.3.3 Flood Flows

The results of the flood peak simulations for the 1:50 and 1:100 year flood events are shown in Figure 20. The maximum flood peak for a 1:50 year event occurs at a 12 hour duration (99.4 mm rain) and the maximum flood peak for a 1:100 year event occurs at a 8 hour duration (101.5 mm rain).

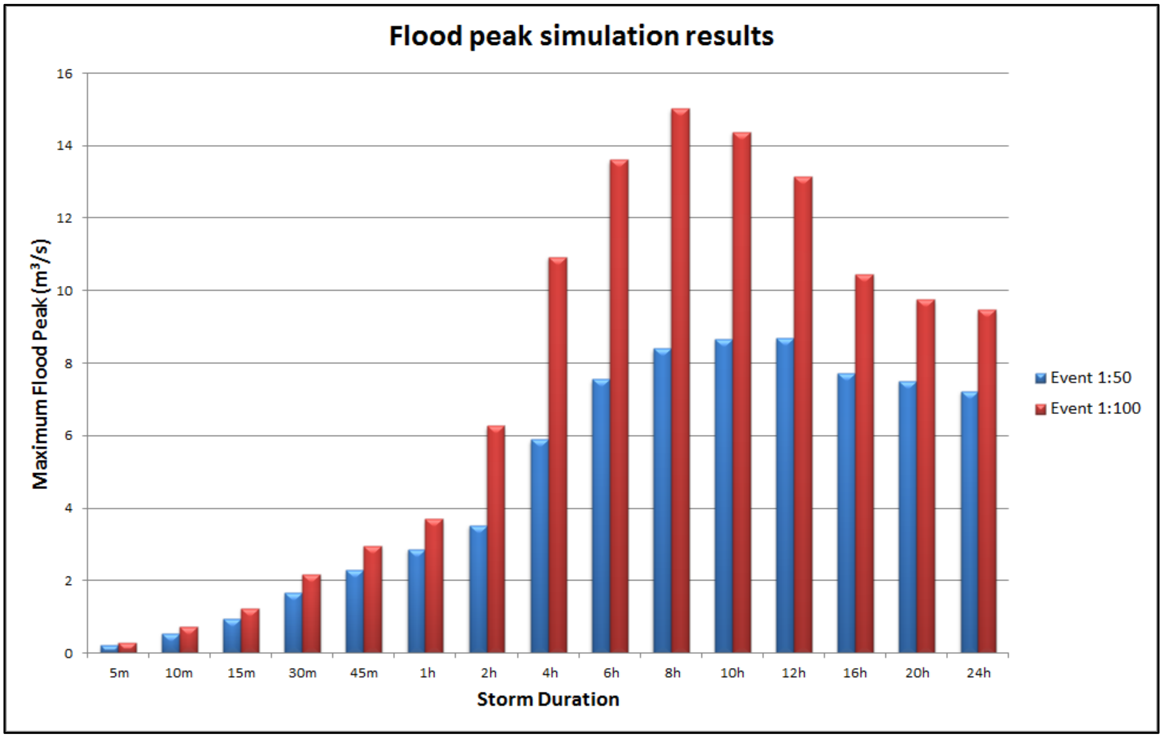

Figure 20: Flood peak simulations

3.13.3.4 Flood Lines

Detail cross-section information is required together with the design rainfall to generate flood lines to be used in the storm water management plan. For the purposes of this document only estimated cross-sections were used for flood line estimation. It is recommended that detail cross-sections be obtained for accurate flood lines.

Design rainfall is used over the site to determine the maximum flood peaks for both the 1:50 and 1:00 year flood events. The design rainfall is presented in Table 32

Table 32: Design rainfall

Duration	Event 1:50 (mm)	Event 1:100 (mm)
5 m	17.7	19.8
10 m	25.9	29
15 m	32.3	36.1
30 m	41	45.9
45 m	47.1	52.8
1 h	52	58.3
2 h	66	74
4 h	77.4	86.7
6 h	84.9	95.1
8 h	90.6	101.5
10 h	95.3	106.8
12 h	99.4	111.3
16 h	106.1	118.9

20 h	111.7	125.1
24 h	116.4	130.4

The resultant flood lines are shown in Figure 21

Figure 21: Estimated flood lines

3.13.3.5 Dam Samples

The following table indicates the location of the dams from which samples were taken.

Table 33: Sensitive Receptors - Dams

ID	Coordinates		Farm Name	Signs of Pollution	Use
Dams	X	Y			
VSSW1	30.000055	-25.727802	Paardeplaats 29	No	Plan to irrigate vegetables
VSSW2	29.997585	-25.723224	Paardeplaats 29	No	None
VSSW3	29.997217	-25.716443	Paardeplaats 29	No	None
VSSW4	30.004385	-25.722407	Paardeplaats 29	No	Stock watering for 120 Egyptian horses in near future

WPSW1	29.979764	-25.753755	Paardeplaats Rmd	No	None
WPSW2	29.988321	-25.751678	Paardeplaats Rmd	No	Stock watering for ± 120 cattle
HSW1	29.999811	-25.744845	Hadeco 29, 40	No	None
HSW2	29.992207	-25.74186	Hadeco 29, 40	No	Used for irrigation (1mil M/day)
WSW1	30.019685	-25.722487	Paardeplaats 13	No	Stockwater (± 100 sheep, 120 blesbok, 20 springbok) and Fishing
WSW2	30.022863	-25.717244	Paardeplaats 13	No	Stockwater (± 100 sheep, 120 blesbok, 20 springbok) and Fishing
WSW3	30.023166	-25.713023	Paardeplaats 13	No	Stockwater (± 100 sheep, 120 blesbok, 20 springbok) and Fishing
WSW4	30.013225	-25.722625	Paardeplaats 13	No	Stockwater (± 25 cattle) and Fishing
WSW5	30.014429	-25.720664	Paardeplaats 13	No	Stockwater (± 25 cattle) and Fishing

3.13.3.6 Spring Samples

The following table indicates the location of the springs from which samples were taken.

Table 34: Sensitive Receptors - Springs

ID	Coordinates		Farm Name	Yield	Signs of Pollution	Use
Springs	X	Y				
VSSP1	30.001151	-25.732064	Paardeplaats 29	Unknown	No	None
VSSP2	30.001034	-25.731837	Paardeplaats 29	Unknown	No	None
VSSP3	30.001361	-25.730792	Paardeplaats 29	Unknown	No	None
VSSP4	30.001594	-25.731552	Paardeplaats 29	Unknown	No	None
VSSP5	30.001964	-25.727818	Paardeplaats 29	Unknown	No	Domestic use (2)
WPSP1	29.981569	-25.754351	Paardeplaats	Unknown	No	None

			Rmd			
HSP1	30.001605	-25.745229	Hadeco 29, 40	Unknown	No	Stockwatering (80 now, 200 seasonal
HSP2	30.001797	-25.745016	Hadeco 29, 40	Unknown	No	None
HSP3	29.997141	-25.744089	Hadeco 29, 40	Unknown	No	None
WSP1	30.021161	-25.725881	Paardeplaats 13	Unknown	No	None

3.13.3.7 Water Quality Results Discussion

During November 2011 Wetland Consulting Services (WCS) conducted aquatic ecology assessment for the affected portions of Paardeplaats 380 JT and Paardeplaats 425 JS on behalf of Groundwater Consulting Services (GCS). During that study surface water samples were collected from nine points around the area and the chemical analysis results are indicated in Table 36.

Twenty (20) surface water points were located and water samples collected from the surface points and submitted to the accredited laboratory for analyses Chemical results were analysed using the WISH software. Existing monitoring data together with the latest hydrocensus data were compiled into a WISH database. The data included is summarised in Table 35.

WISH supports various illustrative presentations of chemical data. Time series plots are a convenient way in which to understand the changes in water quality over time. All available EC (electrical conductivity) data for the groundwater sites is shown in Figure. It is clear from the data that the EC are well below the SANS 241:2005 drinking water guideline. EC is a good global indicator to identify possible problems in most water quality analysis.

It is clear from the available data on the major cations and anions that all sites are well below the SANS 241:2005 drinking water guideline.

In terms of other chemical parameters, it is clear that the pH values are within a relatively narrow band of neutral to slightly acidic. Slightly elevated total iron concentrations are also detected in most of the surface water samples.

The pH is important since it is a bulk indicator of changes. These values also limit the mobilisation of metals and as long as pH values remain in this band, metal content should remain low and consequently environmental impacts should be limited by this.

Table 35: Surface water chemistry results

Surface sampling points	Locations	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO4 mg/l	NO3-N mg/l	F mg/l	Fe mg/l
SVDam1	Portion 30	6.46	19.3	150	3.81	4.89	21.9	10.3	46.7	10.1	0.3	0.178	1.16
SVDam2	Portion 30	7.33	13.1	92	4.23	6.78	12.1	5.75	19.7	4.89	0.35	0.176	0.92
SVDam3	Portion 30	6.6	8	60	2.8	2.45	8.65	5.71	8.81	11.2	0.3	0.238	0.74
HDam 1	Portion 40	7.55	24.1	170	18.2	12.7	9.4	5.1	17.6	50	0.3	0.265	0.05
WPDam 1	Portion 2	6.48	48.7	466	15	10.5	50.6	35.9	119	17.9	0.3	0.441	10.2
WPDam 2	Portion 2	6.79	12.9	114	7.27	5.39	10.1	4.89	13.5	26.6	0.32	0.171	1.01
NWDam1	Portion 13	7.59	8.1	52	4.19	6.35	5.8	1.53	4.08	8.05	0.3	0.266	0.39
LMDam 1	Paardeplaats	7.09	36	282	22.6	18.4	14.7	9.2	20.2	7.19	0.3	0.462	0.17

SANS241:2005

CLASS I: Recommended Operational Limit	5-9.5	<150	<1000	<150	<70	<200	<50	<200	<400	<10	<1	<0.2
CLASS II: Max Allowable/ Acceptable	4.0 - 10.0	150-370	1000 - 2400	150-300	70-100	200-400	50-100	200-600	400-600	10.0 - 20.0	1-1.5	0.2 - 2
Above Class II Limits	10>	370>	24000>	300>	100>	400>	100>	600>	600>	20>	1.5>	2>

Table 36: Water quality data for the aquatic surface water samples (WCS 2011). Relatively high levels that are possible indications of human-related contamination are highlighted in yellow.

Parameters	pH	EC(mS/m)	TDS	Sulphate	Chloride	Phosphate	Nitrate	Sodium	Potassium	Calcium	Magnesium
P1 (Dam)	7.33	16	80.1	1.73	3.89	0	0.11	3.95	0.54	6.96	8.12
P2 (Dam)	7.87	48	291	33.43	18.74	0	0.22	9.96	9	29.86	26.04
P3 (Dam)	7.8	50	246.68	69.45	31.3	0	1.13	8.92	9.98	31.86	26.2
P4 (Dam)	7.57	13	51.26	0.61	12.28	0	0	6.45	3.41	4.1	4.38
P5 (Dam)	7.83	42	189.62	4.13	18.76	0	0.36	7.42	10.9	31.09	20.64
P6 (Dam)	6.95	10	53.42	1.58	3.14	0	0.29	6.64	1.6	6.53	5.74
P7 (Stream)	7.3	11	56.99	5.51	3.54	0	0.18	5.95	6.08	6.57	5.08
P8 (Wetland)	7.02	34	188.25	43.41	12.17	0	18.41	8.91	13.61	29.09	17.83

3.13.3.1 Existing Surface Water Uses

A number of small sized dams are located on the streams feeding onto major rivers within the study area. These dams are used for agricultural purposes, which include drinking water for cattle irrigation and small scale trout fishing both for commercial and recreational purposes. There are four small pans located on the eastern boundary of the study area.

3.13.4 CONCLUSION

The current surface water quality of the area is relatively good. The additional samples tested corroborate this conclusion.

3.14 GROUND WATER

3.14.1 INTRODUCTION AND RELATED IMPACTS

Ground water is defined as water located beneath the ground surface in lithological formations. Mining activities have the potential to impact on ground water resources through potential pollution and/or contamination as a result of activities such as the actual mining method employed and resultant geological exposure of oxidising materials, seepage, spillages and both mineralised and non-mineralised waste streams. Additional impacts related to mining activities also include dewatering cones of depression and loss of water supply to surrounding land users.

3.14.2 DATA COLLECTION

The following data as part of a hydrocensus were recorded for groundwater users in the study area to obtain a baseline data set for the groundwater evaluation:

- GPS co-ordinates and elevation of the borehole or spring;
- Water levels of the boreholes, where accessible;
- Estimated abstraction volumes, where provided;
- The condition of the boreholes; and
- Any other information regarding the water reliability or quality.

Three hydrocensus investigations were available namely:

- GCS (2011) hydrocensus for Glisa EMPR
- Aqua Earth hydrocensus August 2012
- Aqua Earth hydrocensus September 2012

The objectives of the drilling programme were to:

- Provide a control to the geophysical data;
- Collect geological and hydrogeological information;
- Provide boreholes for test pumping; and
- Provide long term monitoring locations.

The programme comprised the drilling of monitoring boreholes as was allowed and approved under certain budget and permitting constraints. Due to surface and wetland delineation constraints two borehole positions were picked from the geophysical targets and borehole pairs with a shallow and deep borehole were drilled at these locations.

During drilling strata samples were collected at 1 m intervals and logged. Detailed logs of the lithologies intersected, fracture zones, water strike depths, blowing yields and groundwater bearing zones were recorded.

Figure 22 indicates the positions of the newly drilled boreholes (in red) in relation to the borehole picked up during the first hydrocensus borehole on Paardeplaats and Glisa. Table 41 provides a summary of drilling and construction details for the new boreholes.

Water samples were collected from all boreholes a day after the drilling and headworks were completed and submitted for analysis. Drill chip samples were collected for ABA analysis.

The main objective of carrying out pumping tests is to determine aquifer parameters of transmissivity, storage and well performance (specific capacity).

The newly drilled boreholes were tested in January 2013.

All testing were carried out under the direct supervision of our site hydrogeologist. Two tier pumping tests were conducted namely a step test and constant rate test to determine large scale aquifer parameters and boundary conditions.

A four hour step test was carried out at each borehole to determine the optimum pumping rate for the constant rate test. Constant rate pumping tests were run for a period of 24 hours or until the hole was pumped dry and recoveries rates were measured.

Drawdowns and fluctuations in water levels were recorded and a summary of the test details are presented in Table 38. A summary of the aquifer parameters derived from these tests are presented in Table 39.

In order to try and get a better understanding of the wetland/groundwater interaction, a number of infiltration tests were conducted to get an understanding of the shallow infiltration conditions. Although there are many limitations with this type of testing, it is still considered sufficient to get a first order estimate of vertical conductivities in the layers that are immediately underlying most wetlands.

Table 42 provides a summary of these test with depths, hole diameter and infiltration durations, while Table 43 provides a summary of the vertical conductivities analysed.

The positions of the infiltration holes are indicated in Figure 23.

The results of the hydrocensus are presented in Table 46. The depths to water level data were obtained from hydrocensus data for the study area. The groundwater levels in the study area vary between artesian to 31.4 mbgl. The average groundwater level is approximately 10 mbgl.

An interpolation technique, using the available data, was used to simulate water levels over the entire model area. The interpolation technique used is referred to as Bayesian interpolation where water levels are correlated with the surface topography. The results indicate a correlation of 88%. Therefore, Bayesian interpolation was valid and used to calculate water levels for the entire model area.

During the desktop study carried out by Aqua Earth Consulting it was recommended that three boreholes be drilled in areas where there are no groundwater monitoring points. A site walkover and geophysical survey was carried out on the 11th to 12th of October 2012. After interpretation of existing hydrogeological and geological maps and a site walkover to evaluate the area in terms of accessibility and the location of boundary fences, topographical features and wetland border zones, it was then decided that three geophysical traverses should be sufficient to cover the area. The geophysical methods used to identify possible targets for drilling were Magnetic Method and Very Low Frequency Electromagnetic Method (VLF). Background hydrogeological and geophysical siting of boreholes in this area has shown that the probability of striking water is greater on fractured and fault zones and where the rocks are highly weathered. The results of the geophysical survey indicated possible drilling targets. The sites were selected on the basis of anomalies delineated from the geophysical profiles. The sites were presented to Exxaro for final approval and after much deliberation and discussion it was decided that only two borehole sites will be drilled, but that two boreholes, a shallow and deep borehole pair, will be drilled at the each of these sites.

3.14.3 RESULTS

3.14.3.1 Aquifer Description

The water bearing strata is mainly the sandstones above the coal seams with the major flow path being on the contact between the sandstone and coal strata. The current available data indicates that the aquifer displays fractured rock characteristics. The aquifer at the Glisa colliery is a secondary aquifer with groundwater usually located in fractures, joints, bedding planes and within the weathered zone (ERM (2008)). Little to no flow occurs in the matrix of the Ecca Group.

3.14.3.2 Aquifer Parameters

Water in a fractured rock aquifer flows along fractures, faults, joints and bedding planes within the rock matrix. Groundwater flow in the main aquifer occur within fault zones and at the bedding plane fractures of the coal seam roofs and floors, while flow in the lesser aquifer will occur at the bedding plane fracture of the contact between the weathered sandstone and carbonaceous shale/fresh rock contact (GCS, 2011). No pumping test data was available for the site therefore values obtained from GCS (2011) were used to set up the initial model. These values are summarised in Table 37. It is important to note that transmissivities can vary greatly in a fractured rock environment.

Table 37: Pumping test results

Borehole Name	Transmissivity (m^2/d)	
	Cooper-Jacob method	Theis method
GB2	0.22	0.21
GB3	7.3	4.7
GB5	23.14	23.89
GB6	0.2	0.23
Water borehole	0.39	0.3
Average	6.25	5.87

Table 38: Summary of pumping tests

Borehole number	Borehole Depth (m)	Static water level	Step drawdown duration (m)	Constantrate testduration (min)	Constant rate testdrawdown (m)	Constant rate test yield (l/s)
AECB1	40	13.37	240	1440	6.29	0.58
AECB1B	21	14.03	240	1440	2.13	0.86
AECB2	34	-	-	40	30.54	0.22
AECB2B	11	1.94	-	900	7.09	0.13

Pumping test data from the tests conducted by Aqua Earth (AEC) confirms the range of transmissivity values to be in the same order as that reported by GCS. Table 39 provides a summary of the pumping test results from the newly drilled boreholes.

Table 39: Pumping test results (AEC, 2013)

Borehole Name	Transmissivity (m^2/d)	
	Theis	Cooper-Jacob
BH 1A	6	11.6
BH 1B	9	9.2
BH 2B	1	0.5
Average	**5.3**	**7.1**

3.14.3.3 Baseline Groundwater Conditions

Boreholes and Springs

The following table indicates the locations of the boreholes from which samples were taken.

Table 40: Sensitive Receptors - Boreholes

ID	Coordinates		Farm Name	BH Yield	SWL	Signs of Pollution	Use
Bore-holes	X	Y		(l/h)			
WPBH1	29.987737	-25.750039	Paardeplaats Rmd	2500	No access	No	Domestic use (16)
HBH1	30.003057	-25.737745	Hadeco 29, 40	Unknown	No access	No	None
HBH2	30.003245	-25.743382	Hadeco 29, 40	Unknown	Dry at 4.88	No	None
HBH3	30.009753	-25.72825	Hadeco 29, 40	2500	No access	No	Domestic use (200)
WBH1	30.018945	-25.722762	Paardeplaats 13	Unknown	1.56	No	Domestic use (5+ tourists)

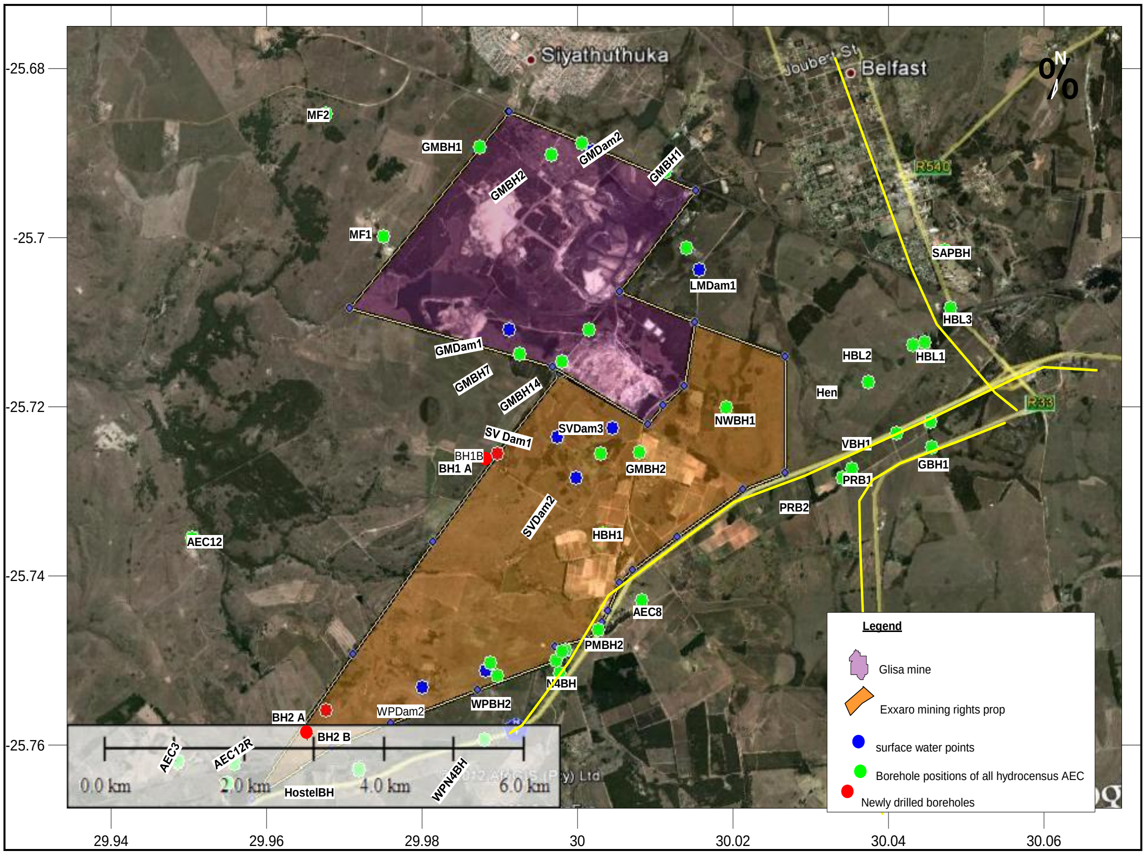

Figure 22: Position of newly drilled boreholes (red)

Table 41: Drilling summary of newly drilled observation boreholes (AEC, 2013)

Borehole number	Date drilled	Coordinates		Depth (mbgl)	Water strike (mbgl)	Static water level (mbgl)	Casing (125 PVC)		Borehole completion
		Lat	Long				Solid	Perforated	
BH1A	21/11/2012	-25.72576	29.98922	39	12	13.63	9	30	Sanitary seal, concrete block, Cap & pole
BH1B	21/11/2012	-25.72572	29.98929	21	19	13.14	15	6	
BH2A	22/11/2012	-25.75587	29.96758	40	12	3.44	9	31	
BH2B	22/11/2012	-25.75583	29.96768	16	15	2.39	9	7	

3.14.3.4 Infiltration Tests

In order to try and get a better understanding of the wetland/groundwater interaction, a number of infiltration tests were conducted to get an understanding of the shallow infiltration conditions. Although there are many limitations with this type of testing, it is still considered sufficient to get a first order estimate of vertical conductivities in the layers that are immediately underlying most wetlands.

Table 42 provides a summary of these test with depths, hole diameter and infiltration durations, while Table 43 provides a summary of the vertical conductivities analysed.

The positions of the infiltration holes are indicated in Figure 23.

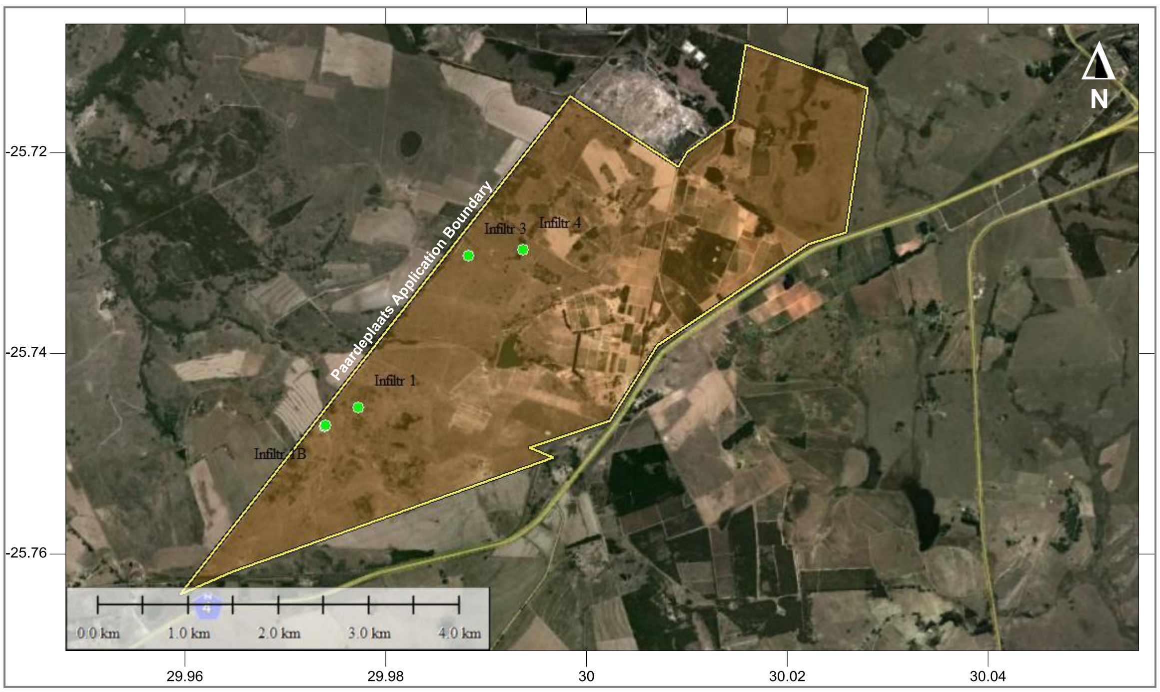

Figure 23: Google map indicating positions of infiltration tests

Table 42: Infiltration test summary

Borehole number	Coordinates (WGS84)		Hole Depth (m)	Hole diameter (mm)	Infiltration duration (min)	Infiltration initial water level (mbgl)	Infiltration Final water Level (mbgl)
	Lat	Long					
Infiltr. 1	-25.745426	29.977288	0.7	75	60	0.06	0.52
Infiltr. 1A	-25.74731	29.97395	0.7	75	5	0.27	0.37
Infiltr. 1B	-25.74722	29.97407	0.7	75	120	0.07	0.55
Infiltr. 3	-25.73034	29.988287	0.7	75	120	0.07	0.43
Infiltr. 4	-25.729681	29.993729	0.7	75	120	0.04	0.52

Table 43: Vertical conductivity determined from field infiltration tests

Site Number	K (m/d)	K (m/s)
Infiltr. 1	0.429	4.968E-06
Infiltr. 1A	1.588	1.839E-05
Infiltr. 1B	0.302	3.505E-06
Infiltr. 3	0.0948	1.098E-06
Infiltr. 4	0.138	1.606E-06
Average	**0.51**	**5.913E-06**

These values compare very well with textbook values obtained for silty sand e.g. as reported by Freeze and Cherry *et al*.

The net result is that seepage from these wetlands will be fairly slow to moderate into the deeper, (shallow) aquifers.

Based on the infiltration tests conducted in the wetland areas it could be stated that there is a distinct difference between the groundwater levels and those encountered in the shallow wetland soils. Water levels in these soils are reported at between 0.3 and 0.5 mbgl, which are significant as it indicates a slow vertical migration of surface water encountered in the wetlands into the aquifer units below.

3.14.3.5 Water Quality Results

Chemical results were analysed using the WISH software. Existing monitoring data together with the latest hydrocensus data were compiled into a WISH database. It is clear from the data that the EC is well below the SANS241:2005 drinking water guideline. EC is a good indicator to identify possible problems in most water quality analysis. Also it is clear from the available data on the major cations and anions that all are also well below the SANS241:2005 drinking water guideline and pH values are within a slightly narrow band of neutral to slightly acidic. The data included is summarised in Table 44.

Newly drilled boreholes chemistry results Table **44: Chemistry data**

Site Description	Borehole number	pH	EC (mS/m)	TDS (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3 (mg
	Aqua Earth Analyses										
	SVBH1	5.06	39.7	328	18	18.3	15.8	24.9	33.8	12.4	33.6
	HFBH1	6.88	36.2	302	27.1	19.3	10.6	11.7	20	25.7	26.3
	HBH1	7.31	36.4	326	27.4	19.6	10.5	11.3	20.1	25.8	26.4
	HBH2	8.03	19	136	7.7	5.06	33.1	3.21	2.14	4.89	0.67

	PMBH1	6.74	3.5	<30	2.37	1.06	3.39	3.61	1.31	1.96	<0.3
	PMBH2	6.95	5.6	42	2.19	1.08	4.05	3.59	1.55	3.04	<0.3
	WPBH1	7.1	8.3	70	8.39	3.95	5.51	1.55	3.42	2.33	0.9
	WPBH2	7.15	13.6	104	8.65	4.87	8.88	4.75	9.68	4.24	<0.3
	N4BH	7.88	10.7	78	10.9	4.3	6.26	4.95	2.19	2.78	<0.3
	LMBH1	6.59	12	72	3.54	3.56	15	3.02	28.7	2.17	0.69
	NWBH1	7.69	8.3	70	6.11	7.09	3.7	1.19	1.79	2.4	<0.3
	GCS Analyses										
	GB3	6.8	139	1224	190	66	29	5.8	3.8	646	<0.1
	GB2	6.4	14.3	126	6.2	3.3	10.9	1.4	26	<0.2	0.7
	GB6	6.1	3.7	56.0	3.0	0.7	8.3	1.7	1.2	1.9	0.4
	GB5	7.3	18.2	126	3.8	20	5	<0.1	1.7	0.8	<0.1
	LFBH	6	19	150	6.3	3.4	16.2	5.9	32.0	2.1	4.7
	EXBH	3.8	29.7	229	11.9	9.2	7.2	6.3	7.8	76	<0.1
	WBH	7.2	10.2	90.0	7.9	5.7	9.0	0.4	2.9	<0.2	<0.1
	VsFtn1	4.7	47.1	452.0	19.7	13.2	21.0	27.0	37.0	22	40.0
	Thandani	7.4	18.9	148.0	13.9	8.1	10.5	3.6	8.2	0.3	<0.1
	HBH	6.6	38.7	327.0	27.0	12.1	10.1	12.5	21.0	13.3	20.0
SANS241:2005											
Class I: recommended Operational Limit		5-9.5	<150	<1000	<150	<70	<200	<50	<200	<400	<10
Class II: Max Allowable / Acceptable		4.0-10.0	150-370	1000-24000	150-300	70-100	200-400	50-100	200-600	400-600	10.0-20.0
Above Class II Limits		>10	>370	>24000	>300	>100	>400	>100	>600	>600	>20

Table 45 provides a summary of chemistry results of the newly drilled boreholes. The results were compared with SANS drinking water standards.

The chemistry results of the newly drilled boreholes indicate that all parameter analysed falls into a class 1 recommended limit. However, borehole AECB2 indicates a slightly elevated iron concentration which falls into class II acceptable limit.

Table 44: Chemistry data

Site Description	Borehole number	pH	EC (mS/m)	TDS (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Cl (mg/l)	SO4 (mg/l)	NO3-N (mg/l)	F (mg/l)	Fe (mg/l)	Mn (mg/l)
	Aqua Earth Analyses													
	SVBH1	5.06	39.7	328	18	18.3	15.8	24.9	33.8	12.4	33.6	<0.1	<0.05	0.21
	HFBH1	6.88	36.2	302	27.1	19.3	10.6	11.7	20	25.7	26.3	0.12	<0.05	<0.05
	HBH1	7.31	36.4	326	27.4	19.6	10.5	11.3	20.1	25.8	26.4	0.11	<0.05	<0.05
	HBH2	8.03	19	136	7.7	5.06	33.1	3.21	2.14	4.89	0.67	0.3	<0.05	<0.05
	PMBH1	6.74	3.5	<30	2.37	1.06	3.39	3.61	1.31	1.96	<0.3	<0.1	0.05	<0.05
	PMBH2	6.95	5.6	42	2.19	1.08	4.05	3.59	1.55	3.04	<0.33	0.12	<0.05	0.09
	WPBH1	7.1	8.3	70	8.39	3.95	5.51	1.55	3.42	2.33	0.9	<0.1	<0.05	<0.05
	WPBH2	7.15	13.6	104	8.65	4.87	8.88	4.75	9.68	4.24	<0.3	0.17	<0.05	0.13
	N4BH	7.88	10.7	78	10.9	4.3	6.26	4.95	2.19	2.78	<0.3	0.28	0.06	<0.05
	LMBH1	6.59	12	72	3.54	3.56	15	3.02	28.7	2.17	0.69	<0.1	<0.05	0.44
	NWBH1	7.69	8.3	70	6.11	7.09	3.7	1.19	1.79	2.4	<0.3	<0.1	0.07	<0.05
	GCS Analyses													
	GB3	6.8	139	1224	190	66	29	5.8	3.8	646	<0.1	0.1	<0.001	0.5
	GB2	6.4	14.3	126	6.2	3.3	10.9	1.4	26	<0.2	0.7	<0.1	<0.001	0.12
	GB6	6.1	3.7	56.0	3.0	0.7	8.3	1.7	1.2	1.9	0.4	<0.1	<0.001	0.0
	GB5	7.3	18.2	126	3.8	20	5	<0.1	1.7	0.8	<0.1	0.1	<0.001	0.018
	LFBH	6	19	150	6.3	3.4	16.2	5.9	32.0	2.1	4.7	<0.1	<0.001	<0.001
	EXBH	3.8	29.7	229	11.9	9.2	7.2	6.3	7.8	76	<0.1	<0.1	<0.001	0.47
	WBH	7.2	10.2	90.0	7.9	5.7	9.0	0.4	2.9	<0.2	<0.1	<0.1	<0.001	<0.001
	VsFtn1	4.7	47.1	452.0	19.7	13.2	21.0	27.0	37.0	22	40.0	<0.1	<0.001	0.2
	Thandani	7.4	18.9	148.0	13.9	8.1	10.5	3.6	8.2	0.3	<0.1	<0.1	<0.001	0.1
	HBH	6.6	38.7	327.0	27.0	12.1	10.1	12.5	21.0	13.3	20.0	0.1	<0.001	0.0
SANS241:2005														
Class I: recommended		5-9.5	<150	<1000	<150	<70	<200	<50	<200	<400	<10	<1	<0.2	<0.1

Operational Limit													
Class II: Max Allowable / Acceptable	4.0-10.0	150-370	1000-24000	150-300	70-100	200-400	50-100	200-600	400-600	10.0-20.0	1-1.5	0.2-2	0.1-1
Above Class II Limits	>10	>370	>24000	>300	>100	>400	>100	>600	>600	>20	>1.5	>2	>1

Table 45: Chemistry results of the newly drilled boreholes

Site Name	BH Number	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO4 mg/l	NO3-N mg/l	F mg/l	Fe mg/l	Mn mg/l
Paardeplaats	**AECB1**	7.17	12.4	90	11.4	6.1	10.5	4.15	2.37	9.28	<0.3	0.256	<0.05	<0.05
	AECB1B	6.13	3.9	36	2.44	1	6.28	2.2	1.36	3.68	1.8	<0.1	<0.05	<0.05
	AECB2	6.52	5.6	38	4.36	2.29	7.84	1.63	2.16	8.69	<0.3	<0.1	0.41	0.06
	AECB2B	6.65	13.7	98	12.3	5.45	10.6	3.77	2.2	30.7	0.4	0.288	<0.05	0.09

SANS 241; 2005

CLASS I: Recommended Operational Limit	5-9.5	<150	<1000	<150	<70	<200	<50	<200	<400	<10	<1	<0.2	<0.1
CLASS II: Max Allowable	4.0-10	150-370	1000 - 2400	150-300	70-100	200-400	50-100	200-600	400-600	10.0-20	1-1.5	0.2-2	0.1 - 1
Above Class II Limits	>10	>370	2400>	>2400	>100	>400	>100	>600	>600	>20	>1.5	>2	>1

All boreholes indicate good quality water. The results indicate EC concentrations which fall within class I recommended limits. The pH of the newly drilled boreholes ranges from 6.1 to 7.2. Three boreholes AECB1, AECB2 and AEC2B indicate fresh or recently recharged water. Borehole AEC1B indicates sodium bicarbonate water (or mixing of water).

3.14.3.6 Groundwater levels

The groundwater levels in the study area vary between artesian to 31.4 mbgl. The average groundwater level is approximately 10 mbgl. The locations of the boreholes and springs are shown in Figure 24. An interpolation technique, using the available data, was used to simulate water levels over the entire model area. The interpolation technique used is referred to as Bayesian interpolation where water levels are correlated with the surface topography. All available levels were plotted against topography as shown Figure 25. The results indicate a correlation of 88%. Therefore, Bayesian interpolation was valid and used to calculate water levels for the entire model area. The water levels are shown Figure 26. As groundwater levels follow topography it can be assumed that groundwater flow takes place under unconfined to semi-confined conditions.

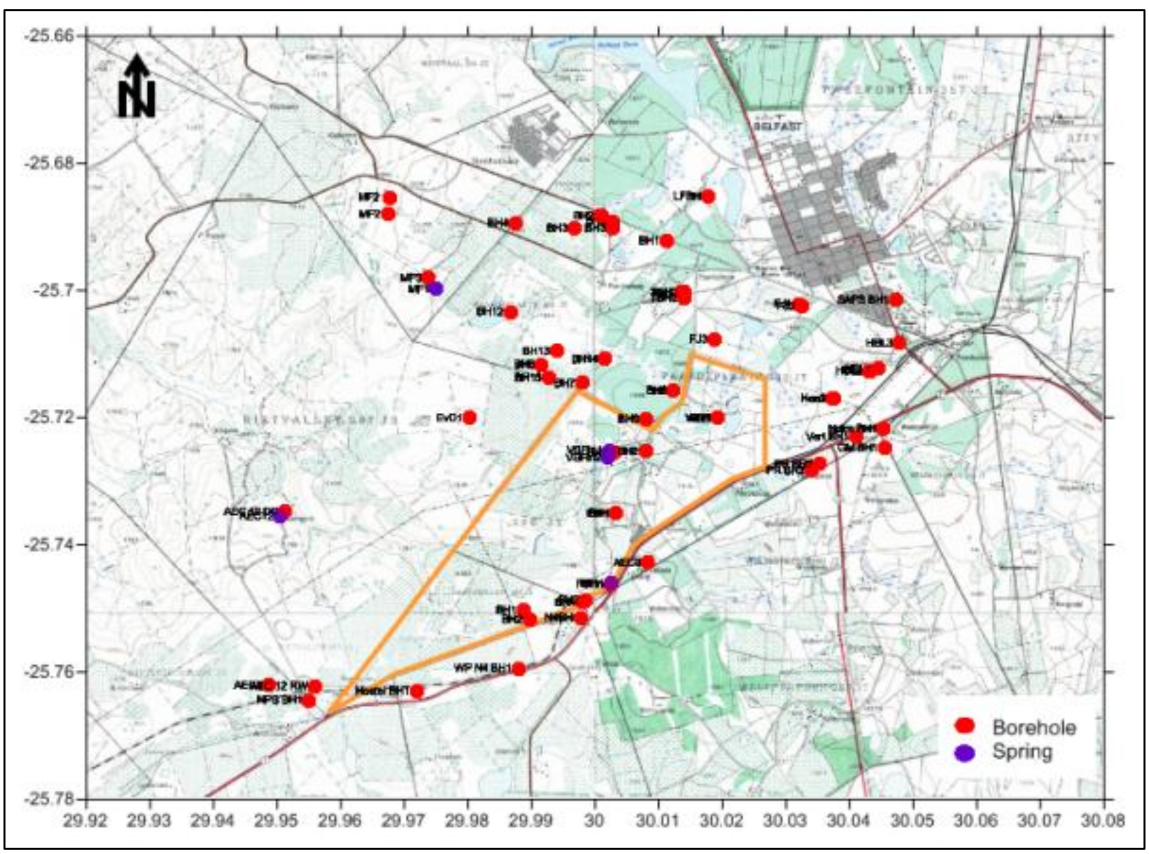

Figure 24: Location of boreholes and springs

Table 46: Hydrocensus data

Borehole Name	Coordinates		Elevation (mamsl)	SWL (mbgl)	Borehole Depth (m)	Pump	Abstraction (l/day)	Comments
	X	Y						
BH15	-2845210	-101079.3466	1866	16.77	32	Not Equipped	N/A	Monitoring Borehole
BH13	-2844745	-100954.6328	1850	0	31	Not Equipped	N/A	Monitoring Borehole
BH7	-2845302	-100543.927	1851.622	5.91	21	Not Equipped	N/A	Monitoring Borehole
BH8	-2845420	-99096.946	1876.394	3.01	23.74	Not Equipped	N/A	Monitoring Borehole
BH9	-2845917	-99532.028	1897.984	31.4	36.73	Not Equipped	N/A	Monitoring Borehole
BH6	-2844977	-101184.2925	1847	3.97	9	Not Equipped	N/A	Monitoring Borehole
BH14	-2844881	-100186	1867	1.91	32	Not Equipped	N/A	Monitoring Borehole
BH1	-2842472	-100074	1862	2.98	33	Not Equipped	N/A	Monitoring Borehole
BH2	-2842386	-100276	1869	3.94	5.95	Not Equipped	N/A	Monitoring Borehole
BH12	-2844067	-101689.5699	1845	2.01	4.91	Not Equipped	N/A	Monitoring Borehole
BH3	-2842595	-100081	1871	Dry	6.9	Not Equipped	N/A	Monitoring Borehole
MF2	-2842382	-103539.0465	1890	16.23	16.6	Windmill	Not Used	Windmill is broken
MF3	-2843491	-102980.1939	1902	Not Accessible	Not Accessible	Not Equipped	N/A	
HFtn	-2848791	-100067	1908	Spring	Spring	Not Equipped	N/A	Sampled
HBH	-2847563	-99988	1919	Not Accessible	+/- 67	Submersible	5000 l/hr	Pumped Daily
VSFtn1	-2846466	-100107	1889	Spring	Spring	Electrical Centrifugal	30000 l/day	Self-Regulating Pump, Sampled
VSFtn2	-2846596	-100121	1913	Spring	Spring	Not Equipped	N/A	
HBL1	-2845017	-95866	1925	4	Unknown	Submersible	20000 l/day	
HBL2	-2845050	-96008	1923	1.02	Not Accessible	Submersible	3000 l/week	Not regularly used
Hen1	-2845540	-96584	1918	4.19	53.05	Not Equipped	N/A	
Hen2	-2845541	-96581	1919	Dry	7.05	Not Equipped	N/A	Borehole may have collapsed
BH7	-2845302	-100543.927	1851.622	5.91	21	Not Equipped	N/A	Monitoring Borehole
BH8	-2845420	-99096.946	1876.394	3.01	23.74	Not Equipped	N/A	Monitoring Borehole

Borehole Name	Coordinates		Elevation (mamsl)	SWL (mbgl)	Borehole Depth (m)	Pump	Abstraction (l/day)	Comments
	X	Y						
BH9	-2845917	-99532.028	1897.984	31.4	36.73	Not Equipped	N/A	Monitoring Borehole
FJ1	-2843895	-97129.66342		3.96	16.83	Not Equipped	N/A	Not Used
FJ2	-2843943	-97087.447743		4.28	80.4	Submersible	5000 l/day	Drinking Water
FJ3	-2844517	-98463.5318		Not Accessible	Not Accessible	Windmill	Not used	Not Used
TBH1	-2843805	-98941	1877	Not Accessible	Not Accessible	Windmill	500 l/hr	Residents complained about the water quality
TBH2	-2843704	-98941	1877	Not Accessible	Not Accessible	Windmill	N/A	Windmill is broken
LFBH	-2842033	-98583	1869	5.5	38	Not Equipped	N/A	Borehole is neglected, hasn’t been opened since 1994
SR1	-2846800	-96911	1919	9	13	Windmill	2000 l/day	Not used for drinking water
SR2	-2846684	-96780	1924	4.3	20	Submersible	8000 l/hr	Used for drinking water, no complaints about water quality
EvD1	-2845921	-102314.5739	1881	7.38	27	Windmill & Submersible	8000 l/day	Used for drinking water and livestock watering
WBH	-2845891	-98406	1897	1.74	45	Submersible	10000 l/week	Drinking Water
BH1	-2846798	-100045.3689	1908	Sealed		Submersible		Domestic
FBH1	-2849093	-100087.2322	1905	Sealed		Submersible		Domestic
BH1	-2847857	-100007.2618	1916	Sealed		Submersible		Domestic
BH2	-2846781	-99558.72887	1913	Sealed		Submersible		Domestic
BH1	-2849420	-100526.2768	1907	Sealed		Hand Pump		Domestic
BH2	-2849376	-100478.4506	1907	Sealed		Hand Pump		Domestic
BH1	-2849560	-101457.4078	1883	18.50		Open		Domestic
BH2	-2849716	-101368.9166				Hand Pump		Domestic
N4BH	-2849686	-100566.398	1906	Sealed		Submersible		Domestic
BH1	-2844002	-99013.43885	1881	5.39		Submersible		

Borehole Name	Coordinates		Elevation (mamsl)	SWL (mbgl)	Borehole Depth (m)	Pump	Abstraction (l/day)	Comments
	X	Y						
BH2	-2844100	-98959.50168	1873	Sealed		Submersible		
BH1	-2843105	-99253.04409	1877	Sealed				
BH14	-2845181	-100211.1601	1856	24.8		Not Equipped		Monitoring
BH15	-2845506	-101100.4311	1869	16.86		Not Equipped		Monitoring
BH6	-2845278	-101206.0592	1857	4.03		Not Equipped		Monitoring
BH7	-2845602	-100563.2959		5.48		Not Equipped		Monitoring
BH3	-2842898	-100711.1099	1866			Not Equipped		Monitoring
BH2	-2842682	-100294.396	1867	3.35		Not Equipped		Monitoring
BH4	-2842819	-101637.554	1899	Sealed				
BH1	-2846186	-98427.8293	1868	Sealed		Submersible		
AEC3	-2850900	-105467.5419				Submersible		
AEC12	-2847040	-105312.4287				Spring		
AEC 12 DS	-2847873	-105232.7464						
AEC 12 RW	-2850906	-104746.0885				Submersible		
NPS BH1	-2851154	-104827.3939				Hand Pump		
Hostel BH1	-2850982	-103140.1381				Submersible		
WP N4 BH1	-2850575	-101527.8903				Wind Pump		
AEC 8	-2848718	-99501.01905				Hand Pump		
PR BH1	-2846984	-96804.26608				Submersible		
PR BH2	-2847093	-96931.92787				Wind Pump		
GM BH1	-2846687	-95774.69211				Submersible		
Vert BH1	-2846500	-96236.72282				Hand Pump		
MF1	-2843980	-102873.4491				Spring		
MF2	-2842383	-103636.8236				Wind Pump		
SAPS BH1	-2844108	-95625.69455				Submersible		
HBL1	-2845313	-95887.00805						
HBL2	-2845347	-96031.29865						

Borehole Name	Coordinates		Elevation (mamsl)	SWL (mbgl)	Borehole Depth (m)	Pump	Abstraction (l/day)	Comments
	X	Y						
HBL3	-2844865	-95557.99764						
Ndim BH1	-2846358	-95798.14711				Submersible		

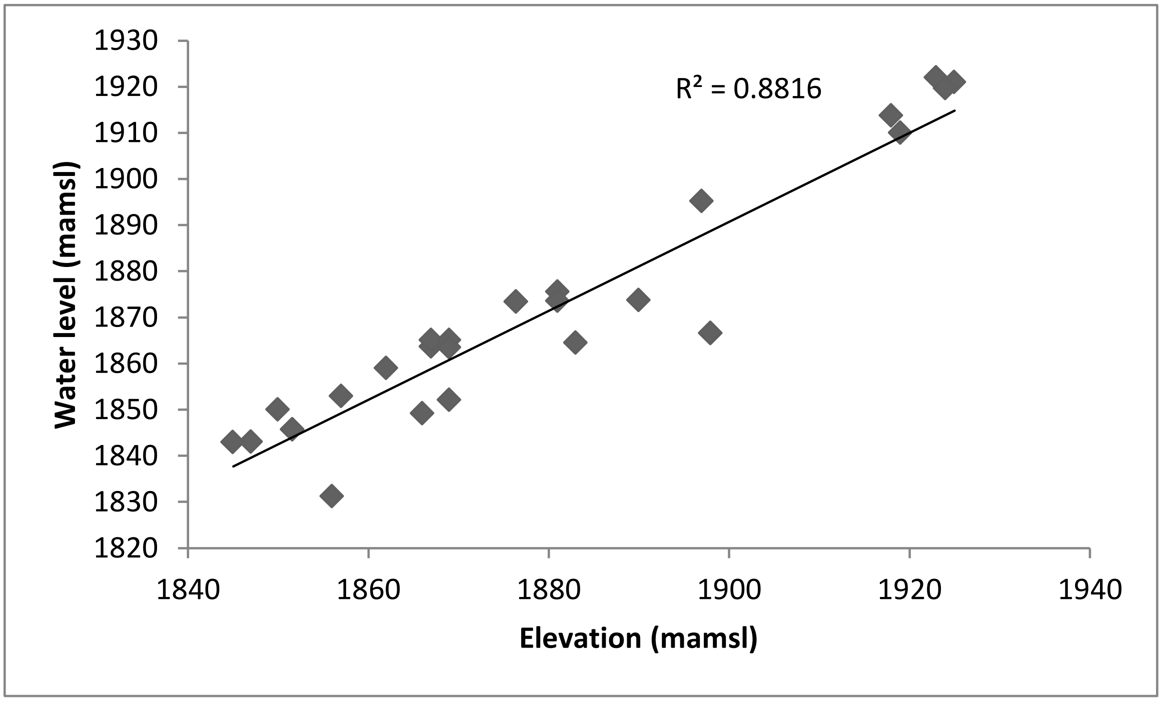

Figure 25: Correlation between water levels and topography

The positions of the various groundwater monitoring positions relative to the site are shown in Figure 27.

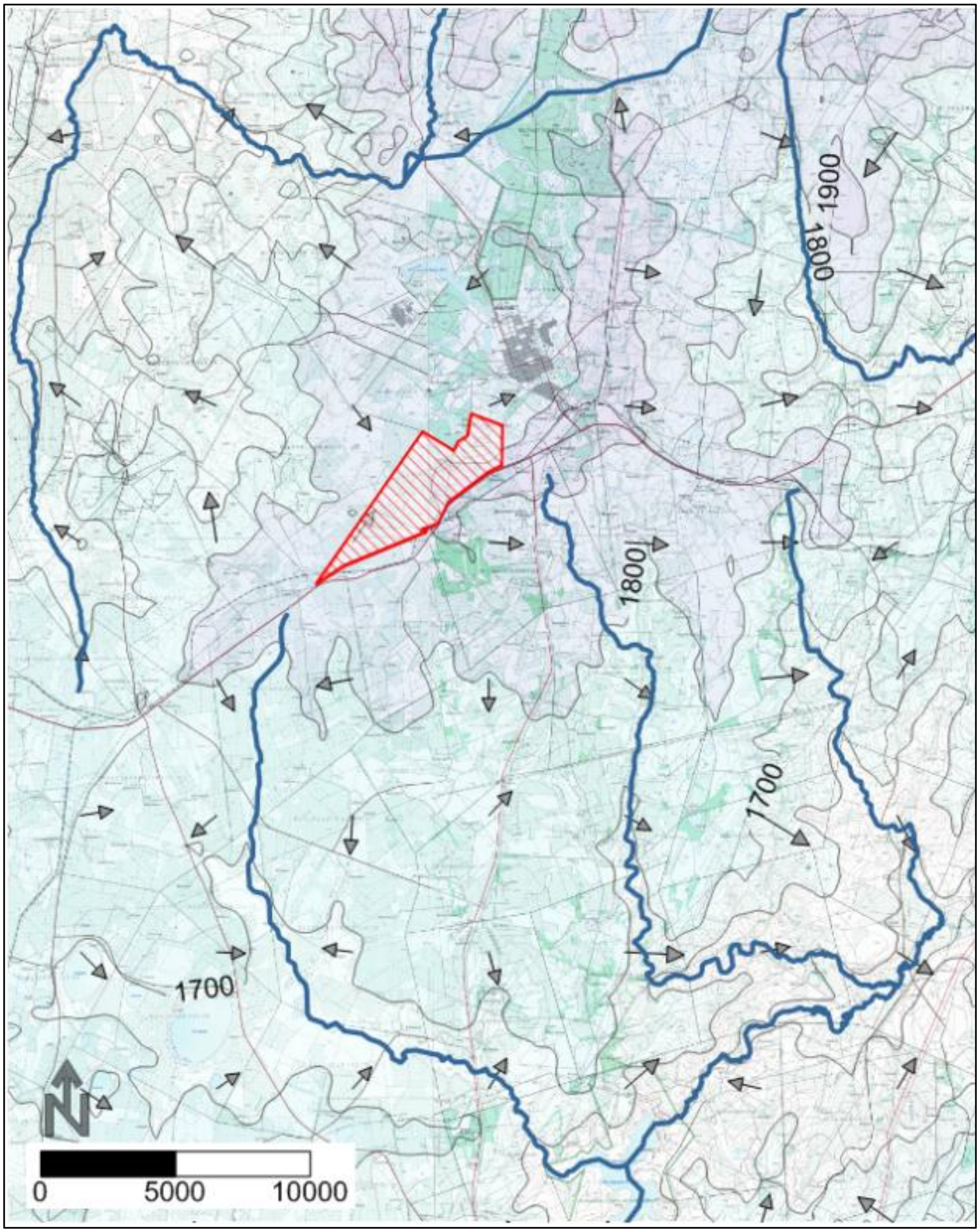

Figure 26: Groundwater levels and flow directions

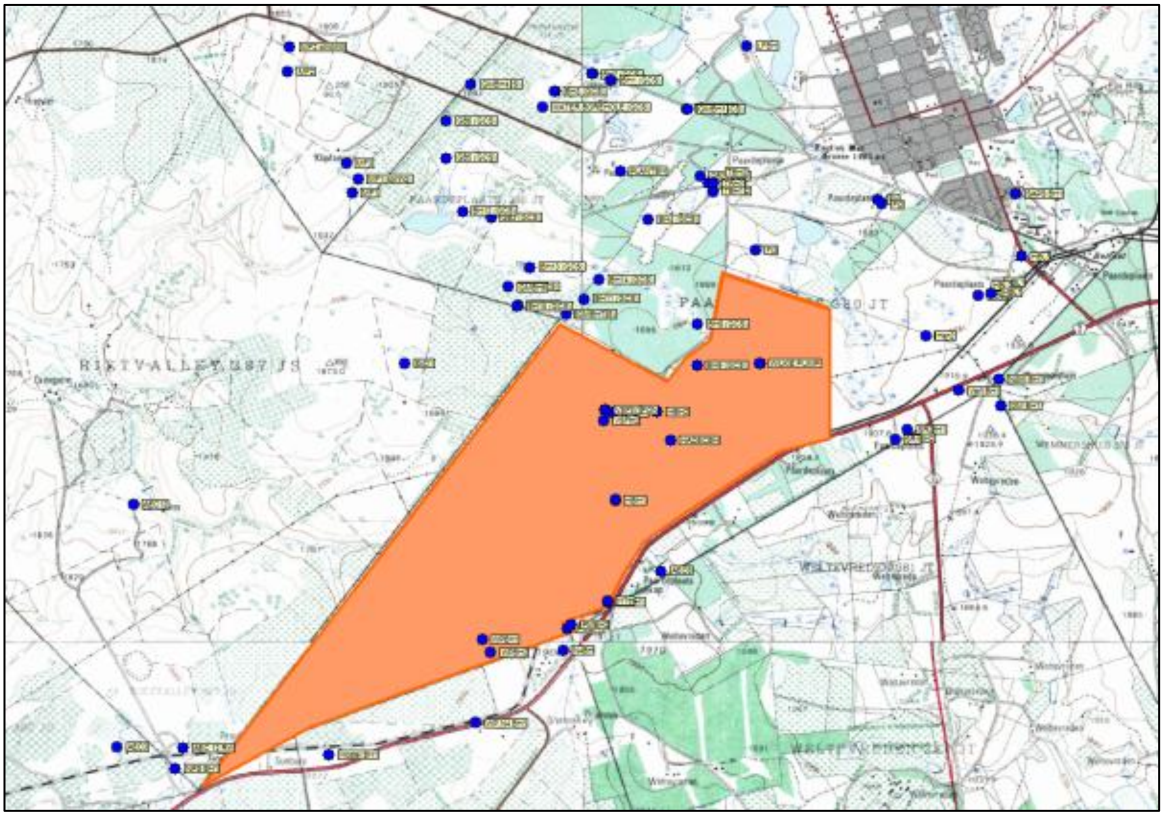

Figure 27: Location of boreholes

It is clear from the available data on the major cations and anions that all sites are well below the SANS 241:2005 drinking water guideline. In terms of other chemical parameters, it is clear that the pH values are within a relatively narrow band of neutral to slightly acidic. The pH is important since it is a bulk indicator of changes. These values also limit the mobilisation of metals and as long as pH values remain in this band, metal content should remain low and consequently environmental impacts should be limited by this. It is a known fact that aluminium can mobilise at pH values as high as 10.

Groundwater Flow Direction and Gradient

As groundwater levels follow topography it can be assumed that groundwater flow takes place under unconfined to semi-confined conditions.

3.14.3.7 Groundwater use

The farmers and residents in the area are dependent on groundwater. The water is used for domestic as well as agricultural uses. Residents in the area obtain water from the located boreholes and springs.

The classification scheme (Parsons, 1995) was created for strategic purposes as it allows the grouping of aquifer areas into types according to their associated supply potential, water quality and local importance as a resource. The farmers and residents in the area are dependent on groundwater. The water is used for domestic as well as agricultural uses. The geology underlying the site was classified according to the Parsons (and DWAF) system using current information as a minor aquifer system.

3.14.3.8 Geochem Analysis

Mineralory and Elemental Composition

It is clear from the available data on the major cations and anions that all sites are well below the SANS 241:2005 drinking water guideline.

In terms of other chemical parameters, it is clear that the pH values shown in Figure 26 are within a relatively narrow band of neutral to slightly acidic. The pH is important since it is a bulk indicator of changes. These values also limit the mobilisation of metals and as long as pH values remain in this band, metal content should remain low and consequently environmental impacts should be limited by this. It is a known fact that aluminium can mobilise at pH values as high as 10.

Acid Base Accounting

Acid Base Accounting (ABA) is a screening procedure whereby the acid-neutralising potential and acid-generating potential of rock samples are determined and the difference (net neutralising potential) is calculated. The net neutralising potential and/or the ratio of neutralising potential to acid-generation potential are compared with a predetermined value, or set of values, to divide samples into categories that either require, or do not require, further determinative acid potential test work. The potential for a given rock to generate and neutralise acid is determined by its mineralogical composition. This includes the quantitative mineralogical composition and also individual mineral grain size, shape, texture and spatial relationship with other mineral grains. The term "potential" is used because even the most detailed mineralogical analysis, when combined with ABA, can give only a "worst-case" value for potential acid production and, depending upon the NP procedure used, a "worst-case", "most likely case" or "best-case" value for potential neutralisation capability.

Neutralisation potential measures the total of carbonates, alkaline earths and bases available to neutralise acidity, and represents the most favourable condition. Calculations of maximum potential acidity and neutralisation potential are structured to equate the two measurements to a common basis for comparison. The resulting values, expressed as calcium carbonate equivalent, are compared to compute a net acid-producing or acid-neutralising potential. The primary advantages of the acid-base accounting method are:

- Short turn-around time for sample processing;
- Low cost;

- Relatively simple analytical procedures; and
- Relatively simple interpretation of results.

The principal disadvantages of acid-base accounting are:

- The method predicts maximum potential acidity and maximum neutralisation capability, and implies a 1:1 acid to base reaction. Actual acid production and neutralisation release rates cannot be predicted with this technique.
- Acid-Base Accounting assumes that all acid production is attributable to iron disulphide minerals (chiefly pyrite) and that no acid is produced by sulphate or

The overburden has a maximum %S of 0.11% and could therefore be classified in terms of its %S as having no potential to generate acidic drainage over the long term. However, the overburden will also not be able to neutralize any acidic drainage from other backfill rock since it has almost no neutralization potential. The overburden could be used as a cover material with rehabilitation.

The No. 4 Upper coal seam sample has a %S of 0.370 and could therefore be classified in terms of its %S as potentially acid generating. Because of the high neutralization potential the No. 4 Upper coal seam will not have a net potential to generate acidic drainage over the long-term.

The No. 4 Lower coal seam has a very high %S of 6.1% and could therefore be classified in terms of its %S as potentially acid generating. A significant portion of the No. 4 Lower coal seam will therefore generate acidic drainage over the long term. Some of the coal will remain in the pit in the discarded roof and floor waste rocks.

The mudstone above the No. 3 coal seam has a maximum %S of 0.05% and could therefore be classified in terms of its %S as having no potential to generate acidic drainage over the long term. The mudstone will have some potential to neutralize acidic drainage from other backfill rock because of its elevated NP.

The No. 3 coal seam sample has a %S of 0.25 and could be classified in terms of its %S as having no potential to generate acidic drainage over the long term. The No. 3 coal seam has a significant neutralization potential with a resultant NNP of >20 kg/t and a NP/AP of above 4. However, in the duplicate the NNP is <20 kg/t and the NP/AP is <2. The No. 3 coal seam will have a variable potential to generate acidic drainage over the long-term.

The siltstone above the No. 2 coal seam has a maximum %S of 0.06% and could therefore be classified in terms of its %S as having no potential to generate acidic drainage over the long term. The siltstone will have some very limited potential to neutralize acidic drainage from other backfill rock.

The No. 2 coal seam has a high %S of 0.45% (and 2.35 % in duplicate) and could therefore be classified in terms of its %S as potentially acid generating. The coal sample has a significant neutralization potential with a resultant NP/AP of 4.92. Because of the high %S the NP/AP in the duplicate is 0.951. A significant portion of the No. 2 coal seam will therefore generate acidic drainage over the long term.

The slurry has a high %S of 0.54% (and 0.31% in duplicate) and could therefore be classified in terms of its %S as potentially acid generating. The slurry has a significant neutralization potential with a resultant NP/AP of >4. Because of the high neutralization potential, the slurry will have no potential to generate acidic drainage over the long term.

Acid based Accounting results for newly drilled boreholes

Six samples, collected from the newly drilled boreholes, were submitted for ABA analysis. A summary of samples is presented in Table 47 and the results are presented in Table 48. Rock classification based on the ABA is presented in Table 49.

Table 47: Samples submitted for ABA analysis, 2013

Borehole Number	Sample depth (mbgl)	Sample Description	Coal Layer represented	Comments
BH1 A	26 to 30	Coal	Seam 4	Drill chip sample
BH1 A	23 to 24	Siltstone	Roof of seam 5	Drill chip sample
BH1 B	19 to 20	Coal	Seam 5	Drill chip sample
BH2 A	26 to 30	Coal	Seam 4	Drill chip sample
BH2 A	23 to 24	Coal	Seam 5	Drill chip sample
BH2 B	15 to 16	Siltstone	Roof of seam 5	Drill chip sample

The samples were taken to represent seam 4 coal, seam 5 coal and the siltstone at the roof of seam 5 coal.

Table 48 provides the results of the acid base accounting for the newly drilled boreholes while Table 49 provides the rock classification. The results indicate slight possibility of acid forming for three of the samples (BH1A (26-30 m), BH2B (16 m) and BH21A (24 m). Borehole BH1A (2 m) and BH1B (21 m) indicate that there are no acid forming potential.

Table 48: The results of the Acid base accounting for the newly drilled boreholes

Acid – Base Accounting Modified Sobek (EPA-600)	Sample Identification					
	BH 1A (26-30m)	BH 2A (26-30m)	BH 2B (15- 16m)	BH 1A (23-24m)	BH 1B (19-20m)	BH2A (23-24m)

Paste pH	7.8	7.9	7.3	7.9	8	7.9
Total Sulphur (%) (LECO)	0.94	0.72	0.32	0.16	0.1	0.72
Acid Potential (AP) (kg/t)	29.38	22.5	10	5	3.13	22.5
Neutralization Potential (NP)	16.46	22.7	2.75	8.22	9.05	16.19
Nett Neutralization Potential (NNP)	-12.91	0.2	-7.25	3.22	5.93	-6.31
Neutralizing Potential Ratio (NPR) (NP : AP)	0.56	1.01	0.28	1.64	2.9	0.72
Rock Type	I	II	I	III	III	I

- Negative NP values are obtained when the volume of NaOH (0.1N) titrated (pH: 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 – 2.5. Any negative NP values are corrected to 0.00.

Table 49: Rock classification

TYPE I	Potentially Acid Forming	Total S(%) > 0.25% and NP:AP ratio 1:1 or less
TYPE II	Intermediate	Total S(%) > 0.25% and NP:AP ratio 1:3 or less
TYPE III	Non-Acid Forming	Total S(%) < 0.25% and NP:AP ratio 1:3 or greater

Based on the ABA results of samples from the newly drilled boreholes and presented in the tables above, the following comments can be made:

- Samples of seam 5 show intermediate to potential characteristic to generate acid;
- Samples of the siltstone collected from the roof of the seam 5 potential to non potential acid generating characteristics;
- Seam 4 is likely to produce acid.

3.14.4 CONCLUSION

Ground water quality in the study area is relatively good. The geology of the area indicates a low to medium acid generating potential.

3.15 AIR QUALITY

3.15.1 INTRODUCTION AND RELATED IMPACTS

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance to and/or health impacts on nearby receptors. Receptor sites include the residential areas, communities and natural environments that have been described below. Mining activities have the potential to result in increased levels of atmospheric dust, increased concentrations of PM_{10}, and increased concentrations of $PM_{2.5}$.

3.15.2 DATA COLLECTION

In assessing atmospheric impacts from the proposed mining activities, an emissions inventory was undertaken, atmospheric dispersion modelling conducted and predicted air pollutant concentrations evaluated.

The National Ambient Air Quality Standards (NAAQS) and Dust Deposition Guidelines (detailed below) are based on human exposure to specific criteria pollutants and as such, possible sensitive receptors were identified where the public is likely to be unwittingly exposed. NAAQS are enforceable outside of mine boundaries and therefore the sensitive receptors identified include the nearest residential areas in the region; eMakhazeni (Belfast) (<2 km north-east) and Siyathuthuka (~3 km north). The town hospital and three schools are located within 3 km of the north-east corner of the proposed mining operations. Individual residences (i.e. farm houses) are also within the area of proposed operations. The modelled dust-fall rates of total suspended particulates (TSP) as well as the ground-level concentrations of PM_{10} and $PM_{2.5}$ were compared to National Standards and Guidelines.

3.15.2.1 Air Quality Standards

The environmental regulations and guidelines governing the emissions and impact of the mining operations need to be considered prior to potential impacts and sensitive receptors are identified.

Air quality guidelines and standards are fundamental to effective air quality management, providing the link between the source of atmospheric emissions and the user of that air at the downstream receptor site. The ambient air quality limits are intended to indicate safe daily exposure levels for the majority of the population, including the very young and the elderly, throughout an individual’s lifetime. Air quality guidelines and standards are normally given for specific averaging periods. These averaging periods refer to the time-span over which the air concentration of the pollutant was monitored at a location. Generally, five averaging periods are applicable, namely an instantaneous peak, 1-hour average, 24-hour average, 1-month average, and annual average. The application of these standards varies, with some countries allowing a certain number of exceedances of each of the standards per year.

National Ambient Air Quality Standards

The South African Bureau of Standards (SABS) assisted the Department of Environmental Affairs (DEA) in the development of ambient air quality standards. National Ambient Air Quality Standards (NAAQS) were determined based on international best practice for PM_{10}, SO_2, NO_2, ozone (O_3), CO, lead (Pb) and benzene. The NAAQS were published in the Government Gazette (no. 32816) on 24 December 2009 (Table 50).

Draft $PM_{2.5}$ national ambient air quality standards were gazetted for comment on the 5 August 2010 (Table 51).

Table 50: South African national ambient air quality standards (Government Gazette 32816, 2009)

Substance	Molecular formula / notation	Averaging period	Concentration limit (µg m^{-3})	Frequency of exceedance[1]	Compliance date[2]
Sulfur dioxide	SO_2	10 minutes	500	526	Immediate
		1 hour	350	88	Immediate
		24 hours	125	4	Immediate
		1 year	50	0	Immediate
Nitrogen dioxide	NO_2	1 hour	200	88	Immediate
		1 year	40	0	Immediate
Particulate matter	PM_{10}	24 hour	120	4	Immediate – 31 Dec 2014
			75	4	1 Jan 2015
		1 year	50	0	Immediate – 31 Dec 2014
			40	0	1 Jan 2015
Ozone	O_3	8 hours (running)	120	11	Immediate
Benzene	C_6H_6	1 year	10	0	Immediate – 31 Dec 2014
			5	0	1 Jan 2015
Lead	Pb	1 year	0.5	0	Immediate
Carbon monoxide	CO	1 hour	30 000	88	Immediate
		8 hour (calculated on 1 hour averages)	10 000	11	Immediate

[1]The number of averaging periods where exceedance of limit is acceptable. [2]Date after which concentration limits become enforceable.

Table 51: Draft South African national ambient air quality standards for $PM_{2.5}$

Substance	Molecular formula / notation	Averaging period	Concentration limit (µg m^{-3})	Frequency of exceedance[1]	Compliance date[2]
Fine particulate matter	$PM_{2.5}$	24 hour	65	0	Immediate – 31 Dec 2015
			40	0	1 Jan 2016 – 31 Dec 2029
			25	0	1 Jan 2030
		1 year	25	0	Immediate – 31 Dec 2015
			20	0	1 Jan 2016 – 31 Dec 2029
			15	0	1 Jan 2030

National Regulations for Dust Deposition

No criteria for the evaluation of dust fallout levels are available for the United States Environmental Protection Agency (US-EPA), European Union (EU), World Health Organisation (WHO), or the World Bank (WB). Dust deposition may be gauged according to the criteria published by the South African Department of Environmental Affairs (DEA). In terms of these criteria dust deposition is classified as follows:

Table 52: National regulations for dust deposition

Classification	Volume
SLIGHT	less than 250 mg m^{-2} day^{-1}
MODERATE	250 to 500 mg m^{-2} day^{-1}
HEAVY	500 to 1 200 mg m^{-2} day^{-1}
VERY HEAVY	more than 1 200 mg m^{-2} day^{-1}

The DMR uses the 1 200 mg m^{-2} day^{-1} threshold level as an action level. In the event that on-site dust-fall exceeds this threshold, the specific causes of high dust-fall should be investigated and remedial steps taken.

A perceived weakness in the current dust-fall guidelines is that they are purely descriptive, without giving any guidance for action or remediation (SLIGHT, MEDIUM, HEAVY, and VERY HEAVY). On the basis of the cumulative South African experience of dust-fall measurements, a modified set of dust-fall standards is proposed, within the overall framework of the new Clean Air

Legislation. Dust-fall will be evaluated against a four-band scale as presented in Table 53 and Table 54.

A draft copy of the National Dust Regulation was published for comment on 27 May 2011 which states no person may conduct any activity in such a way as to give rise to dust in such quantities and concentrations that:

- The dust or dust fall, has a detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage, or has contributed to the degradation of ambient air quality beyond the premises where it originates; or
- The dust remains visible in the ambient air beyond the premises where it originates; or
- The dust fall at the boundary or beyond the boundary of the premises where it originates exceeds:
    - 600 mg m^{-2} day^{-1} averaged over 30 days in residential and light commercial areas measured using reference method ASTM 01739; or
    - 1 200 mg m^{-2} day^{-1} averaged over 30 days in areas other than residential and light commercial areas measured using reference method ASTM 01739.

Table 53: Bands of dust-fall rates proposed for adoption

Band number	Band description label	Dust-fall rate (D) (mg m^{-2} day^{-1}, 30-day average)	Comment
1	Residential	D < 600	Permissible for residential and light commercial
2	Industrial	600 < D < 1 200	Permissible for heavy commercial and industrial
3	Action	1 200 < D < 2 400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	Alert	2 400 < D	Immediate action and remediation required following the first exceedance. Incident report to be submitted to relevant authority.

Table 54: Target, action and alert thresholds for ambient dust-fall

Level	Dust-fall rate (D) (mg m^{-2} day^{-1}, 30-day average)	Averaging period	Permitted frequency of exceedances
Target	300	Annual	
Action residential	600	30 days	Three within any year, no two sequential months.
Action industrial	1 200	30 days	Three within any year, not sequential months.
Alert threshold	2 400	30 days	None. First exceedance requires remediation and compulsory report to authorities.

3.15.3 RESULTS

Power generation, mining activities, farming and residential land-uses occur in the vicinity of the proposed Paardeplaats project. These land-uses contribute baseline emission sources via vehicle tailpipe emissions, household fuel combustion, biomass burning and various fugitive dust sources. Long-range transport of particulates, emitted from remote tall stacks and from large-scale biomass burning in countries to the north of South Africa, has been found to contribute significantly to background fine particulate concentrations over the interior (Andreae *et al*., 1996; Garstang *et al.,* 1996; Piketh *et al.,* 1996). More detail about these sources was provided in the Paardeplaats Project Air Quality Scoping report (Bird and Kornelius, 2012).

The largest contributor to particulate emissions is as a result of vehicle entrainment on the unpaved roads. The cumulative impact on maximum monthly dust-fall is predicted to remain within the residential guideline (600 mg/m^2-day) except within localised areas near the operations. Similarly annual ground-level concentrations of PM_{10} and $PM_{2.5}$ are within the current and future NAAQS annual limits except in small areas within the operational boundaries close to the emission sources.

3.15.3.1 Projected Air Quality at the Neighbouring Glisa-North-Block Complex

The Exxaro North-block/Glisa complex is located adjacent to the proposed Paardeplaats project. The current overall production rate of Glisa Colliery is approximately 7 million tonnes of coal per annum, consisting of 4.6 million tonnes from Blesbok and 2.4 million tonnes from Block B. The remainder of Blesbok and Block B reserves will be mined at the current mining rate for the next eight years. A recent air quality impact assessment of current and future mining operations (Kornelius and Bornman, 2011) concluded the following:

- Predicted incremental highest daily PM_{10} values due to unmitigated emissions exceed post-2015 South African standards at all the representative residential sensitive receptors and everywhere on the mine boundary for both the baseline and project scenarios. However, predicted annual average contributions result in exceedances only at Siyathuthuka and a farm house immediately adjacent to the mine on the eastern side. It is for this reason, and because considerable background values are also expected, that mitigation measures were proposed and modelled.
- In all cases, the projected mitigated annual average values due to mining operations meet the proposed South African post-2015 standard of 40 µg m^{-3}, except at the adjacent farm house, in the mining area itself (which is not subject to community exposure standards), and in limited areas immediately adjacent to the mining area.
- Predicted highest daily values exceed the proposed South African standard of 75 µg m^{-3} (from 2015 onwards) at some areas outside the mining area, even with the mitigation described. A small section of Siyathuthuka will experience PM_{10} concentrations in excess of the daily post-2015 standard on some days of the year.
- All mitigated predicted off-site values for dust fall-out are within the guideline values for residential areas.

3.15.4 CONCLUSION

From dispersion modelling, air quality in the close proximity of the Proposed Paardeplaats Project is likely to be negatively impacted by the mining operations. These impacts can be limited to a large extent by the mitigation of emissions from unpaved road surfaces. It is recommended that mitigation and monitoring be implemented to effectively manage the air quality as a result of mining operations.

3.16 NOISE

3.16.1 INTRODUCTION AND RELATED IMPACTS

Certain noise generating activities associated with the Paardeplaats mining operations can cause an increase in ambient noise levels in and around the site. This may cause a disturbance to nearby receptors. Potential receptor sites include the residential areas and communities that occur on site and in the surrounding environment.

3.16.2 DATA COLLECTION

The general procedure used to determine the noise impact was guided by the requirements of the Code of Practice SANS 10328:2008: Methods for Environmental Noise Impact Assessments. The level of investigation was the equivalent of an EIA. A comprehensive assessment of all noise impact descriptors (standards) has been undertaken. The noise impact criteria used specifically take into account those as specified in the South African National Standard SANS 10103:2008, The Measurement and Rating of Environmental Noise with Respect to Annoyance and Speech Communication as well as those in the National Noise Control Regulations. The investigation comprised the following:

- Determination of the existing situation (prior to the development of the colliery);
- Determination of the situation during the construction phase and the operational phase;
- Assessment of the change in noise climate and impact; and
- Identification of mitigation measures.

3.16.2.1 Determination of the Existing Conditions

This phase comprised the following:

- Review of the Noise Impact Assessment report for the Glisa Mine by dBAcoustics (2010).
- The relevant technical details of the planned mine (as known at this stage), the existing traffic patterns and the existing and planned land use in the study area were reviewed in order to establish a comprehensive understanding of all aspects of the project that will influence the future noise climate in the study area.
- Using these data, the limits of the study area were determined and the potential noise sensitive areas, other major noise sources and potential problems in these areas were identified.
- Applicable noise standards were identified. The National Noise Control Regulations and the SANS 10103:2008 standards were applied.
- The existing noise climate of the study area was determined by means of a field inspection and a noise measurement survey. The measurement survey appropriately covered the whole extent of the study area, focussing specifically on the identified noise sensitive/problem areas. Measurements were taken at four monitoring sites. The sound pressure level (SPL) (noise) measurements were taken in accordance with the requirements of the Code of Practice SANS 10103. A Type 1 Integrating Sound Level meter was used for the noise measurements. All measurements were taken under dry weather and normal traffic (that is mid-week/school term) conditions. Refer to Appendix I for details of the measurement survey.

- On the general field inspection and at the same time as each individual measurement was being taken, the qualitative nature of the noise climate in the area of the measurement site was assessed and recorded. This comprised an appraisal of the general prevailing acoustic conditions based on the subjective response to the sounds as perceived by the listener (i.e. auditory observation by the surveyor), as well as identifying those noise incidents, which influenced the noise meter readings during that measurement period. This procedure is essential in order to ensure that that there is a human correlation between the noise as perceived by the human ear and that, which is measured by the meter, as well as to establish any anomalies in the general ambient noise conditions.
- The existing noise climates along the main roads as related to the current traffic volumes and patterns were established. These traffic noise levels were calculated using the South African National Standard SANS 10210 Calculating and Predicting Road Traffic Noise for Route. The latest traffic was used as the baseline reference. The calculated 24-hour period noise indicators, as well as those for the daytime period and night-time period provided the main data for the impact assessment. The measured data provided a field check of the acoustic conditions. See Appendix I for details of the road traffic noise impact.
- A general analysis of the rail traffic impact in the study area was undertaken.

3.16.2.2 Assessment of Impacts

Aspects of the pre-design field surveys and construction activities that potentially will have a noise impact were identified.

The main focus of the impact assessment was to establish the nature, magnitude and extent of the potential change in noise climate in the study area directly related to and within the area of influence of the development site. The modelling of the noise propagation from a multi-noise source site such as the proposed Paardeplaats Project is extremely complex and requires the careful consideration and input of many diverse parameters. The likely noise that will be generated by the mining operations was established and this was used to determine a footprint of impact.

As the detailed sound power levels of the plant and equipment were not available, the anticipated noise profile was calculated from data at similar type equipment. Firstly, the sound power levels of the various elements of the mining operation were obtained from similar facilities JKA has worked on, international standards and available databases of source noise levels. For the mining of the open cast pits (roll-over method, including drill and blast), the noise from the drill rigs, excavators, FELs, dozers, ore trucks, diesel bowsers, water carts and dewatering pumps was input into the calculation model. Variation of activities and/or variation of intensity of activities over a period of time have been taken into account. Equipment will not always be operating 100% of the time over a 24-hour period and adjustments need to be made.

Secondly, the combined level of the noise from all these elements was calculated at various distances from the noise sources by means of a propagation model in order to establish the noise contours. The model used was based on SANS 10357:2004, The Calculation of Sound Propagation by the Concawe Method. Note that the noise descriptor being calculated is the equivalent continuous A-weighted sound pressure level (ambient noise level) determined for the average condition. The following was taken into account:

- The determination of the correction for atmospheric absorption which is representative of an average condition is complex as the interaction of the variables of atmospheric pressure, temperature, and humidity especially when related to the changes over a 24-hour cycle and a yearly cycle need to be considered. The correction also has to be related to various frequencies of the sound spectrum.
- Correction for the effect of ground surface, that is, the attenuating effect of vegetation.
- The determination of the correction for meteorological effects which is representative of an average condition is complex as the interaction of the variables of wind speed, incident solar radiation, time of day and cloud cover, especially when related to the changes over a 24-hour cycle and a yearly cycle, need to be considered. Conditions for both high wind and temperature inversion were checked.
- The effect of the topography of the core study area was reviewed.
- With regard to the open pit analysis, the ambient noise climates (noise profiles) that will be generated by virtually continuous mining operations at the open pit have been predicted. These are for the unmitigated conditions. The mining operation will not extend over the whole area of the planned pit at any one time, but the area will be mined incrementally. This will mean that there will not be a static noise footprint from the mining operations, as with a fixed feature such as a crusher. As well as moving in plan, the noise levels from the respective sections being mined will also vary (decrease) as the depth of the pit increases due to the shielding from the sidewalls of the excavation and the building of a berm with waste rock. The position of the access roads down into the pit (haul truck routes) will also alter with time. The given noise footprint thus calculated for the pit mining operations is rather the total “noise envelope” covering all situations over the full mining period. It indicates the worst situation that could occur at any specific receiver point from the open pit mining operations over the lifetime of the mine.

3.16.3 RESULTS

The following conditions were observed in the study area and the following aspects were determined from the surveys, calculations of noise indicators and the predictive modelling undertaken for the assessment of the noise impact of the planned Paardeplaats Project.

The main sources of noise in the area are from:

- Road traffic.
- Glisa Coal Mine.
- Middelburg - Nelspruit railway line.
- General farming activities (not a major source of noise).
- Air traffic noise at Belfast Aerodrome.

The main noise sensitive receptors in the area are as follows (refer also to Figure 45 in Section 3.21) are the residential areas of eMakhazeni (Belfast), Siyathuthuka township, farm houses, farm labourer residences, Hadeco Village, schools, crèches, clinics, and hospitals.

Table 55: Existing noise climate adjacent to main roads in the Paardeplaats Coal Mine study area (year 2012 traffic)

Road	Noise Climate Alongside the Main Roads at Given Offset from Centreline (SANS 10103 Indicator) (dBA) Year 2012																				
	25 m Offset			100 m Offset			250 m Offset			500 m Offset			1000 m Offset			2000 m Offset			2500 m Offset		
	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}
N4	68.5	62.6	70.3	62.3	56.4	64.1	57.9	52.0	59.7	54.1	48.2	55.9	49.6	43.7	51.4	44.3	38.4	46.1	42.4	36.5	44.2
R33	60.5	54.6	62.3	54.3	48.4	56.1	49.9	44.0	51.7	46.1	40.2	47.9	41.6	35.7	43.4	36.3	30.4	38.1	34.4	28.5	36.2
Spitskop	56.6	50.8	58.5	50.4	44.6	52.3	46.0	40.2	47.9	42.2	36.4	44.1	37.7	31.9	39.6	32.4	26.6	34.3	30.5	24.7	32.4

A noise measurement survey was undertaken by the Glisa Colliery in 2010: Environmental Noise Impact Assessment for the Exxaro Glisa Colliery on the Farm Paardeplaats 380 JT, Belfast, by dBAcoustics. The prevailing ambient noise levels along the boundaries of the Glisa Colliery at the time of the survey were found by dBAcoustics to be as follows:

Western Boundary: 33.9 dBA for the daytime and 31.9 dBA for the night-time.

Southern boundary: 39.1 dBA for the daytime and 42.3 dBA for the night-time.

Eastern Boundary: 47.9 dBA for the daytime and 52.6 dBA for the night-time.

Northern boundary: 54.1 dBA for the daytime and 47.6 dBA for the night-time.

In overview, the situation with respect to the existing noise climate in the study area was found to be as follows:

- Residual noise levels at the various farmhouses and farm labourers' dwellings are relatively low (quiet). Daytime ambient conditions across the area range from about 42 dBA to 53 dBA near the main road. In areas remote from the influence of road traffic noise, the evening conditions range from about 30 dBA to 39 dBA, while the night-time ambient levels fall even lower to about 25 dBA in places. These are acceptable rural residential conditions (SANS 10103).
- Residual noise levels at the schools generally meet the noise standards required for educational purposes, namely 50 dBA not exceed during school hours.
- The existing noise climate alongside the main roads is degraded with regard to rural residential living conditions. Residences in some areas are negatively impacted from traffic noise (particularly at night) for up to the following distances from these roads:
    - National Road N4 2300 metres.
    - Road R33 800 metres.
    - Spitskop Road 500 metres.
- The Middelburg - Nelspruit railway line is on the southern boundary of the development site, running parallel to and just to the north of the N4 and has very little influence on the ambient noise climate of the study area.
- The residual (existing background) noise levels are relatively low (quiet) in the residential areas of eMakhazeni (Belfast) and in Siyathuthuka.
- In general the residual noise levels in the undeveloped areas to the north-west of the proposed development site are low (that is, the areas are very quiet). The noise levels are typically representative of a rural farming area, namely where the average daytime noise levels do not exceed 45 dBA and the night-time levels do not exceed 35 dBA.

3.16.4 CONCLUSION

The study area is one of changing character. Previously, and still in some areas, the main land use is agricultural and a rural noise climate prevails. However, west of eMakhazeni (Belfast) there has been a significant development of coal mines along the N4 Freeway.

Residual noise levels at the various farmhouses and farm labourers' dwellings which are remote from the main roads and the mines are relatively low (quiet). Daytime ambient conditions across the area range from about 42 dBA to 53 dBA near the main road. Evening conditions range from about 30 dBA to 39 dBA, while the night-time ambient levels fall even lower to about 25 dBA in places. These are acceptable rural residential conditions (SANS 10103). Residual noise levels at some of the schools do not meet the noise standards required for educational purposes, namely they exceed 50 dBA during school hours. There are numerous noise sensitive receptors in the area that potentially will be impacted by the mining of the new pit, namely schools, farmhouses, farm workers' dwellings, eMakhazeni (Belfast) and Siyathuthuka.

The existing noise climate alongside many of the roads through the area is degraded with regard to residential living. The operations at the Glisa Mine to the north of the planned Paardeplaats Project have raised ambient noise levels in this sector of the study area significantly. There will be very loud and short term noises (for example blasting) from sections of the colliery that will at times be heard well beyond the indicated positions of the respective 35 dBA contours and the total 35 dBA contour envelope of the operation.

There are measures that can be introduced to mitigate some of the impact of the operational noise, but in general the development of the Paardeplaats Project will alter the noise profile and character of the area significantly. Adverse noise conditions can be expected, especially at night.

3.17 VISUAL

3.17.1 INTRODUCTION AND RELATED IMPACTS

Landscape character, landscape quality (Warnock & Brown, 1998) and "sense of place" (Lynch, 1992) are used to evaluate the visual resource i.e. the receiving environment. A qualitative evaluation of the landscape is essentially a subjective matter. In this study the aesthetic evaluation of the study area is determined by the professional opinion of the author based on site observations and the results of contemporary research in perceptual psychology.

The sensitivity of visual receptors and views are dependent on the location and context of the viewpoint, the expectations and occupation or activity of the receptor or the importance of the view. This may be determined with respect to its popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art.

In determining the quality of the visual resource, both the objective and the subjective or aesthetic factors associated with the landscape are considered. Many landscapes can be said to have a strong sense of place, regardless of whether they are considered to be scenically beautiful but where landscape quality, aesthetic value and a strong sense of place coincide - the visual resource or perceived value of the landscape is considered to be very high. The criteria given in Appendix O are used to assess landscape quality, sense of place and ultimately to determine the aesthetic value of the study area.

Visual impacts would result from the construction, operation and decommissioning phase of the proposed Paardeplaats Coal Mine Project. Specifically, impacts would result from the overburden dumps and the mining activities being seen from sensitive viewpoints (i.e. impacts of views from residences) and the negative effects (relating primarily to visibility and intrusion) on the scenic quality and sense of place of the landscape of the proposed site

3.17.2 DATA COLLECTION

The assessment of likely effects on a landscape resource and on visual amenity is complex, since it is determined through a combination of quantitative and qualitative evaluations, (The Landscape Institute with the Institute of Environmental Management and Assessment, 2002). The landscape, its analysis and the assessment of impacts on the landscape all contribute to the baseline for visual impact assessment studies. A field survey was undertaken on 24 February 2012 and the area scrutinised. Sensitive viewing areas were visited and photographs taken from these areas towards the proposed project. The study area is defined as a 10 km radius about the proposed project site. Beyond this distance the proposed mining infrastructure and structures would be ‘absorbed’ into the landscape setting and would therefore have an insignificant impact on sensitive views.

3.17.3 RESULTS

The following sensitive viewer groups have been identified based on the above considerations, on 1:50000 Topographical maps, aerial photographs and observations from the site visit:

- The residents of the town of eMakhazeni (Belfast);
- The residents of the town of Siyathuthuka;
- The employees of the Exxaro Glisa Coal Mine;
- The travellers and tourists driving on the N4 and staying in guesthouses within a 10km radius;
- The local population and workforce driving on local roads and the N4;
- The residents and workforce of the outlying farms in a 10 km radius;
- Visitors to, and employees of the Hadeco Nursery

The most important views onto the site identified during the site visit are the following:

- From the N4 along the 3.5 km boundary closest to the road reserve and train commuters.
- The view from the homes of the residents on the southern boundaries of the towns of eMakhazeni (Belfast) and Siyathuthuka.
- The views from residential properties, homesteads and guesthouses in a 10 km radius.
- The views from local roads.
- Users of outdoor recreational or sport facilities including the Belfast Dam and various other tourist destinations, especially those whose intent it may be to admire the natural beauty of the area.

Subjectively, the landscape is pastoral and peaceable with grassland and agricultural fields, small homes and farmsteads and small dams amidst stands of tall woody trees near water and residential development. The landscape character does however have a dual character – it is also interspersed with activity at mine sites, contributing to the sense of place of this particular region. The landscape offers long, panoramic views to the extended horizon over rolling hills and fields with wetlands and greater visual variety in depressions, valleys and rises. The foreground is textured, while the far-middle to background is often obscured due to atmospheric haze.

The area has a low to moderate visual complexity, as it includes scenes with water and topographic interest. The landscape also has a moderate visual complexity as there is an amount of natural landscape within the long views of this area, punctuated at intervals by agricultural development and mining development.

The landscape contains no especially vivid, distinguished, uncommon or rare visual features or abstract attributes; although the wide open spaces and the ability of the landscape to attract nature lovers and other tourists renders the landscape more than able to elicit evocative responses from the viewer.

The criteria given in Appendix O are used to assess landscape quality, sense of place and ultimately to determine the aesthetic value of the study area.

3.17.4 CONCLUSION

It was established that even though there are existing mining activities taking place the proposed Project will be highly intrusive to the area due to the fact that the overburden dumps will be located along the N4 and the landscape will therefore not be able to absorb the visual intrusion of these dumps. Due to the topography of the area the proposed mining activities and overburden dumps will not be highly visible from all the sensitive viewers.

3.18 BLASTING AND VIBRATION

3.18.1 INTRODUCTION AND RELATED IMPACTS

Blasting operations will impact on the surrounding environment. These impacts include ground vibration, air blast, fumes, and fly rock. The application of explosives for the purpose of breaking rock will always have both positive and negative manifestations of different energies. It is the effects that have negative outcome that will need to be managed.

3.18.2 DATA COLLECTION

Data regarding the receiving environment was collected through a site visit and Google Earth imagery. Information was obtained regarding surface structures present within a 3500m radius from the proposed mine boundary requiring consideration during modelling of blasting operations. These include houses, general structures, power lines, pipe lines, reservoirs, mining activities, roads, shops, schools, gathering places, and possible historical sites.

In order to define expected ground vibration, air blast and fly rock influences a site visit was undertaken. Data obtained from the Glisa blast monitoring programme was consulted as well. The Glisa blast monitoring includes fixed monitors stationed at three different areas on private property outside the mine boundary. Information gathered from this monitoring process was then used to predict and determine the possible influences of the expansion of current mining operations.

3.18.3 RESULTS

Ground vibration is an inevitable yet undesirable result of blasting activities. The shock wave energy that travels beyond the zone of rock breakage is wasted and could cause damage and annoyance. The level or intensity of these vibrations is however dependant on various factors. Some of these factors can be controlled in order to yield the required energy to break the rocks and stay within the desired levels of ground vibration.

Factors influencing ground vibration are the charge mass per delay, distance from the blast, the delay period and the geometry of the blast. These factors are controlled by planned design and proper blast preparation.

The larger the charge mass per delay, the greater the vibration energy yielded. Blasts are timed to produce effective relief and rock movement for successful breakage of the rock. A certain quantity of holes will detonate within the same time frame or delay and it is the maximum total explosive mass per such delay that will have the greatest influence. All calculations are based on the maximum charge detonating on a specific delay.

Of secondary importance is the distance between the blast and the point of interest/concern. Ground vibrations attenuate over distance at a rate determined by the mass per delay, timing and geology. Each geological interface a shock wave encounters will reduce the vibration energy due to reflections of the shock wave. High ground vibration levels will therefore be experienced closer to the blast with lower being experienced further from the blast.

Thirdly the geology of the blast medium and surroundings will influence the ground vibrations as well. High density materials have high shock wave transferability while low density materials have low transferability of the shock waves. Solid rock, i.e. norite, will yield higher levels of ground vibration than sand for the same distance and charge mass. The precise geology in the path of a shock wave cannot be observed easily, but can be tested for if necessary in typical signature trace studies.

The ground vibration predictions for the two alternatives are modelled in the figures below.

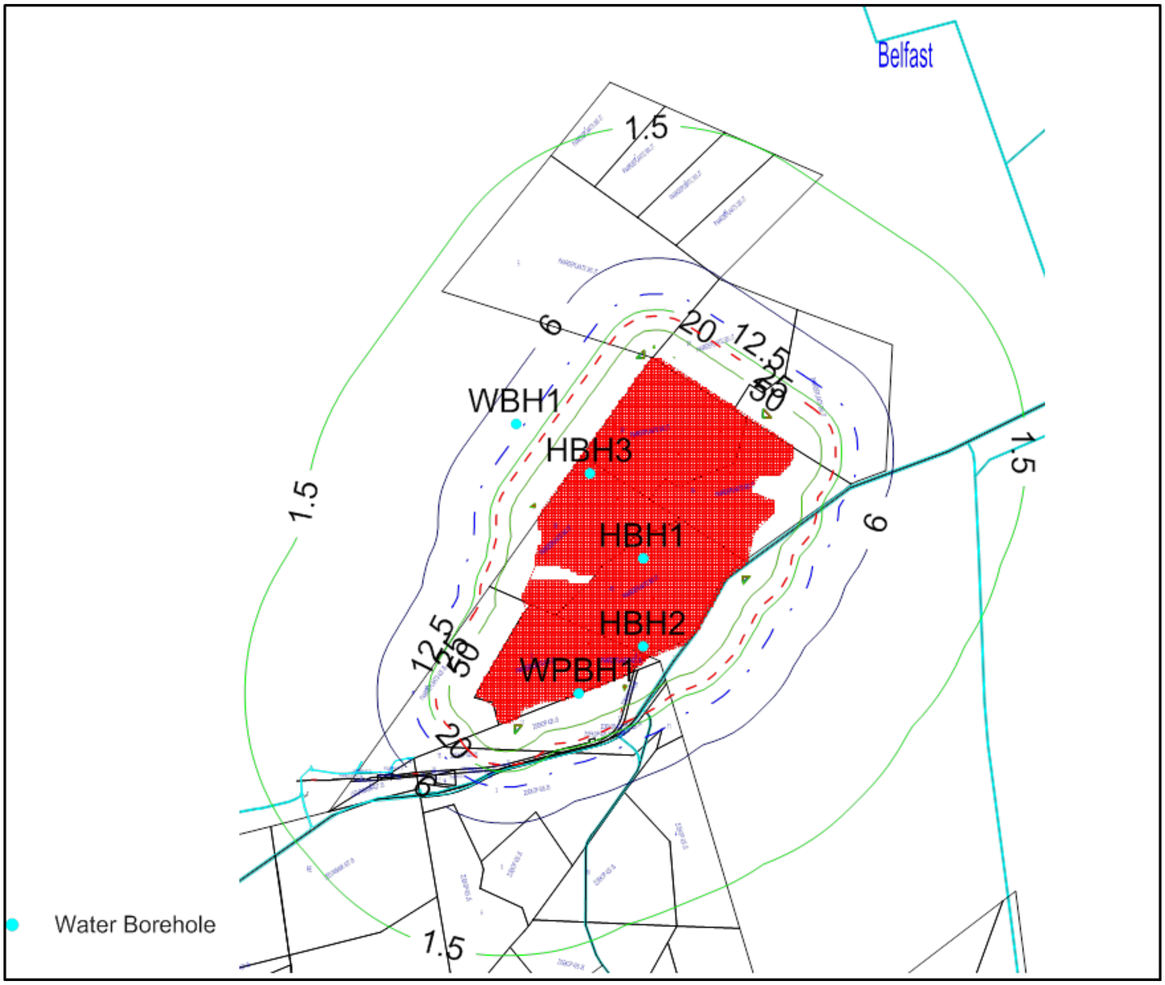

Figure 28: Ground vibration for whole area

Figure 29: Ground vibration for Portion 30

Air blast or air-overpressure is the result of a build-up of pressure and should not be confused with sound that is within audible range (detected by the human ear). Sound is also a build-up of air pressure but is at a completely different frequency to air blast. Air blast is normally associated with frequency levels less than 20 Hz, which is the threshold for hearing. Air blast is a direct result of the blast process although the final result is influenced by meteorological conditions, the final blast layout, timing, stemming, accessories used, covered or not covered etc.

The three main causes of air blasts can be observed as:

- Direct rock displacement at the blast; the air pressure pulse (APP);
- Vibrating ground some distance away from the blast; rock pressure pulse (RPP); and
- Venting of blast holes or blowouts; the gas release pulse (GRP).

Air blast levels for the maximum charge are modelled in the following figures.

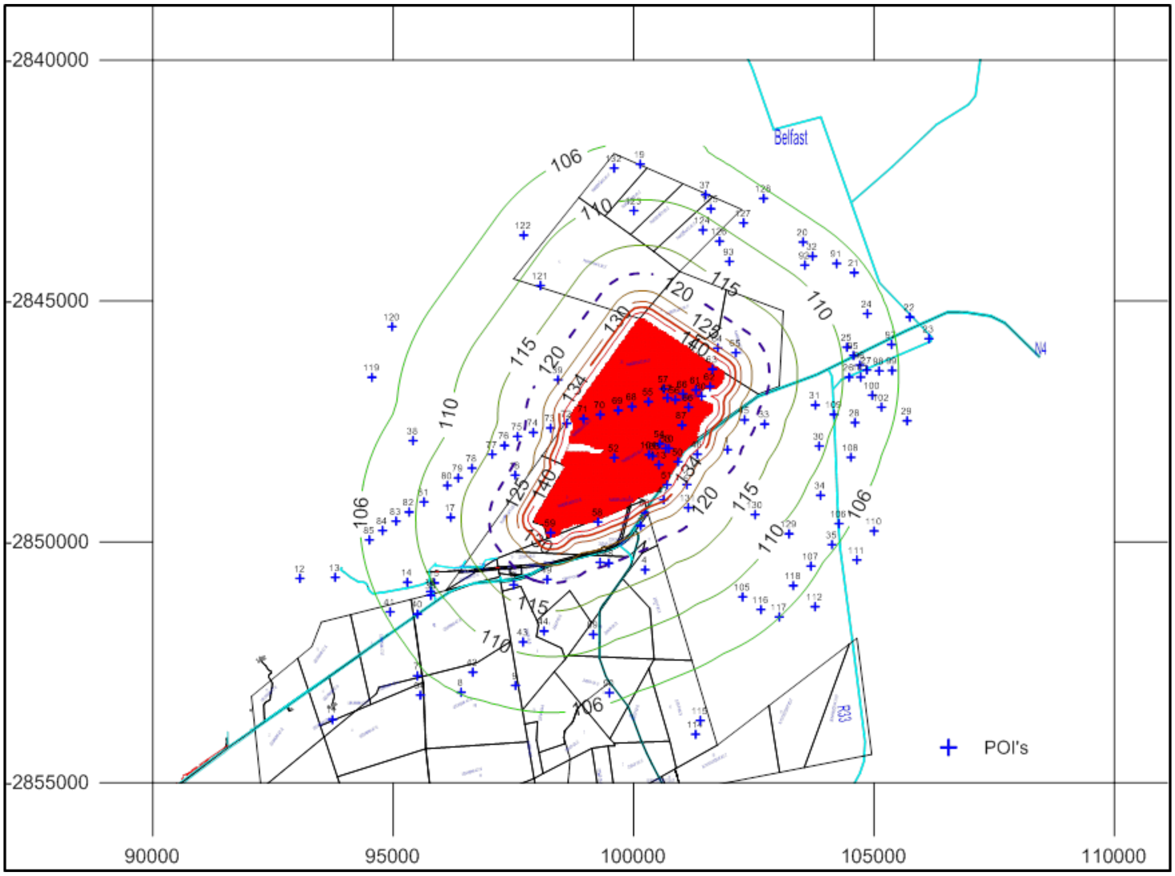

Figure 30: Air blast for maximum charge for whole area

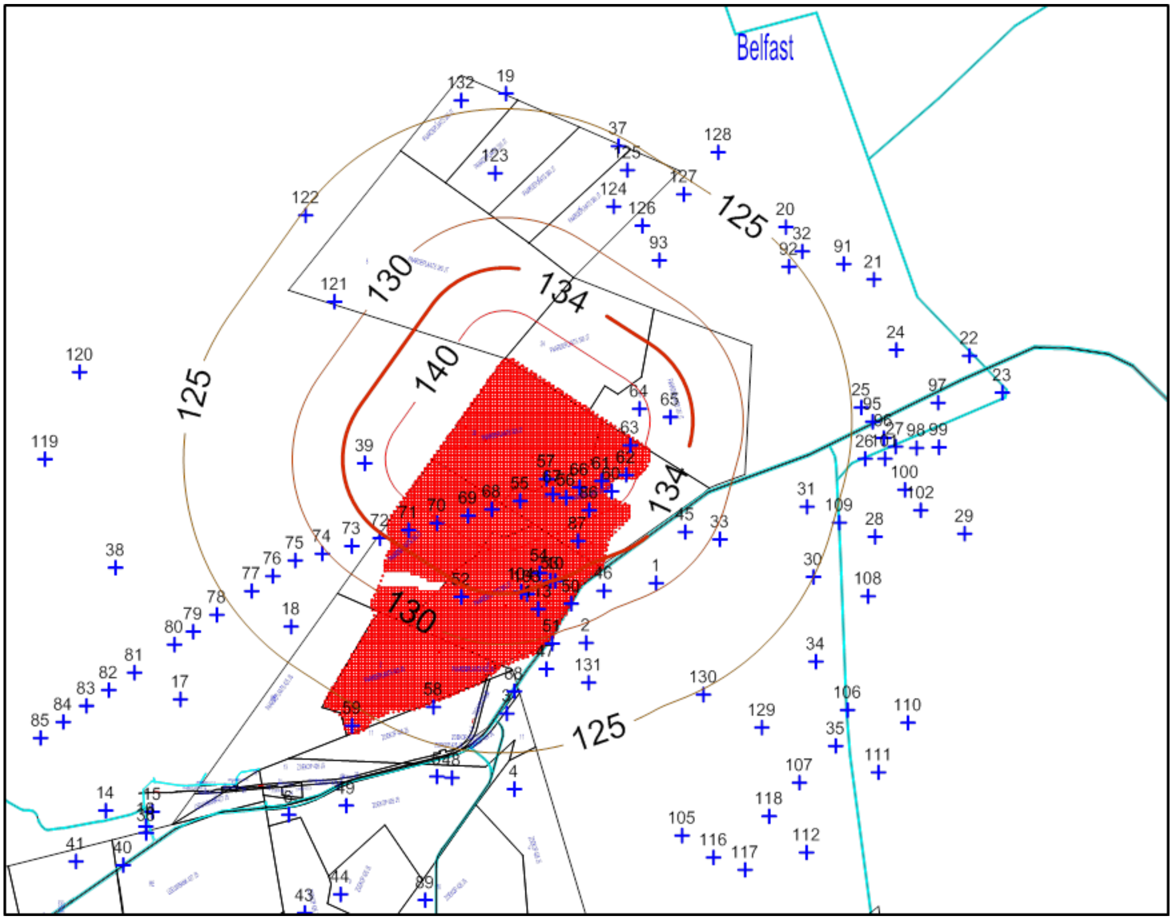

Figure 31: Air blast for maximum charge for Portion 30

Blasting practices require some movement of rock to facilitate the excavation process. The extent of movement is dependent on the scale and type of operation. For example, blasting activities within large coal mines are designed to cast the blasted material much greater distances than practices in a quarrying or hard rock operations. This movement should be in the direction of the free face, and therefore the orientation of the blasting is important. Material or elements travelling outside of this expected range may be considered to be fly rock.

Fly rock from blasting can be the result of three mechanisms due to the lack of confinement of the energy in the explosive column. The main mechanisms are:

- Face burst - burden conditions usually control fly rock distances in front of the face
- Cratering - If the stemming height to hole diameter ratio is too small or the collar rock is weak
- Rifling - If the stemming material is ejected with insufficient stemming height or inappropriate stemming material is used

The typical causes of fly rock are listed below:

- Burden too small;
- Burden too large;
- Stemming length too short;
- Out of sequence initiation of blastholes;
- Drilling inaccuracies;
- Incorrect blasthole angles; and
- Over charged blastholes.

It is possible to prevent fly rock with proper confinement of the explosive charges within blast holes using proper stemming procedures and materials. Stemming is further required to ensure that explosive energy is efficiently used to its maximum. Free blasting with no control on stemming cannot be allowed as this will result in poor blast results and possible damage to nearby structures.

Explosives currently used are required to be oxygen balanced. Oxygen balance refers to the stoichiometry of the chemical reaction and the nature of gases produced from the detonation of the explosives. The creation of poisonous fumes such as nitrous oxides and carbon monoxide are particularly undesirable. These fumes present themselves as a red brown cloud after the blast has detonated. It has been reported that 10 to 20 ppm is considered to be mildly irritating. Exposure to 150 ppm or more (no time period given) has been reported to cause death from pulmonary oedema. It has been predicted that 50% lethality would occur following exposure to 174 ppm for 1 hour. Anybody exposed must be taken to hospital for proper treatment.

3.18.4 CONCLUSION

The effects yielded by blasting operations were evaluated for a 3500 m buffer around the mining area. The range of structures expected include typical town and farming communities with structures that range from well-built to informal building style. These include rural type mud house buildings, brick and mortar structures, cement brick structures, and industrial structures. The project area consists mainly of one opencast pit area.

There is the possibility for people and animals to be present in close proximity to the proposed mining operations. There are a significant number of structures within 1000 m of proposed pit areas. The N4 national highway is one concern that will need specific attention if the full project area is to be mined, as it lies within 500 m of the boundary of the project area on the southern side. No animals or people should be present within 500 m of the blasting operations.

Three different charge masses were evaluated. The location of structures around the pit areas are such that even with minimum charge impacts are to be expected. Ground vibration yielded from blasting is expected to be of lesser concern. Air blast did show levels of concern and over distances further than that of ground vibration. There are a significant number of houses in range where complaints may be expected. Complaints from air blast are normally based on the actual effects that are experienced due to rattling of roof, windows, doors etc. These effects could startle people and raise concern of possible damage.

This pit is located such that “free blasting” – meaning with specific controls on blast preparation – will not be possible.

3.19 TRAFFIC

3.19.1 INTRODUCTION AND RELATED IMPACTS

The proposed project will result in increased use of the local road network. Increased use of the roads may impact on the adjacent road network, on bridges and culverts in the area, and on the surrounding communities.

3.19.2 DATA COLLECTION

As part of the study a site visit was carried out in February 2012. This site visit was focused on the surrounding road network and associated infrastructure. During the site visit a number of photos of the road network were taken to help illustrate the road network.

Traffic counts were carried out over a three hour period on 22 February 2012 during the AM and PM peak periods at the following intersections:

- Vermooten Street (R33) and Spitskop Road;
- Spitskop Road and Van Kraayenburg Street; and
- Spitskop Road and Site Access.

In order to carry out the traffic assessment and determine the impact that the mine will have on the road network and the environment it is necessary to calculate the amount of traffic generated by the mine and the future background traffic in the assessment year.

The future background traffic takes latent and growth rate into account. The trip rate has been based on the information from existing mining operations.

3.19.3 RESULTS

The main route to the site is Spitkskop Road and the results from the traffic counts can be summarised as follows:

- During the AM peak hour approximately 114 vehicles are travelling on the road to the east and 70 to the west of the site;

- Of the 114 vehicles to the east, 40% are heavy vehicles and this decreases to 18% west of the site;
- During the PM peak hour approximately 78 vehicles are travelling to the east of the site and 41 vehicles to the west; and
- Approximately 41% are heavy vehicles.

The major road in the area is Vermooten Street (R33) and traffic flows on this road can be summarised as follows:

- Approximately 400 vehicles travel on this road during the AM peak hour in both directions with the flow evenly split between northbound and southbound traffic;
- In the PM peak hour approximately 530 vehicles travel in both directions with the heaviest flow being northbound.

The N4 Road carries approximately 1 060 vph during the AM peak hour in both directions of which the majority is eastbound. During the afternoon peak, the N4 Road carries approximately 1 020 vph in both directions. The peak direction in the afternoon is in a westerly direction.

3.19.4 CONCLUSION

The Exxaro Paardeplaats Project will be developed adjacent to the Spitskop Road in the eMakhazeni area. The access will be from the existing mine access off Spitskop Road.

Based on the information from the Glisa Mine TIA it has been estimated that the Paardeplaats Project could generate the following trips:

- 60 light vehicle trips in the AM peak (39 inbound, 21 outbound);
- 47 light vehicle trips in the PM peak (10 inbound, 36 outbound);
- 55 heavy vehicle trips in the AM peak (30 inbound, 25 outbound); and
- 60 heavy vehicle trips in the PM peak (25 inbound, 35 outbound).

It should be noted that the calculation for the number of trips generated by the proposed Paardeplaats Project has been based on the Transport Impact Assessment for the neighbouring Glisa Mine.

The analysis indicates that the addition of the additional traffic will have no impact on the adjacent road network. The link based analysis shows that each link will operate at Level of Service (LOS) C or better, which is acceptable from a traffic engineering perspective.

The access to the site will be provided at the existing access off Spitskop Road. The following recommendations are made in relation to the access:

- The access consist of one inbound and one outbound lane and this will be adequate for the future development;
- The stacking area between the gate and the main road is constructed to provide space for vehicles to wait while being processed in and out of the gate; and
- It is recommended that one of the access lanes must be at least 4.5 m wide to allow for emergency and service vehicle entry. Vertical clearance to any overhead structures should be at least 4.2 m.

It is recommended that a lay-by for public transport be provided on Spitskop Road eastbound, downstream of the intersection Spitskop Road/Access to mining area.

3.20 ENVIRONMENTAL ASPECTS WHICH MAY REQUIRE PROTECTION AND/OR REMEDIATION

Environmental aspects both within the application and surrounding area that may require protection or remediation are listed below. These aspects have been identified and based on the information contained in the description of the baseline receiving environment in Sections 3.1 to 3.19. Furthermore, these environmental aspects that may require protection or remediation have been included in the action plan and technical management measures contained in Section 21 and Section 22.

Table 56: Environmental features which may require protection or remediation

Aspect	Feature
Topography	Surface drainage lines
Groundwater	Groundwater resources (such as aquifers)
	Groundwater quantity
	Groundwater quality
	Wetlands and pans
Surface Water	Surface water resources (such as streams and pans)
	Surface water quantity
	Surface water quality

Aspect	Feature
	Wetlands and pans
Biodiversity	Species of concern (flora and fauna)
	Eastern valley grassland vegetation unit
	Biodiversity corridors
	Wetlands and pans
Soils	Stripped and stockpiled soils
	Soils of moderate to high agricultural potential
Land Use	Hadeco's cold climate bulb operation
	Hadeco worker village and school
	Irrigation channels
	Supporting infrastructure such as cold storage rooms
	Livestock
Land Capability	Agricultural potential
	Grazing potential
Air Quality	Ambient air quality
Noise Environment	Ambient noise levels
Social	Livelihoods
Economic	Employment at alternative land uses
Heritage and Cultural	Cemeteries and graves
	Structures

Aspect	Feature
	Rock art
Visual	Sensitive viewer locations

3.21 MAPS SHOWING THE SPATIAL LOCALITY AND AERIAL EXTENT OF ALL ENVIRONMENTAL FEATURES

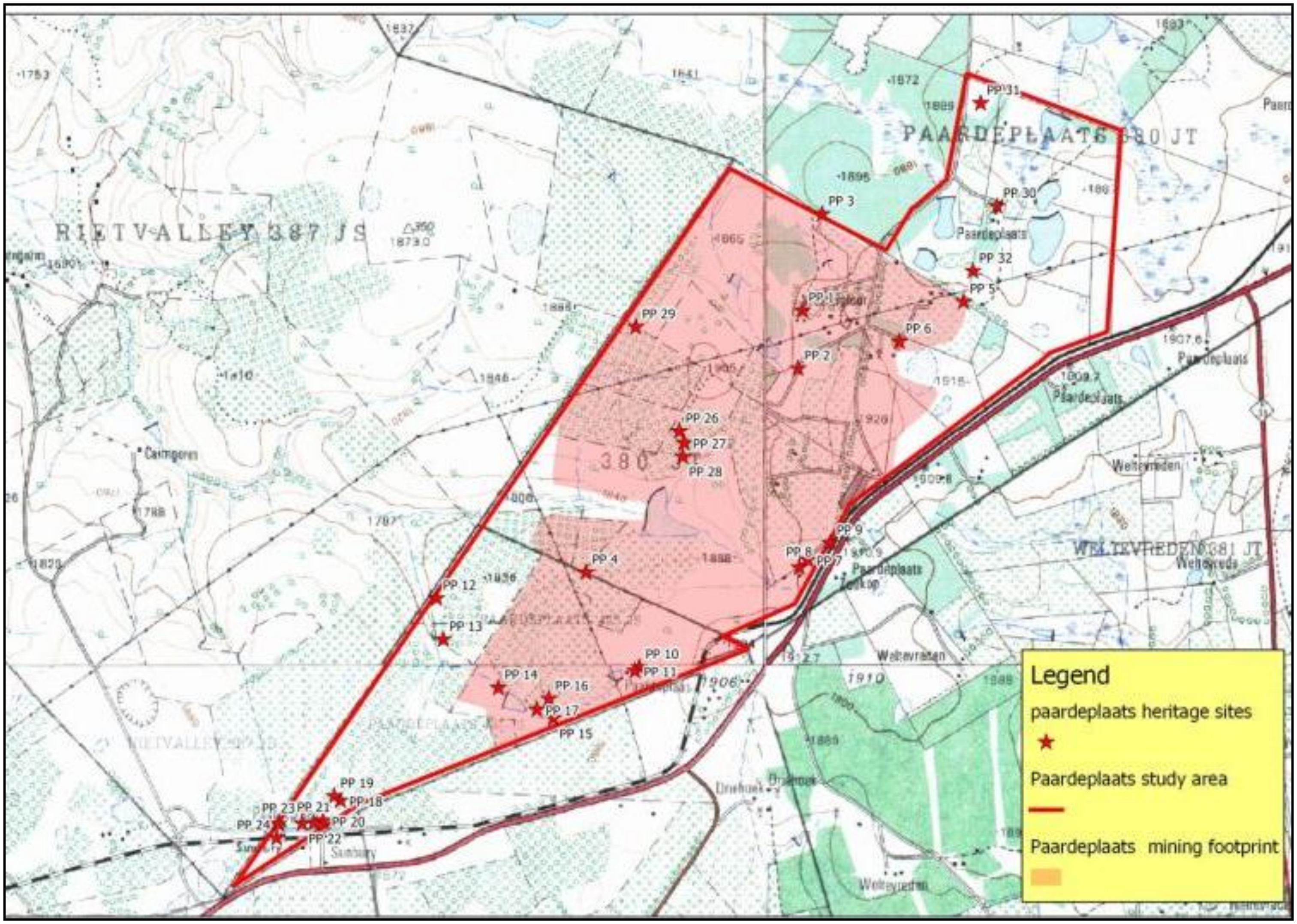

Figure 32: Sensitive heritage features in the study area

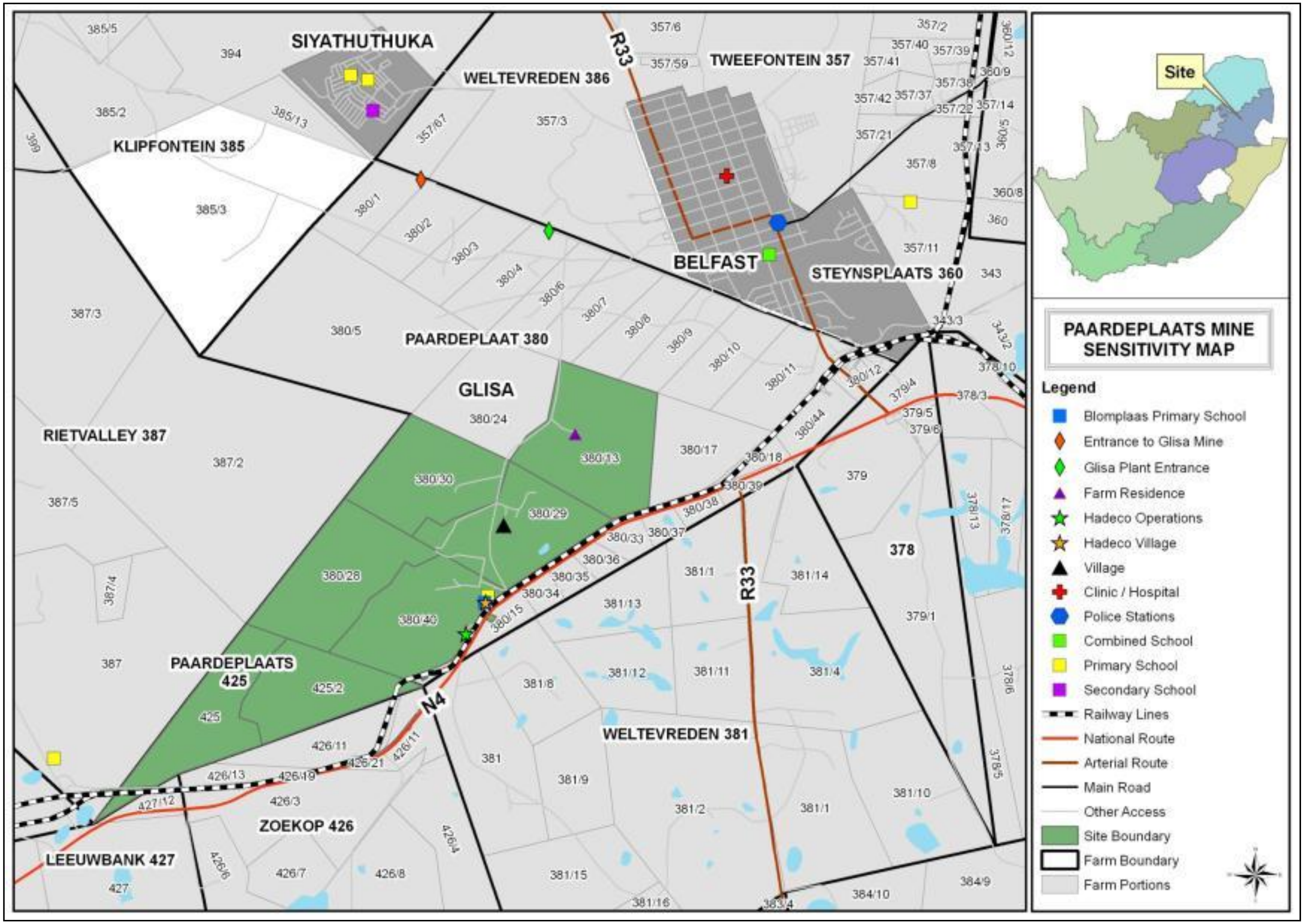

Figure 33: Social sensitivity in the study area

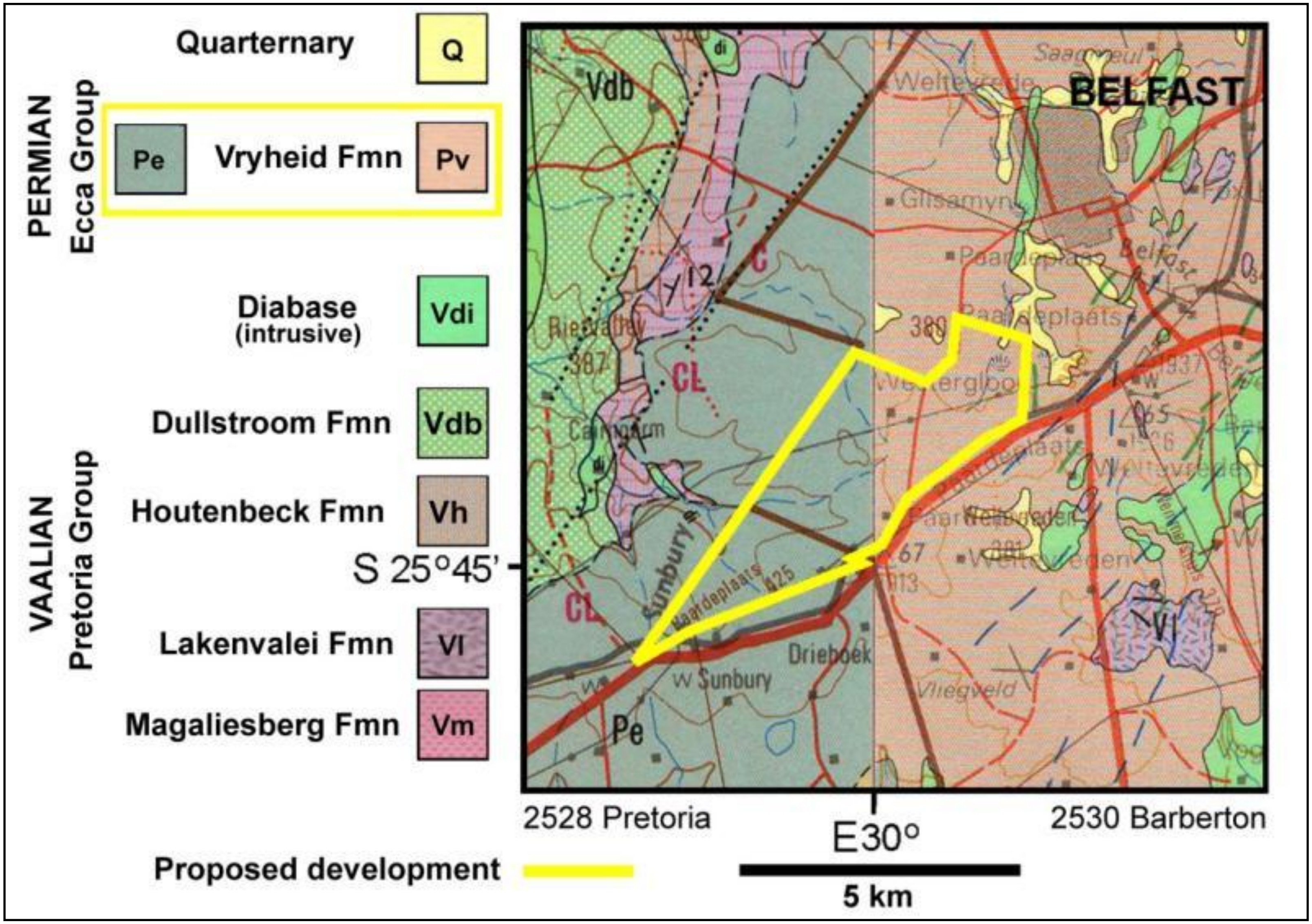

Figure 34: Geology of the study area

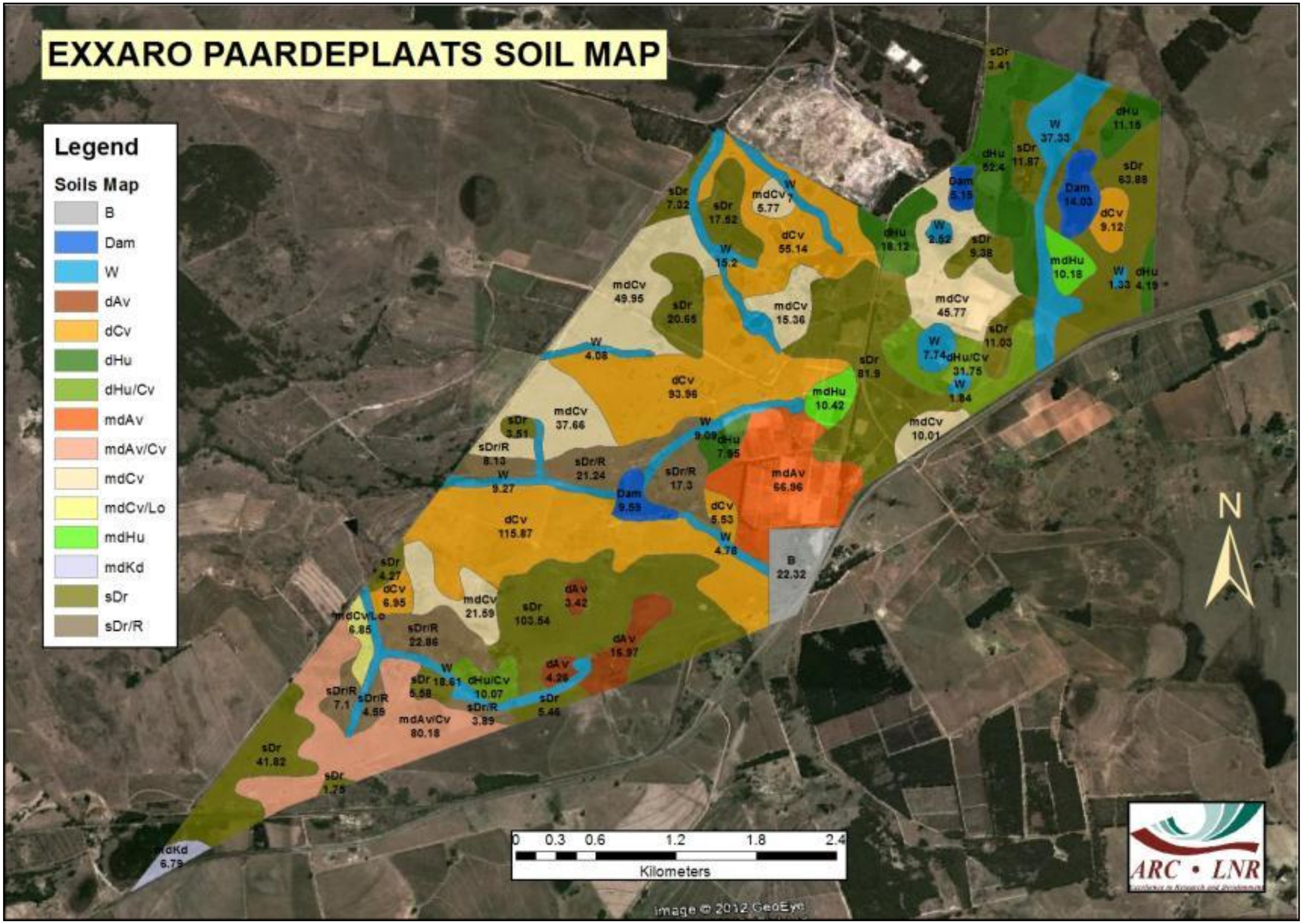

Figure 35: Soil types in the study area

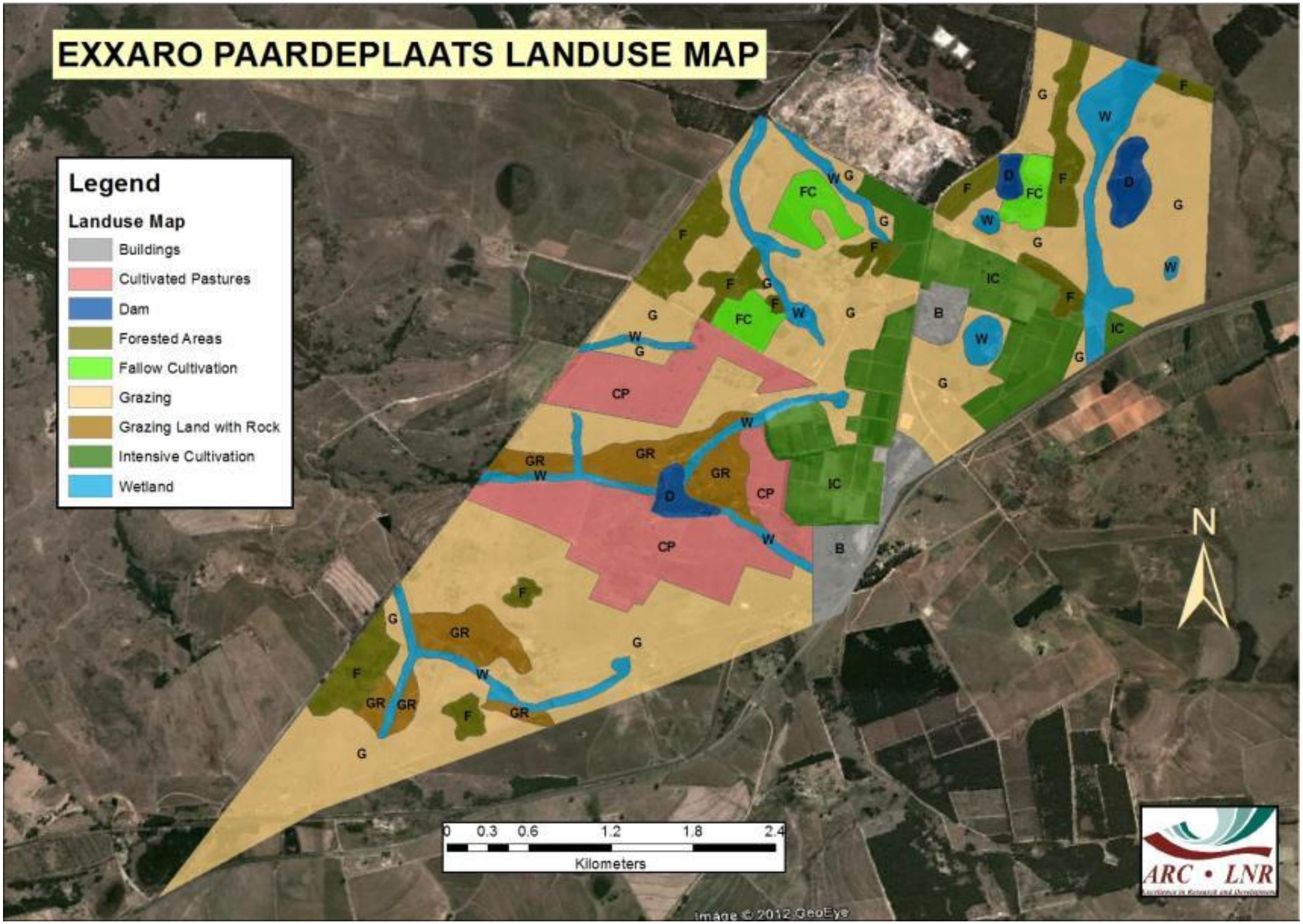

Figure 36: Land use within the study area

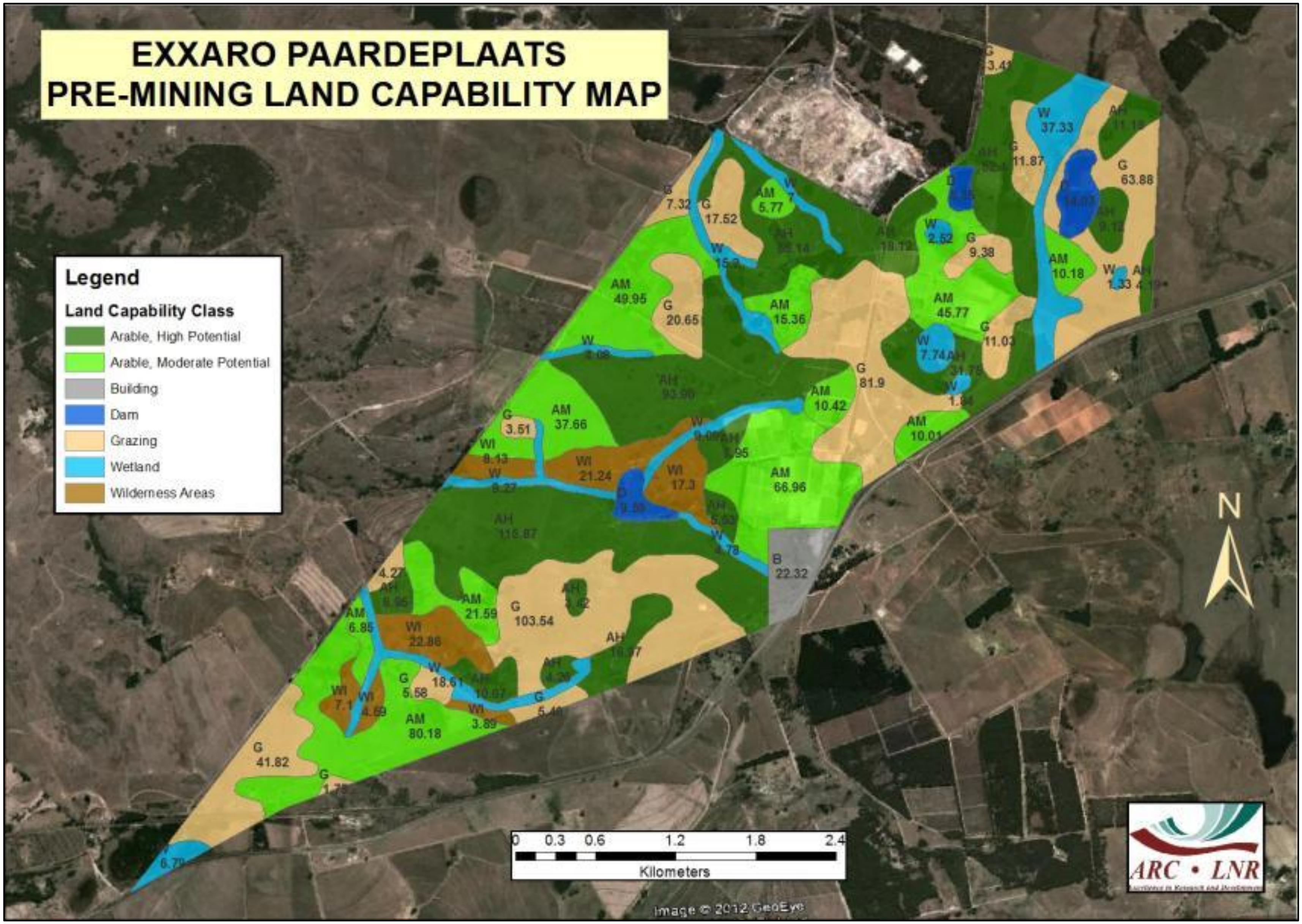

Figure 37: Land capability within the study area

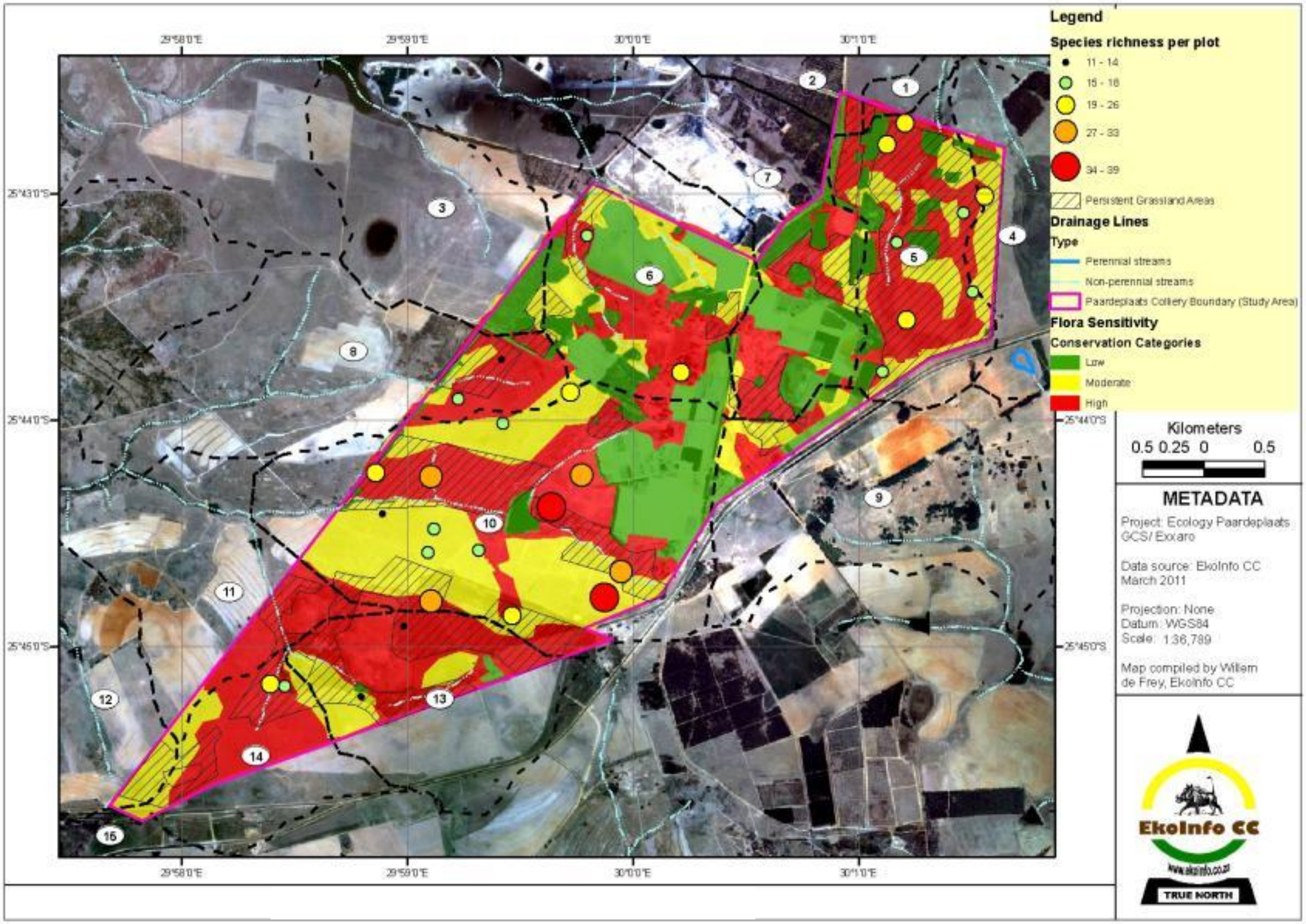

Figure 38: Vegetation sensitivity in the study area

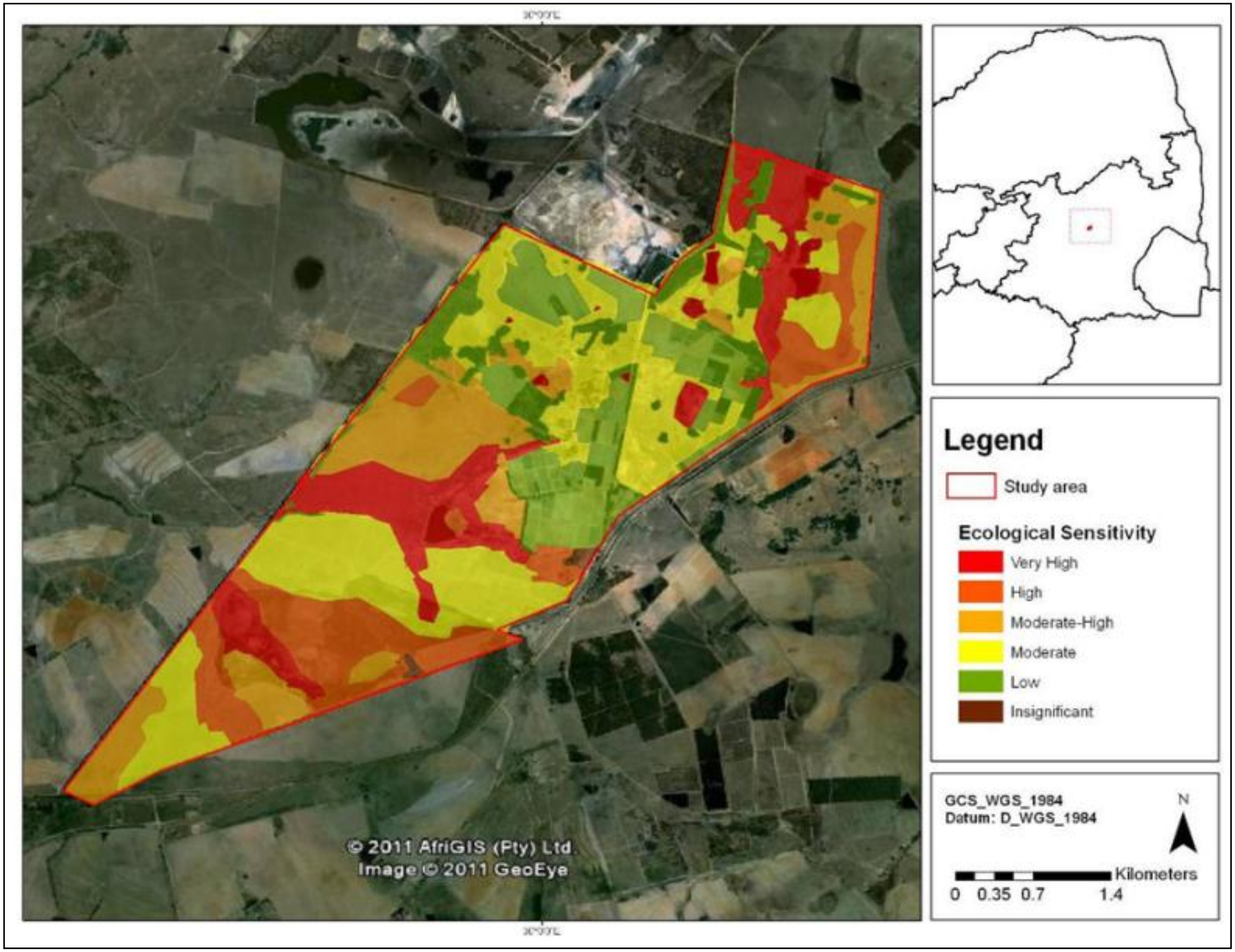

Figure 39: Avifauna sensitivity in the study area

Figure 40: Herpetofauna sensitivity in the study area

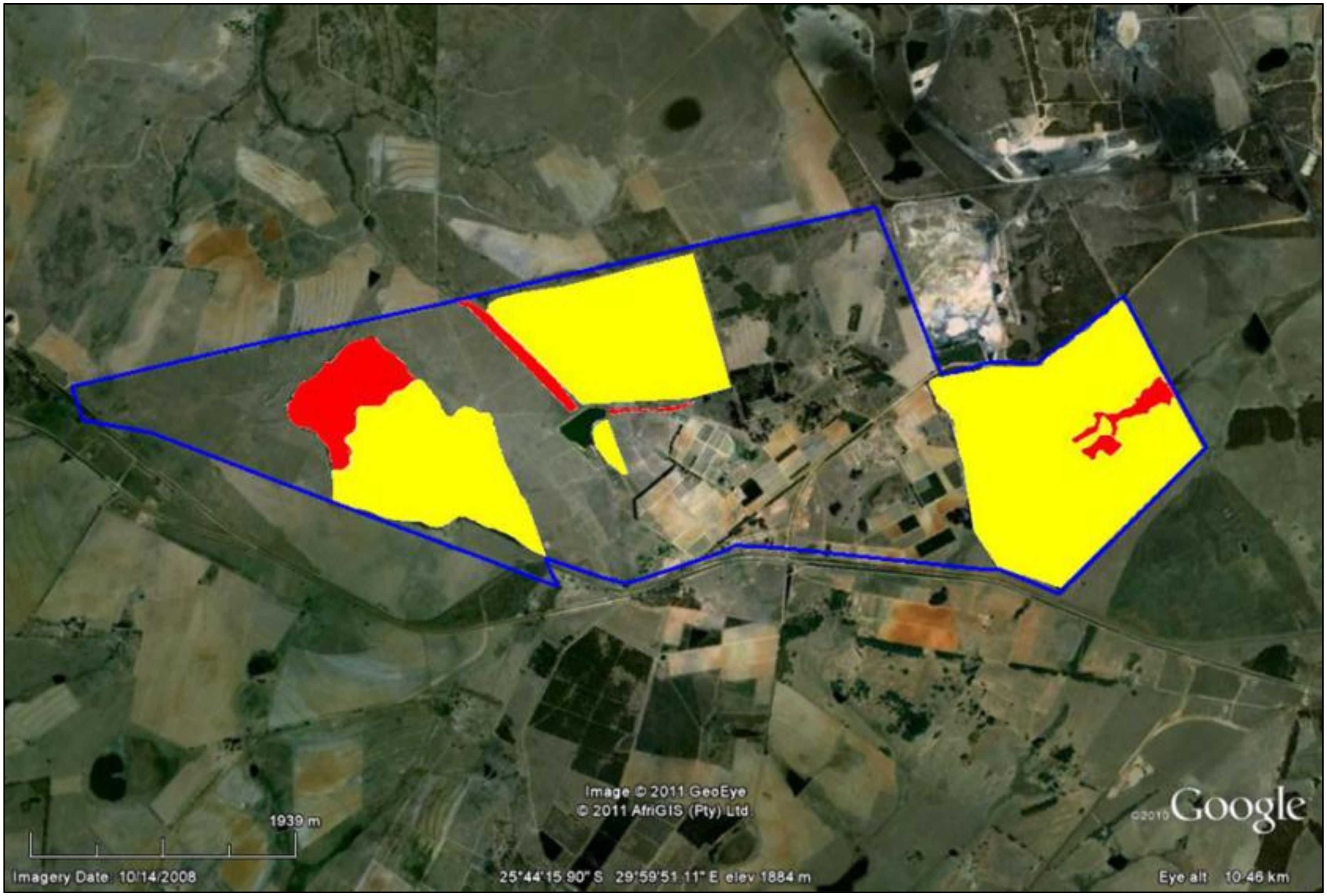

Figure 41: Mammal sensitivity in the study area

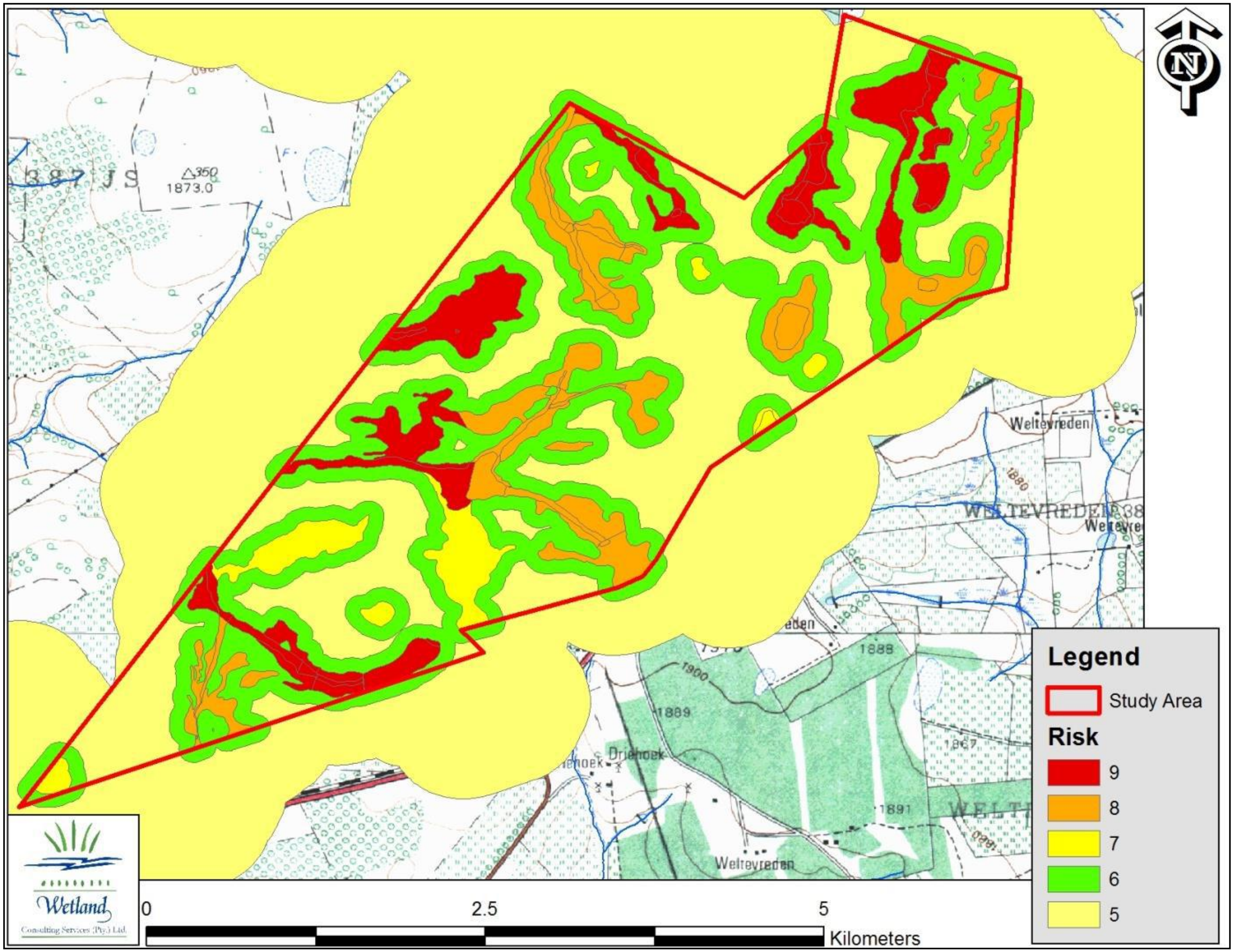

Figure 42: wetland sensitivity in the study area

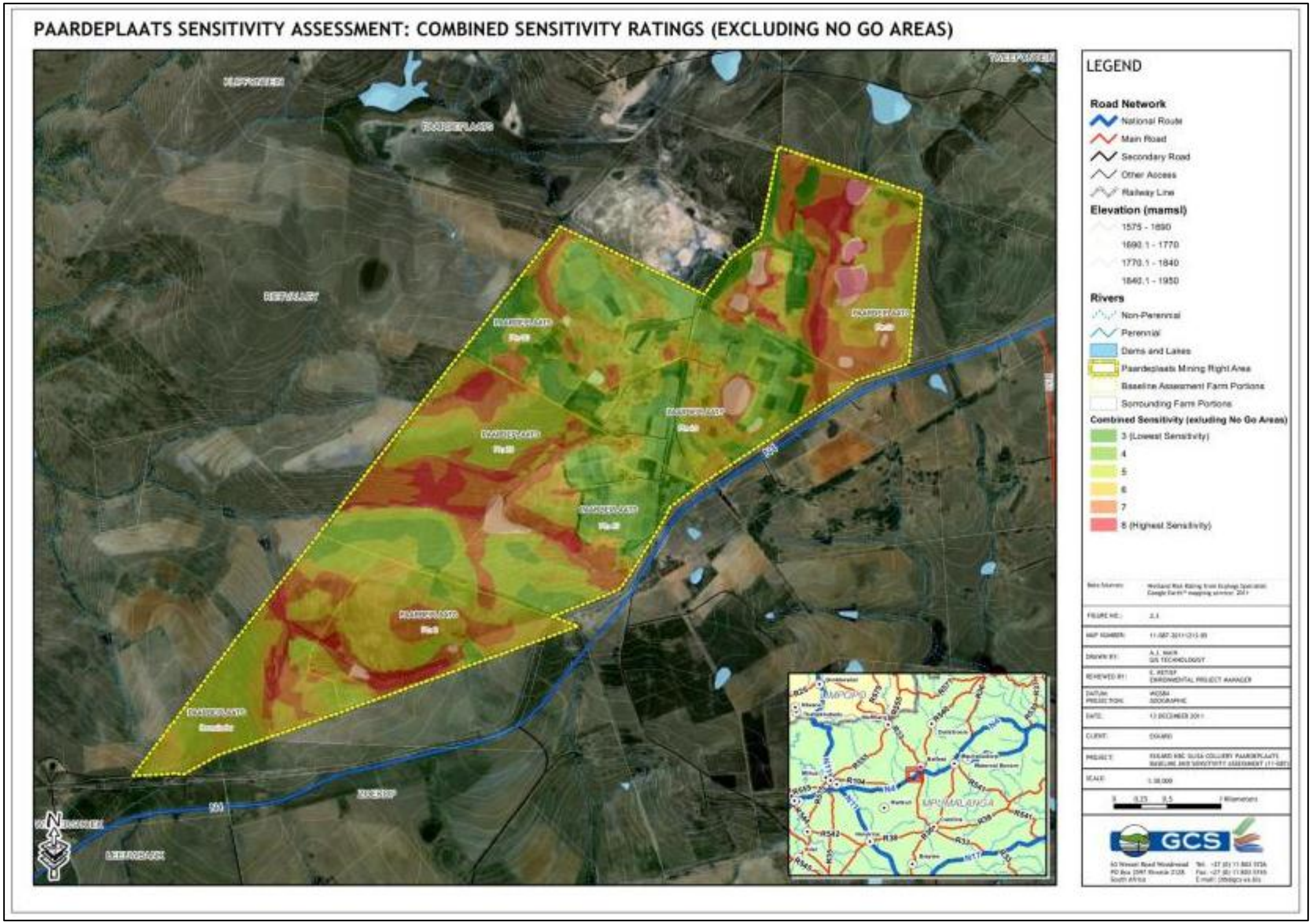

Figure 43: Combined ecological sensitivity in the study area

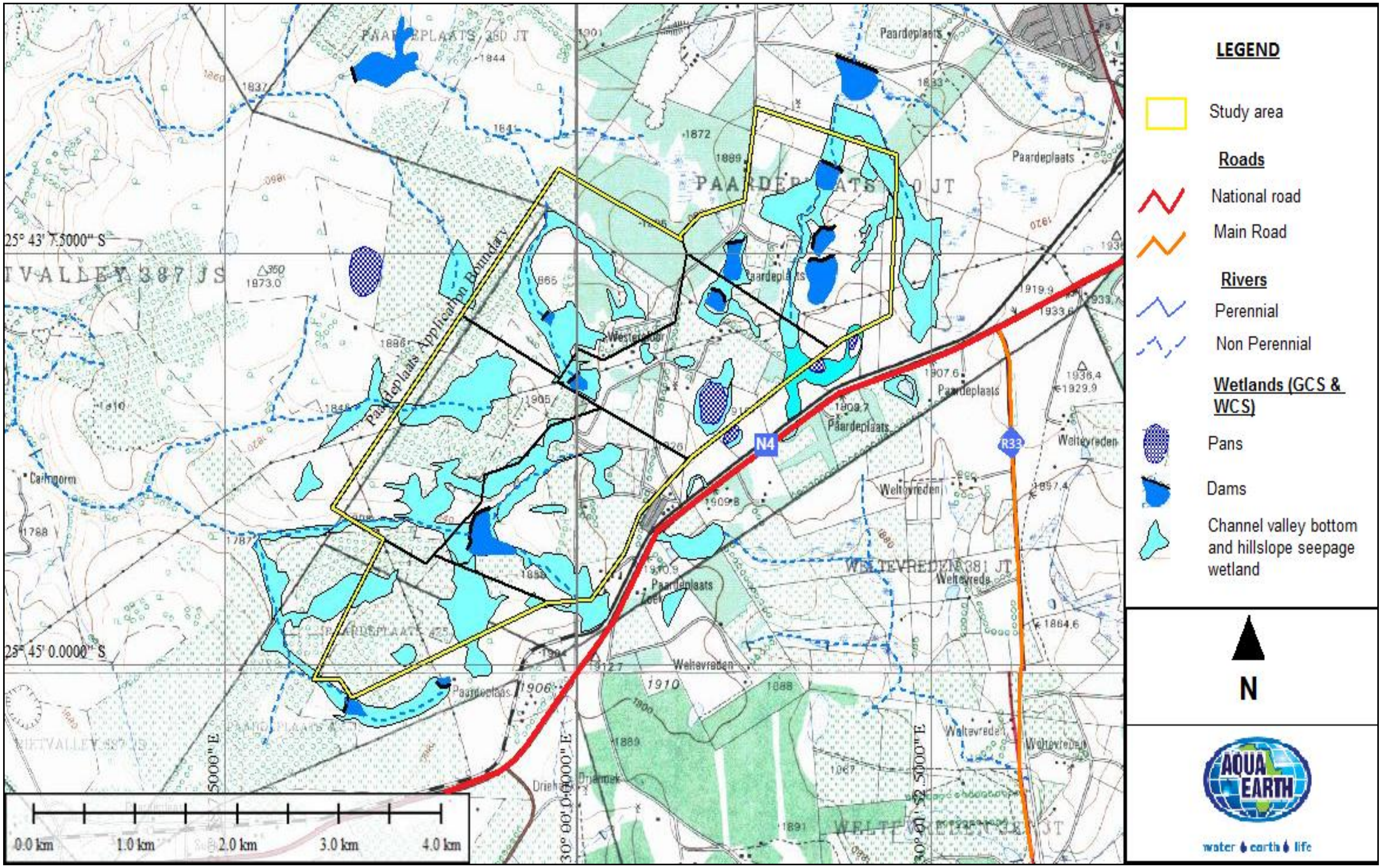

Figure 44: Location of surface water features

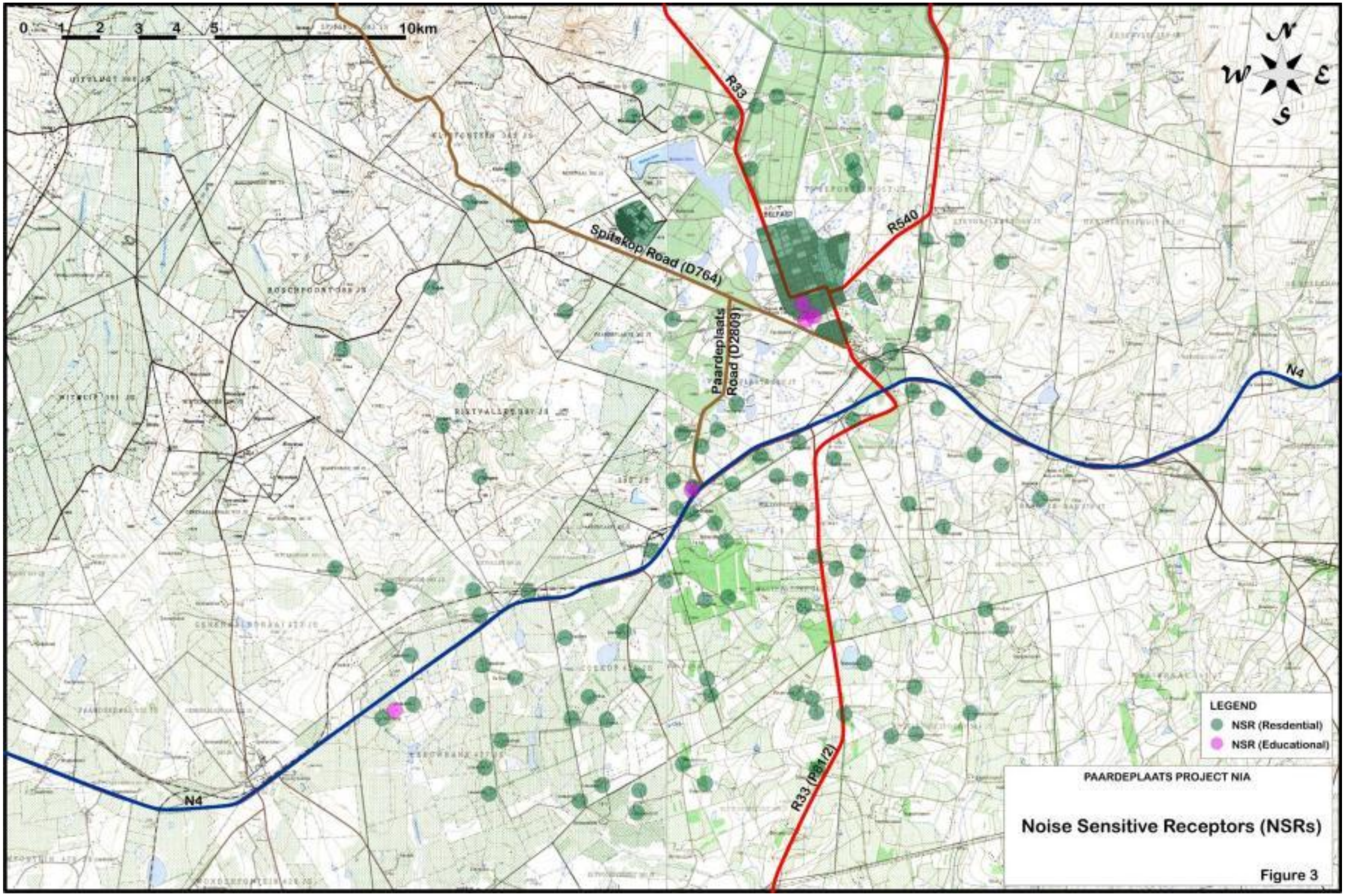

Figure 45: Noise sensitive receptors

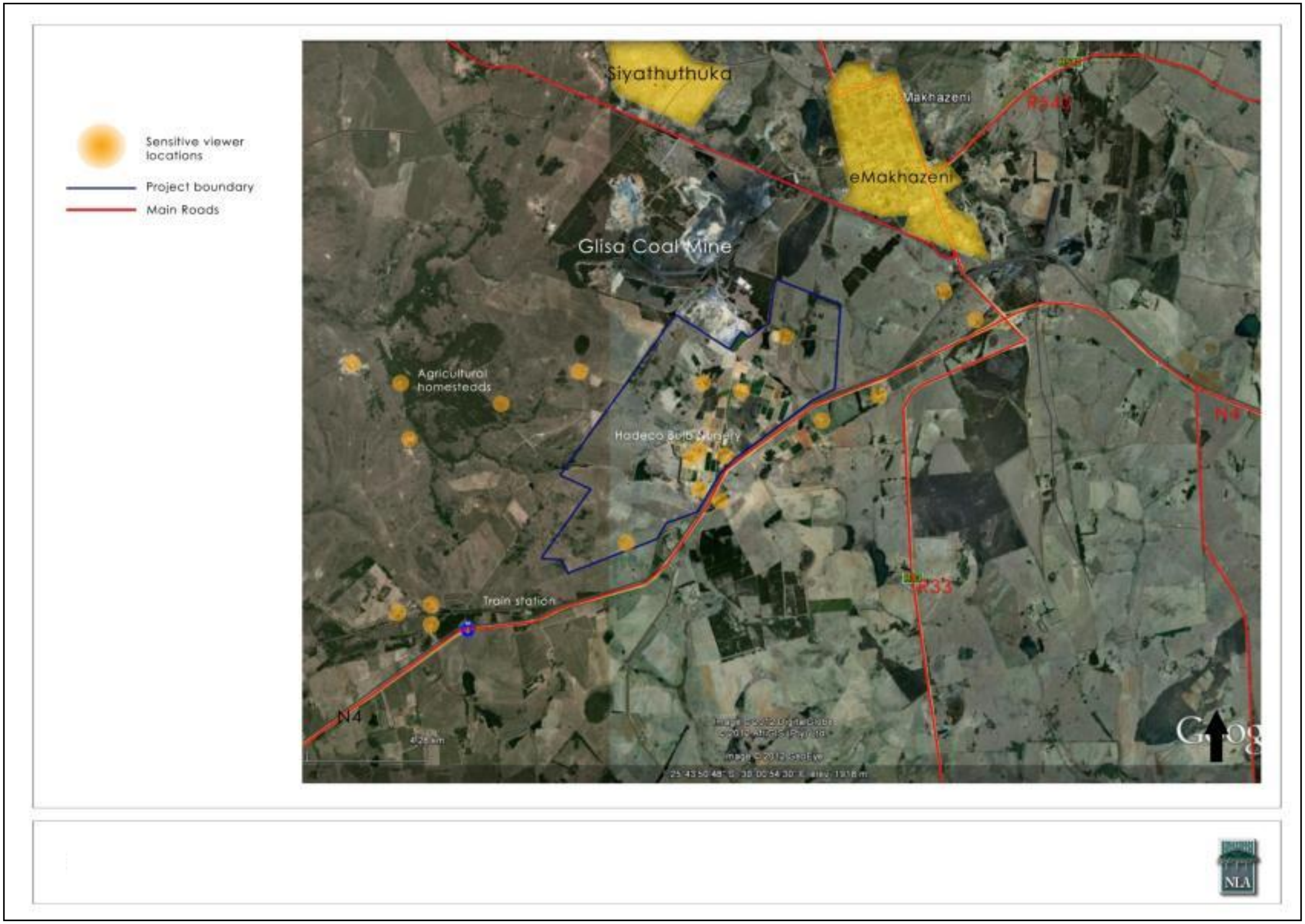

Figure 46: Sensitive viewer locations

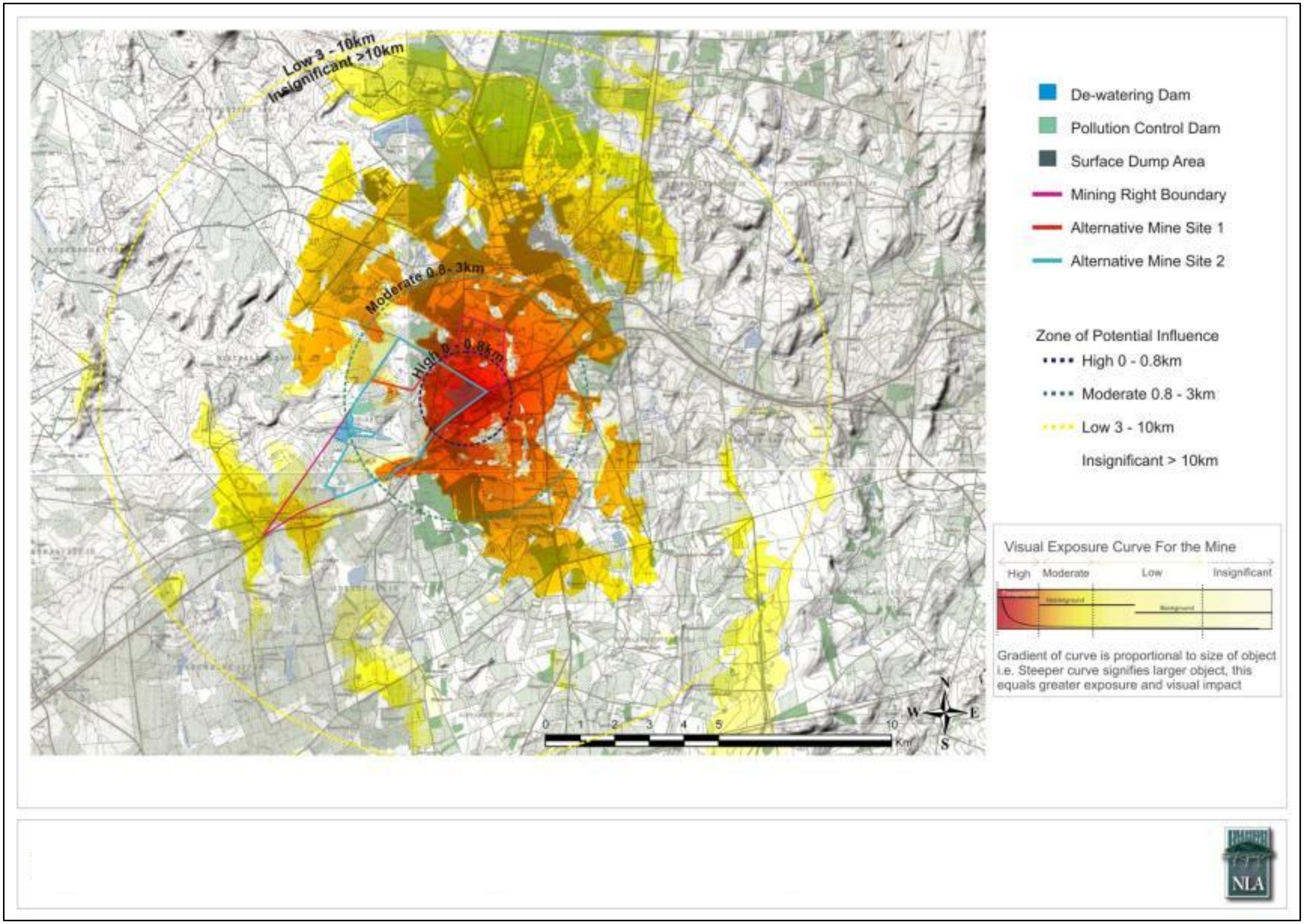

Figure 47: Viewshed analysis

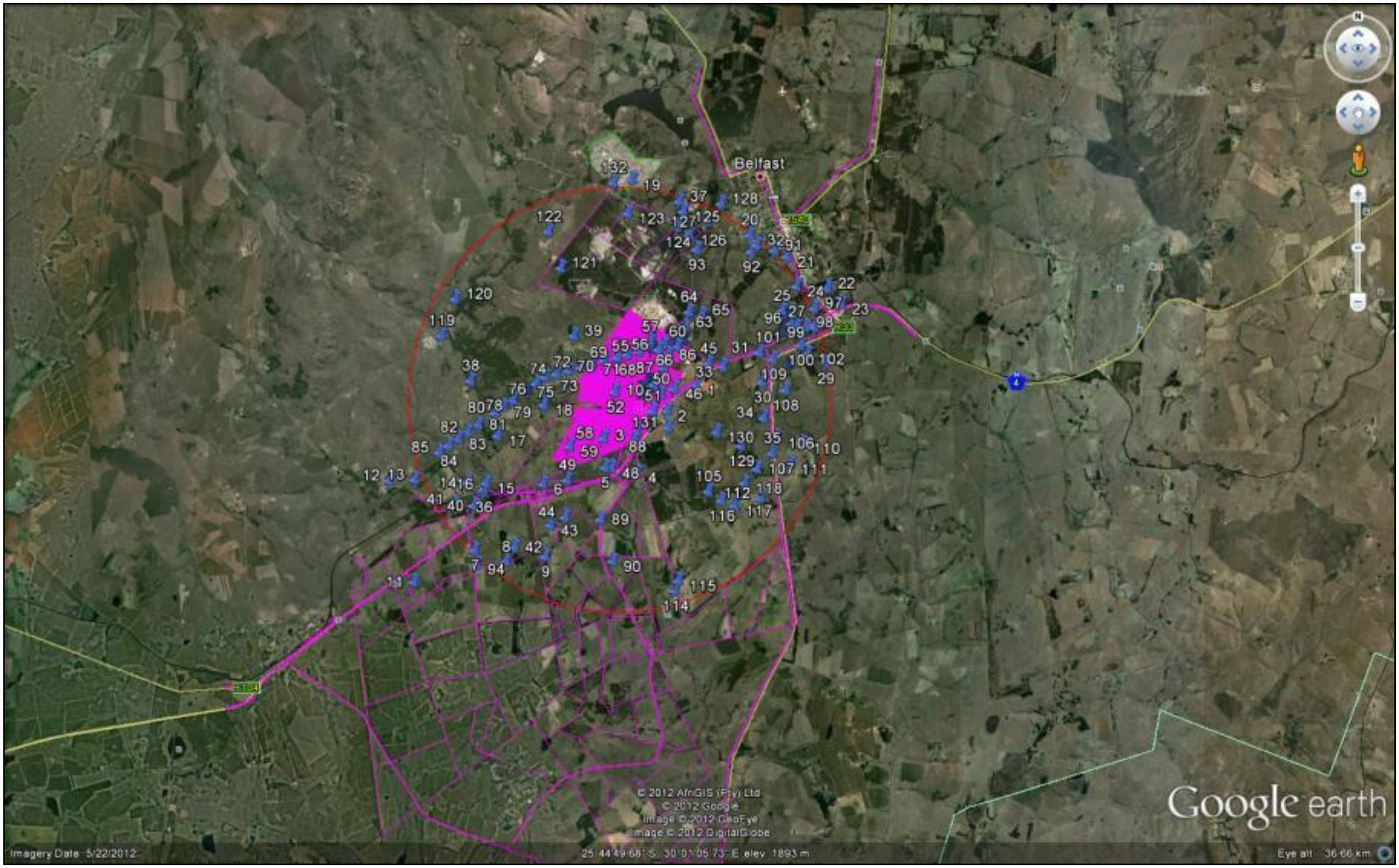

Figure 48: Structures sensitive to blasting

Figure 49: Traffic sensitivity

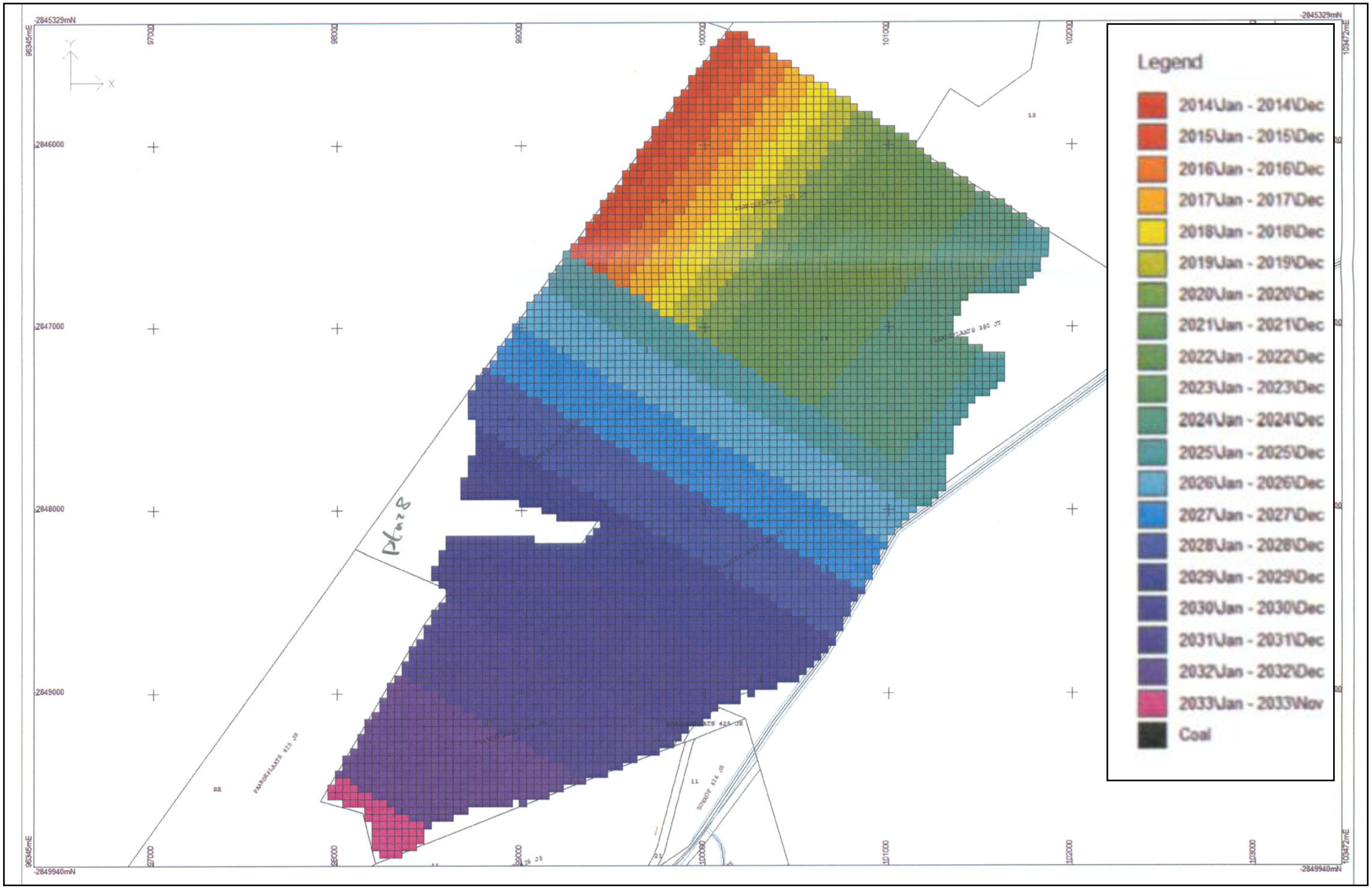

Figure 50: Proposed mining schedule

4 PROPOSED MINING OPERATION DESCRIPTION

The section below provides a detailed project description. The aim of the description is to indicate the activities that are planned to take place at the proposed Paardeplaats Coal Mine. Furthermore, the detailed project description is designed to facilitate the understanding of the activities taking place which will result in impacts that have been identified and assessed and for which management measures have been designed.

4.1 THE MINERAL RESOURCE

Witbank Coal Field and is close to the north-eastern edge of the Karoo Basin. The Karoo sequence is represented by the Dwyka Formation consisting of diamictite and the overlaying Ecca Group. The coal seams of the Witbank Coal Field are found at the base of the Vryheid Formation of the Ecca Group and the strata in which coal seams occur consist predominantly of fine, medium and course grained sandstone with subordinate mudstone, shale, siltstone and carbonaceous shale.

All five coal seams of the Witbank Coal Field occur within the proposed Paardeplaats Coal Mine application area. The number 2 and 4 seams are more extensively developed than seams 1, 3 and 5. In the far north–east portion of the application area a dolerite sill is believed to have completely displaced coal seams. The dolerite sill is likely a post depositional feature related to the Lesotho Basalts.

The coal seams are relatively flat-lying and the average seam thickness is presented below:

- The No. 1 seam has an average thickness of 0.34 m;
- The No. 2 seam has an average thickness of 5.37 m;
- The No. 3 seam has an average of 0.78 m;
- The No. 4 seam has an average thickness of 3.04 m; and
- The No. 5 seam has an average thickness of 0.62 m.

Up to four seams can be mined whilst the No. 3 seam, although persistent across the entire coal filed, has been determined to be too thin to be considered an economically viable resource.

4.2 MINE PRODUCTION RATE

The proposed Paardeplaats Coal Mine will target a RoM production rate of between 4.2 – 4.4 million tonnes per annum (mtpa). The available reserve is approximately 76.65 million tonnes and equates to a LoM of 20 years. The majority of the coal will be low grade suitable for local Eskom power station. On occasion A-Grade and P58 coal may be produced for export to markets in

Asia, Europe and the USA. All RoM from the Paardeplaats Coal Mine will be transported to the existing Glisa Coal Mine for minerals processing.

4.3 MINING METHOD TO BE EMPLOYED

The proposed Paardeplaats Coal Mine will entail open cast mining. The open cast mining method is due to the shallowness of the target coal seams present within the application area.

4.3.1 OPEN CAST MINING

The open cast mining will be undertaken as a hybrid of roll-over and bench/box cut mining techniques. The use of the two respective techniques is dependent on the number of seams present as well as overburden thickness.

The roll-over technique will be utilised where only a single seam is present and where the overburden has a corresponding thickness of less than 20 m .The bench/box-cut technique will be utilised where two or more seams are present and the overburden has a thickness of more than 20 m

The creation of the open cast is initiated through a stripping operation which removes topsoil and exposes the overburden of the first proposed cut. Initial topsoil will be hauled to a designated area and stored for use in rehabilitation. Topsoil, subsoil, and wetland soil will be stockpiled separately. No mixing of stockpiled soils will occur. When steady state is reached, topsoil is replaced in a continuous operation.

The overburden is then drilled and blasted. The removal of overburden is undertaken in two phases namely, the top portion will be loaded and hauled and the lower portion dozed. This will ensure that backfilling is adequately addressed and that concurrent rehabilitation may take place.

Once the overburden has been removed and dozed, the coal seams are drilled and blasted and then transferred to Glisa for minerals processing by means of standard load and hauls operations. The accompanying figures, numbered 1 to 12 are a schematic representation of the mining process. It is anticipated that after the first 4 cuts a steady state will be reached.

The following generic actions and activities are involved in the creation of the open cast and are classified sequentially as follows:

a) Strip topsoil, subsoil, and wetland soils;

b) Separate stockpiling of topsoil, subsoil, and wetland soils;

c) Drill and blast overburden;

d) Load and Haul the top off;

e) Doze the roll over;

f) Clean the top of the coal;

g) Dig trench to prevent contamination;

h) Drill and blast coal;

i) Load and haul coal; and

j) Start with next cut.

The schematic layout below (Figure 51 to Figure 54) describes the mining method in more detail and depicts the following:

1. A section through the general stratigraphic sequence. The mining direction is from left to right;
2. The box cut is now excavated after removal of the topsoil and subsoil;
3. Coal is removed from the box cut, subsoil from cut 2 and topsoil from cut 3;
4. The overburden from cut 2 is blasted;
5. The top most part of the overburden is hauled to a stockpile as there is not enough pit room available;
6. The bottom part is dozed over and the coal face cleaned;
7. Coal is removed from cut 2 and subsoil from cut 3;
8. Cut 3 overburden is blasted;
9. The top part of blasted overburden is hauled and placed at the beginning of the low wall;
10. The bottom part of cut 3 is dozed over and the coal face cleaned;
11. Coal is removed from cut 3 and subsoil from cut 4; and
12. Overburden from cut 4 is blasted. The pit is now in a ready state and no more material is stockpiled as it can be accommodated in the pit. Concurrent rehabilitation can now logically follow as soon as the subsoil gets stripped in the front and replaced in the back. The same is true for the topsoil which gets placed over the subsoil in a continuous process. Wetland soil will be replaced in the original location and in the correct sequence.

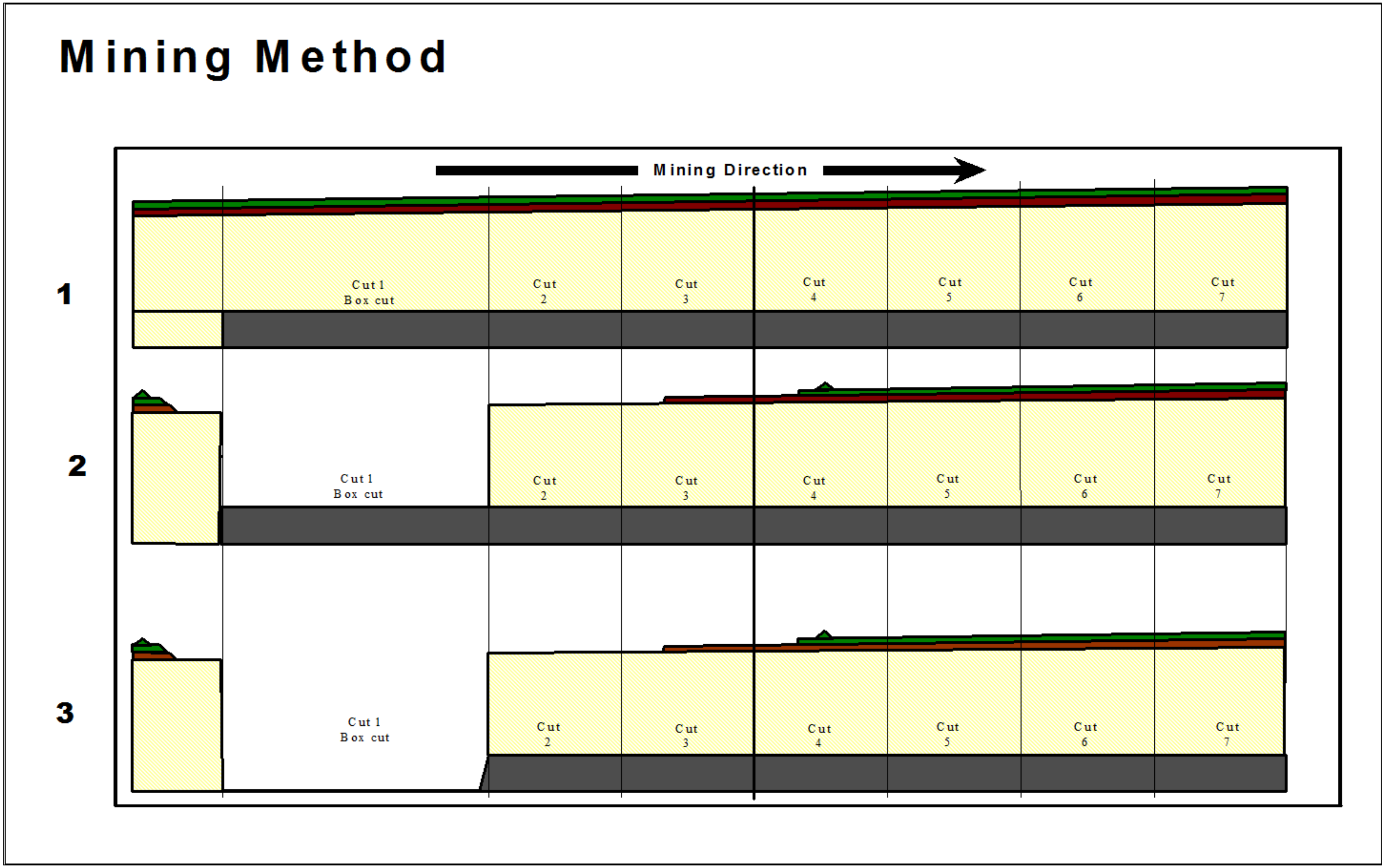

Figure 51: Mining Method steps 1-3

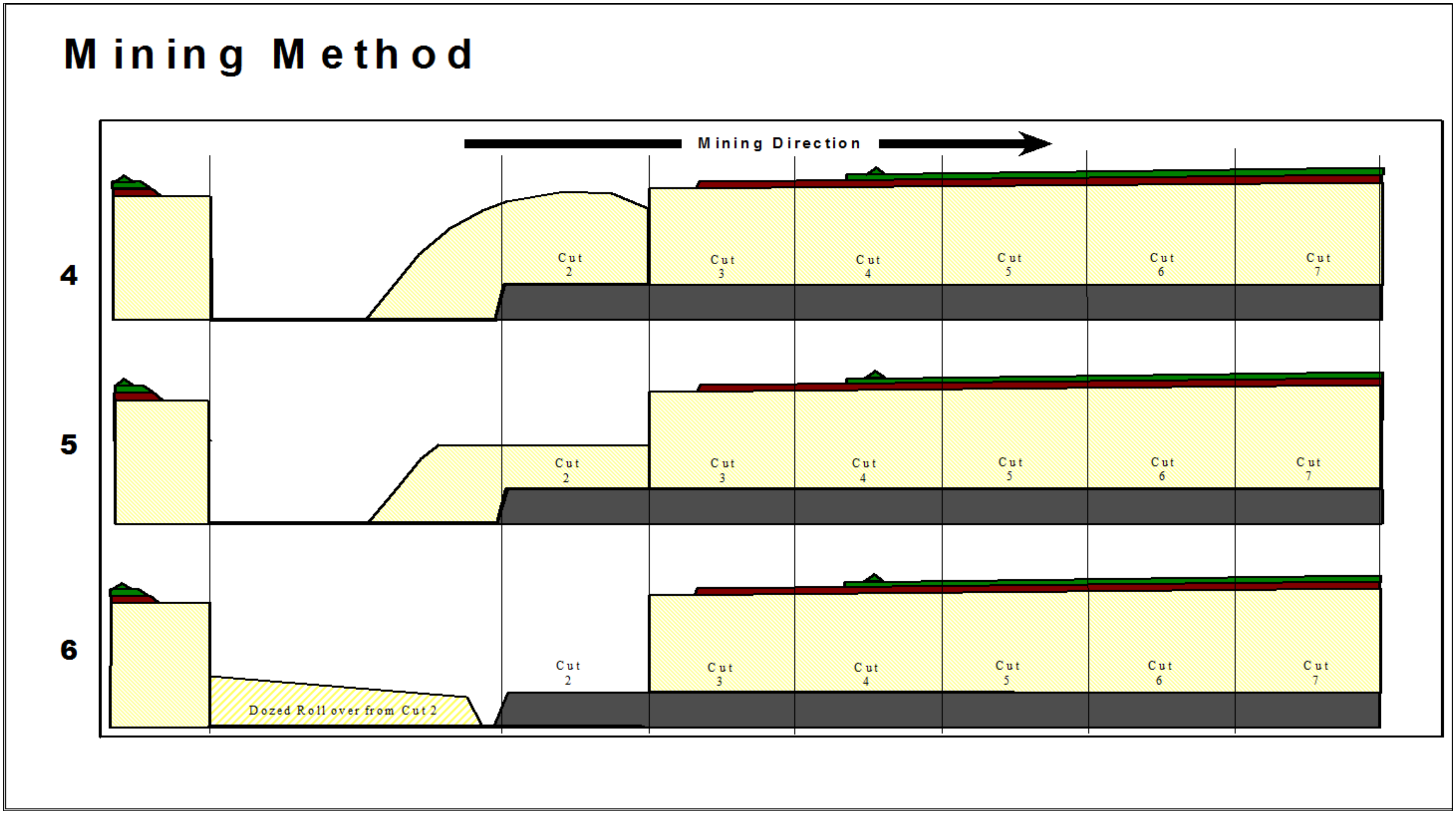

Figure 52: Mining Method steps 4-6

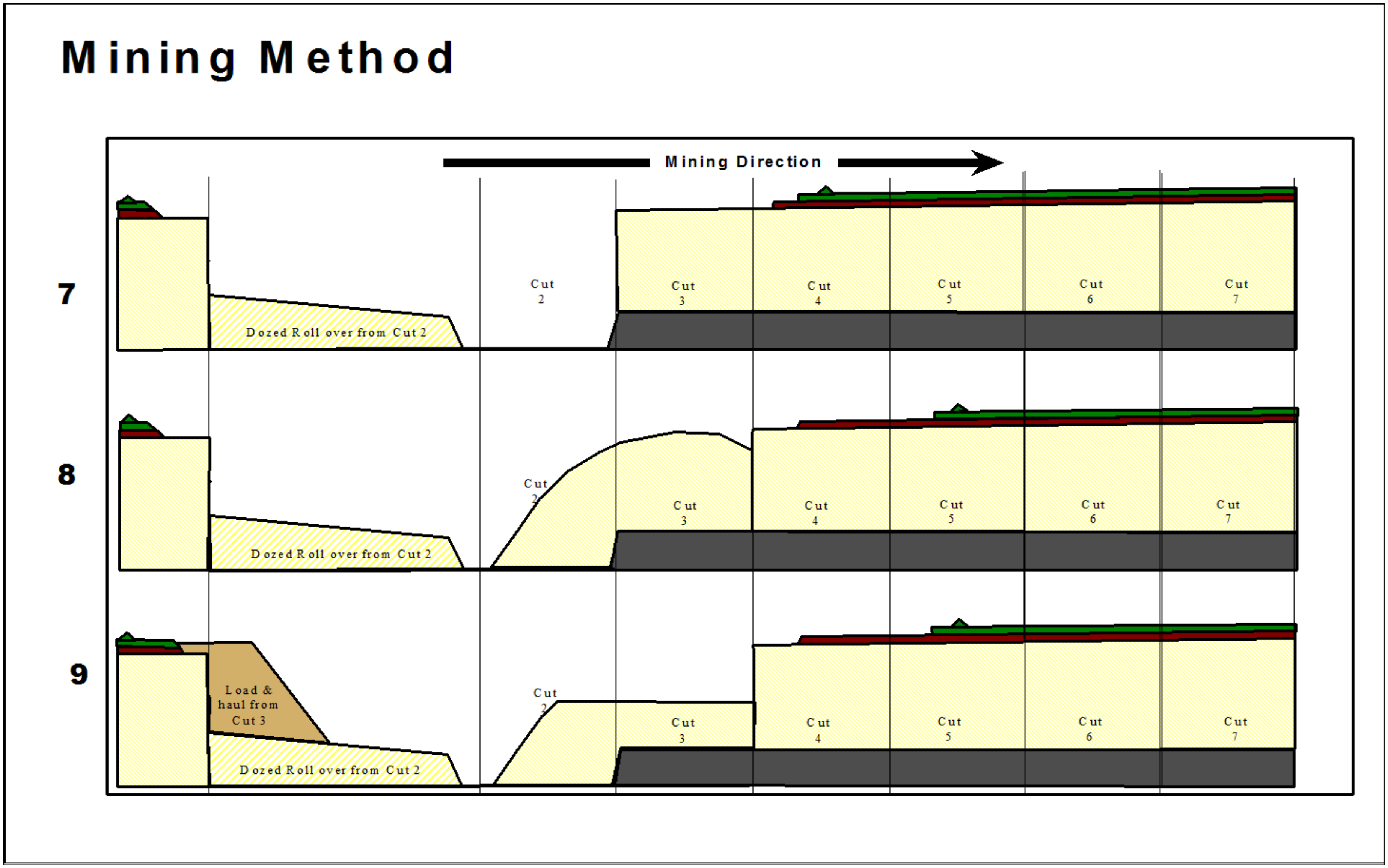

Figure 53: Mining Method steps 7-9

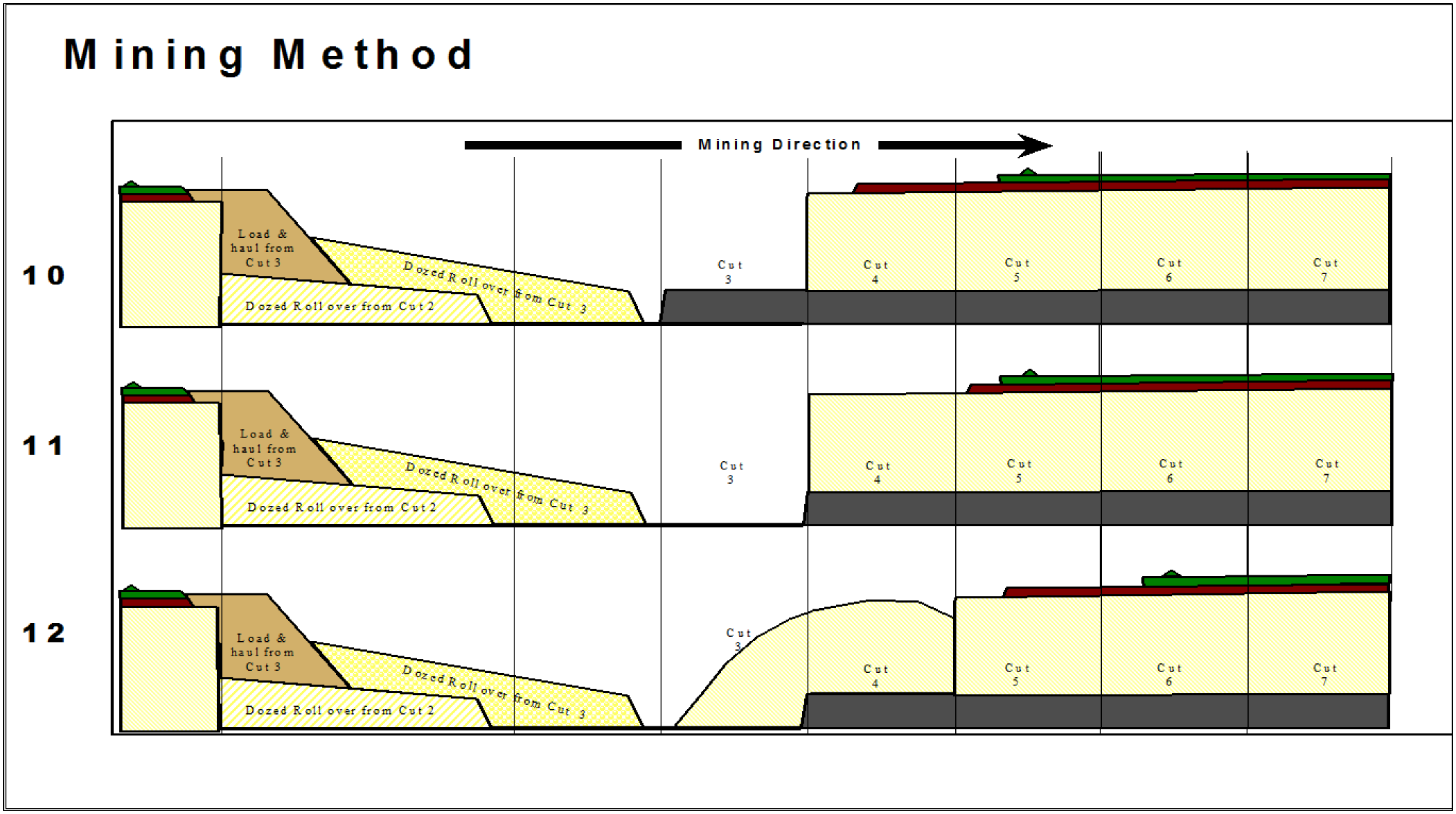

Figure 54: Mining Method steps 10-12

4.3.2 MAGNITUDE OF MINING OPERATIONS

The creation of the open cast is to be undertaken in two phases:

- Phase 1 Practical Pit of 191.09 ha on Portion 30 of the farm Paardeplaats 380 JT; and
- Phase 2 Practical Pit of 648.1 ha on Portions 28, 29 and 40 of the farm Paardeplaats 380 JT and Portion 2 of the farm Paardeplaats 425 JS.

The total hectares of the open cast pits are approximately 839.19 of the 1 415 ha under application.

4.4 MINERALS PROCESSING

The proposed Paardeplaats Coal Mine is envisaged to operate as an extension of the existing NBC Glisa Coal Mine. As an extension of an existing mine, all RoM from Paardeplaats will be transported by conventional load and haul operations to NBC Glisa for processing. No minerals processing, storage & disposal of mineralised waste and other supporting infrastructure is required or will occur on Paardeplaats. As such, all the mineral processing activities described below will occur on NBC Glisa.

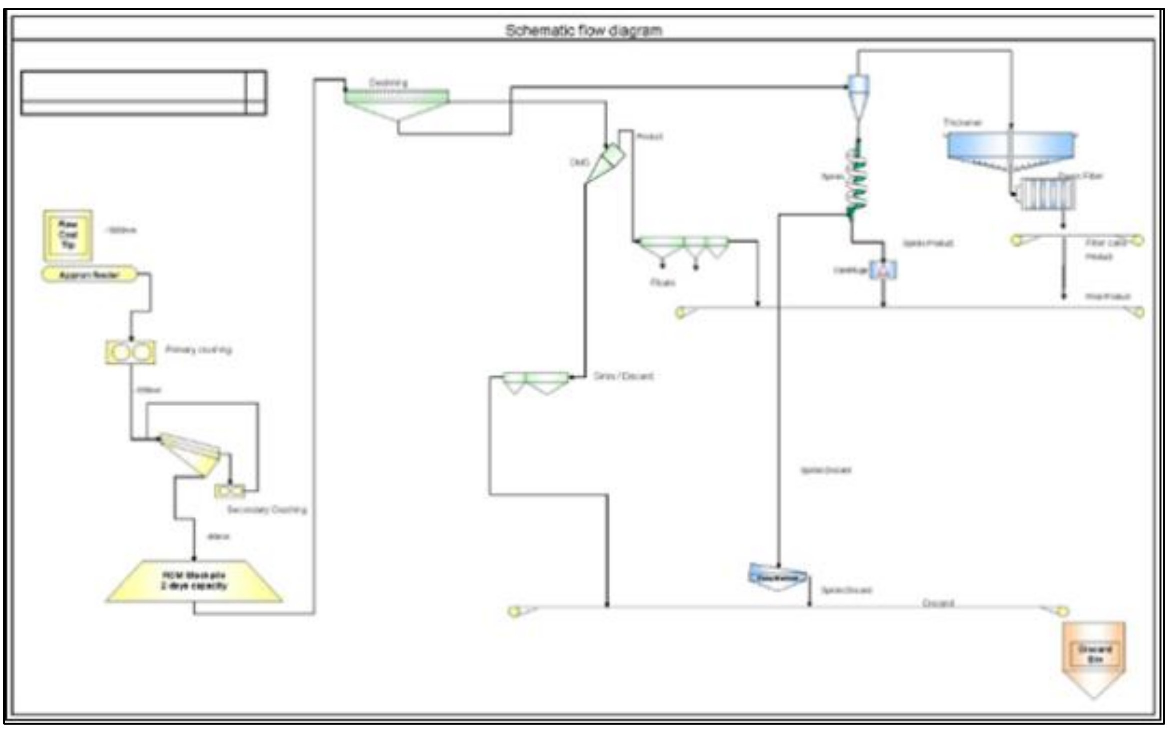

Figure 55: Processing flow diagram for NBC Glisa

4.4.1 CRUSHING AND SCREENING PLANT

NBC Glisa will undertake crushing and screening of coal from Paardeplaats. NBC Glisa has three stationary crusher and screen plants namely:

- Main plant crusher and screen plant;
- Gijima plant crusher and screen plant; and
- Majamela plant crusher and screen plant.

The primary crushing of coal from Paardeplaats will take place at the Main and Gijima plant crusher and screen plants.

4.4.2 WASHING PLANT

Post crushing and screening, coal is then washed. A recently constructed washing plant is located close to the Main plant crusher and screen plant. The slurry produced from the washing plant is then disposed of by pumping the material into an unlined void which acts as a Dirty Water Dam with a capacity of 20,412 m^3. Coal not suitable for sale or export is discarded at an unlined coarse discard dump near to the washing plant.

4.4.3 RUN OF MINE STOCKPILES

After coal from Paardeplaats has been mined, crushed, screened and washed the final product is stockpiled in RoM stockpiles at Glisa and then transported by truck to its end location. The RoM stockpiles at Glisa are unlined. Limited RoM stockpiles may be present at Paardeplaats and will be lined.

4.4.4 TOPSOIL STOCKPILES

Soils of significantly different soil groups will be stockpiled separately. This will ensure that the characteristics are suitable for the prevailing landscape and drainage conditions once replaced. Soils will be separated into categories based on clay content and into topsoil and subsoil horizons.

Topsoil stockpiles will ideally be placed in a topographical crest which will provide free drainage in all directions and safety from erosion. Alternatively, a side-slope location with suitable cut-off berm construction upslope is acceptable.

Soil stockpiles will not be moved after initial stripping unless the soil is being replaced in its final location in the rehabilitated profile. This is because each re-handling damages soil structure and increases compaction. In addition, soil losses occur with each re-handling and there is considerable additional cost. While it may cost more initially, it is better to place stockpiles in areas where they will not have to be moved, allow for free drainage and are safe from erosion risks.

4.4.5 WEIGHBRIDGE

Two existing weighbridges are present at Glisa situated at the entrance to the main plant area. Both weighbridges will be utilised for final product originating from Paardeplaats.

4.5 WASTE

The Paardeplaats Coal Mine will generate the following non-mineralised wastes:

- Domestic waste; and
- Hazardous waste.

4.5.1 DOMESTIC WASTE STREAMS

Domestic waste streams will include waste streams such as paper, plastic, scrap metal, building rubble and drums. Domestic waste will be stored in a demarcated area in bins and skips for final off-site disposal. Domestic waste will be collected and transported by the Belfast Local Municipality to their solid waste disposal site which is a licensed waste facility.

4.5.2 HAZARDOUS WASTE STREAMS

Hazardous waste streams will include used oil, diesel, grease and lubricants used on site. All hazardous waste streams will be disposed of at a permitted hazardous waste facility.

4.5.3 INDUSTRIAL AND MINING WASTE STREAMS

All mineralised waste products such as coal slurry and coal discard will be produced at Glisa as a result of minerals processing of coal from Paardeplaats. Coal discards will be stored at the discard dump near the washing plant and used to backfill open cast pits at Glisa. Slurry from the washing plant will be disposed of in the existing void which is in close proximity to the washing plant.

4.5.4 SEWERAGE WASTE

The Paardeplaats operation will make use of a mobile site office and ablution facilities. Sewage from the ablution facilities will be disposed of into septic tanks which will be emptied and removed by the Belfast Local Municipality.

4.5.5 WATER TREATMENT PLANT

Exxaro is in the process of constructing a water treatment plant to treat contaminated water. The water treatment design and specification are at an advanced stage. The plant will be located at

Glisa and will be used to treat decant water as well as contaminated water from the Paardeplaats Coal Mine.

4.6 ADMINISTRATION BUILDINGS, ENGINEERING BAYS, WORKSHOPS, AND OTHER BUILDINGS

The Paardeplaats Coal Mine will be supported by the existing Glisa Coal Mine and as such requires limited infrastructure such as administration buildings, engineering bays and workshops. A mobile office block and ablution facility will be located on the Paardeplaats operations area. The mobile is a temporary structure that will house the site office as well as an ablution block for employers. The mobile office block will serve as the base of operations for coordinating the mining operation and the ablution block will serve as a change room and ablution facility for employers.

4.7 DANGEROUS GOOD STORAGE

The proposed Paardeplaats mining operation will only require a fuel storage facility. Chemicals and explosives storage will be undertaken at facilities at the existing Glisa Coal Mine

4.7.1 HYDROCARBON STORAGE

The proposed Paardeplaats Coal Mine will require the construction of a facility for the storage of fuel. The facility will be a bunded, above ground facility where fuel is stored in containers. The combined capacity of the facility will not exceed $500m^3$. The fuel stored will be used to re-fuel the diesel powered equipment and infrastructure.

4.8 WATER SUPPLY

The proposed Paardeplaats Coal Mine will require water in the form of both potable and bulk water.

4.8.1 POTABLE WATER SUPPLY

Potable water will be obtained from the Emakhazeni Municipality. Potable water will be used in the mobile office and ablution block.

4.8.2 PROCESS WATER SUPPLY

The proposed Paardeplaats Coal Mine will only require process water for dust suppression .No additional process water is required as all minerals processing activities will take place at NBC Glisa. The water required for dust suppression on the proposed 9,810 m of haul road will be obtained from dirty water dams. It is anticipated that the volumes of water required for dust suppression will range from 120-150 m^3/day.

4.9 CLEAN AND DIRTY WATER PROCESSES

The management of clean and dirty water systems is required for pollution control by facilitating the following:

- Control run-off and seepage entering the open pit;
- Control run-off from rock dumps, stockpiles and other dirty areas; and
- Control and separate the mixing of clean and polluted/contaminated water which is contained in the two pollution control dams and pit de-watering dam located within the Paardeplaats application area.

4.9.1 CLEAN AND DIRTY WATER PROCESSES

Two pollution control dams (PCD’s) will be located within the Paardeplaats operations area. The PCD’s will both have a wall height not exceeding 10m and a storage capacity of 50 000 cubic meters .Both PCD’s will be HDPE lined and used to collect water diverted by the network of water control berms ensuring clean and dirty water separation.

A single pit de-watering dam will also be located within the Paardeplaats operations area. The dame will also have a height not exceeding 10, and a storage capacity roughly the same as one of the PCD’s. The dam will be of zinc construction and also HDPE lined. The purpose of the dam is to abstract via pipeline groundwater that may seep into the pit and run-off from storm events. Water from the pit-dewatering dam will be pumped back into the PCD’s on site.

All three dams will be maintained and operated as to not spill any dirty water into a clean water system more than once in 50 years and a minimum freeboard of 0.8 m above full supply level will maintained.

4.9.2 STORMWATER MANAGEMENT PLAN

As a result of the aternatives proposed it is difficult to develop a site specific Stormwater Management Plan (SWMP). As such, should the EMPR be approved a detailed SWMP will be designed and undertaken with regard to the alternatives approved prior to mining operations commencing.The proposed Stormwater Management Plan (SWMP) will include the following that needs to be incorporated in the detailed plan. The SWMP must be updated and detail included. Areas that need to be taken into account in the development of the SWMP are discussed in Table 57.

Table 57: Areas that need to be addressed in a storm water management plan

Classification	Area	Comment
Clean water	Undisturbed land area	Regional geology or agricultural practices may contaminate runoff.
	Administrative offices	Generally only suspended solids (SS) to consider
	Tarred roads	Tarred roads are not expected to be contaminated by waste, coal or discard, but may have a run off volume implication.
	Newly rehabilitated areas Clean water dams	SS to be considered
Moderately dirty	Poorly rehabilitated areas	SS and other contaminants to consider
	Roads	If it carries traffic that bears coal, discard, slurry, waste rock, slimes, etc.
Dirty	Workshops and storage yards where oil is handled or ground is covered in fines	Oils, grease and soap, dissolved and suspended Contaminants
	Opencast pits	SS and other contaminants to consider
	Residue deposits	Includes coal discard, slurry facilities, slimes dams, waste rock dumps and sand dumps.
	Raw material or product stockpiles	Dissolved and suspended contaminants
	Unrehabilitated areas	Dissolved and suspended contaminants
	Haul roads	Dissolved and suspended contaminants
	Pollution control dams	Depends on contents of dams

Basic issues (WSP, 2011) that must be included in the SWMP are:

4.9.2.1 Operations Area

This area will include stockpiles, roads, workshop, stores and refuelling areas. Pollution sources include runoff from the stockpiles and haul roads, spills of hydrocarbonsand other chemicals within the workshops, stores and refuelling areas. To limit the impact to surface water bodies, water flow from this area will be directed through earth channels, berms and culverts towards a silt trap just upslope of a pollution control dam. The silt trap will remove suspended solids, while the lined pollution control dam willcontain any polluted runoff. The pollution control dam will be kept empty at all times by pumping dirty water into the dewatering dam and through use in dust suppression.

4.9.2.2 Pollution Control Dam

The pollution control dam will not overtop for recurrence events up to the 1:50 year event. In addition, the dam embankments will also not overtop for the 1:200 year recurrence event. The dam must be lined with a 1.5 mm thick HDPE liner. A sub-surface drainage system will be installed toensure that all seepage water within the dam area is also collected.

Overburden stockpiles

An erosion containment and dirty water berm must be constructed around the outside of each stockpile.Containment berms must also be constructed perpendicular to the outside berm to ensure that dirty water “coffers” arecreated. The area between the berms and stockpile will be vegetated to promote rapid evaporation, to reduce pondingwithin these areas. A 15m wide thickly vegetated “buffer” zone must also be constructed around the outside of berms tocontain sediment.

Overburden stockpiles must be separated, with one portion containing carbonaceous waste and the other containinginert materials. The treatment of each of these stockpiles will differ:

- Carbonaceous stockpiles: Surface water will be contained within the stockpile and berms. Groundwater contamination will be prevented by placing a 125 mm clay liner at the bottom of the stockpile. Captured water will be lost through evaporation.
- Inert stockpiles: Dirty water will be contained within the stockpile and berms. Surface water seepage through the containment berms can be accommodated, with the provision that siltation is prevented.

4.9.2.3 Mining Area

Dirty water containment berms will be constructed around the mineto separate dirty water from clean water. Dirty water will be diverted back into the pit whilst clean water will be directedinto the clean water catchment areas.

The pit will be rehabilitated as work progresses. Rehabilitated areas will be vegetated and contour berms will beconstructed to slow surface water and to prevent erosion from taking place. It will furthermore be ensured during rehabilitation thatbuffer zones, containing thick vegetation, are established downstream of the rehabilitated areas. This will ensure thaterosion and subsequent sedimentation is minimised. Rehabilitated areas will be classified as clean water areas andthe surface water will be released into clean water areas.

Dirty water storage in the pit will be localised in various storage depressions within the pit. This will eliminate the needfor a large storage area for capturing the entire pit run-off, which would prevent effective rehabilitation as opencastoperations proceed. However, a depression should be made available to hold water transferred from the pollutioncontrol dam. This water would be used for dust suppression purposes. The size of the depression would this need tobe at least the size of the pollution control dam.

4.9.2.4 Haul Roads

Pit access roads could either traverse rehabilitated or mining areas and may exhibit some pollution potential. Wherever pit access roads traverse rehabilitated areas, small coffer dams, constructed adjacent to the road, are proposed. This will prevent pollution from entering newly defined clean water areas. Coffer dams will also be constructed along the mining areas to prevent a significant amount of surface water from being concentrated at one specific point.

4.9.2.5 Dewatering Dam

Groundwater is expected to decant and the pH can drop. A treatment system must be designed based on the expected decant volumes and associated water quality.

4.9.3 WATER AND SALT BALANCE

The current water balances are based on available information, and should be considered as an initial water balance, highlighting information gaps and assist in identifying points of metering and monitoring in order to develop a realistic and site specific water balance.

The only detailed information on water requirements, used in the estimation of the monthly average volumes are the volume of water required for dust suppression (120-150 m^3/day). Specific usages as summarized in WRC 801/1/01 on generic water balances for South African coal mining industry were also used considering the study site as an open cast mine without beneficiations plants. The average monthly mine production (358333 tonnes) rate used is derived from annual target mine production rate (4.2 to 4.4 million tonnes).

Volumes of Groundwater, Storm water and Evaporation have been estimated using specifics usages calculated from other South Africa coal mines (WRC 801/1/01).

Using information on the average monthly water balance related to mining activities on Blesbok (17 ha) and Block B (8.8 ha) of the Glisa mine, as estimated in the “Environmental Impact Assessment and Environmental Management Plan Report (EIA/EMP, 2011)”, a water balance is calculated. The calculations include all the above considered sources and sinks. Table 59 and Table 61 show the calculated water balance for alternative 2 (full mining area) and alternative 3 (portion 30) respectively.

The following water balance flow diagrams have been developed as a preliminary water balance for each alternative and are presented in Figure 56 and Figure 57 while the detailed descriptions for each component are included in Table 58 and Table 60. This will need to be updated and further developed in consultation with the design engineers once finalization of mine infrastructure and mine plans has been reached. The water and salt balance must be updated annually.

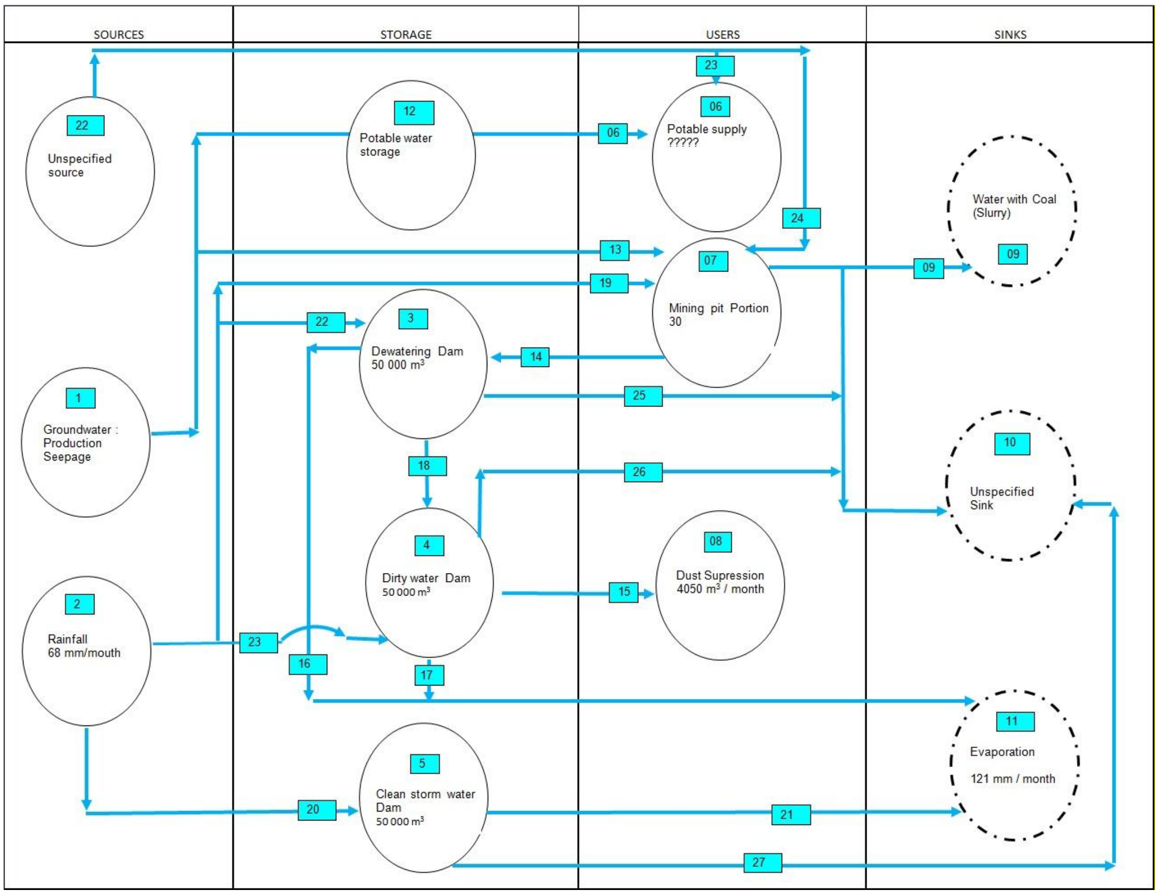

Figure 56: Generic Flow Diagram for Water Balance (Alternative 2)

Table 58: Description of Generic Water Balance Flow diagram for Alternative 2

Stream/Activity number	Description	Specific usage L/t)	Average Volume / Month
1	Total volume of ground water taken in by the mine for all uses, including boreholes production and ground water entering	2.09	748916.67
2	Total rain water taken in by the mine for all uses, including rain into pits, storage dams and stormwater runoff	1.18	422833.33
3	Total volume of water stored in the Dewatering dam		

4	Total volume of water stored in the Dirty water dam		
5	Total volume of water stored in the Clean water dam		
6	Total volume used for human needs	0.11	39416.67
7	Total volume used for mining in the pit area		
8	Total water need for dust suppression		4050000.00
9	Total water associated with slurry		
10	Total water of going to unspecified sink		
11	Total water evaporated from the portion	0.13	46583.33
12	Total Potable water stored		
13	Total volume of groundwater that seep into Open pit Area when operating		
14	Total volume of water pump from Open pit Area (ground water + Run-off water)to the dewatering dam		
15	To test water pump from dirty dam for dust suppression during operation		
16	Total volume of water evaporated from the dewatering dam		
17	Total volume of Dirty water drained to the dirty water dam		
18	Total volume of water pumped from dewatering Dam to the Dirty dam		
19	Total volume of rain water falling directly on the Open pit mining area including upstream run-off water		
20	Total volume of clean water drained to the clean water dam + volume of rain water falling directly on the dam		
21	Total volume of water evaporated from the clean water dam		
22	Total volume of unspecified source water		
23	Total volume of potable water supplied from unspecified sources		
24	Total volume of used in mine pit supplied from unspecified sources		
25	Total volume of water lost from dewatering dam to unspecified sinks		
26	Total volume of water lost from dirty water dam to unspecified sinks		
27	Total volume of water lost from clean water dam to unspecified sinks		

Table 59: Calculated initial Generic Water Balance for alternative 2 (1410 ha)

Sources	Average monthly Volume (m^3)	Storage	Use	Sinks	Average monthly Volume (m^3)
Groundwater	1460279.07			Evaporation	2954223
Rain (Run-off)	2238511.628			Unspecified sink	1979793
Unspecified source	1351523.256			Slurry	299.2562
Total	5050313.953				4934316
Net Balance	115998.4				

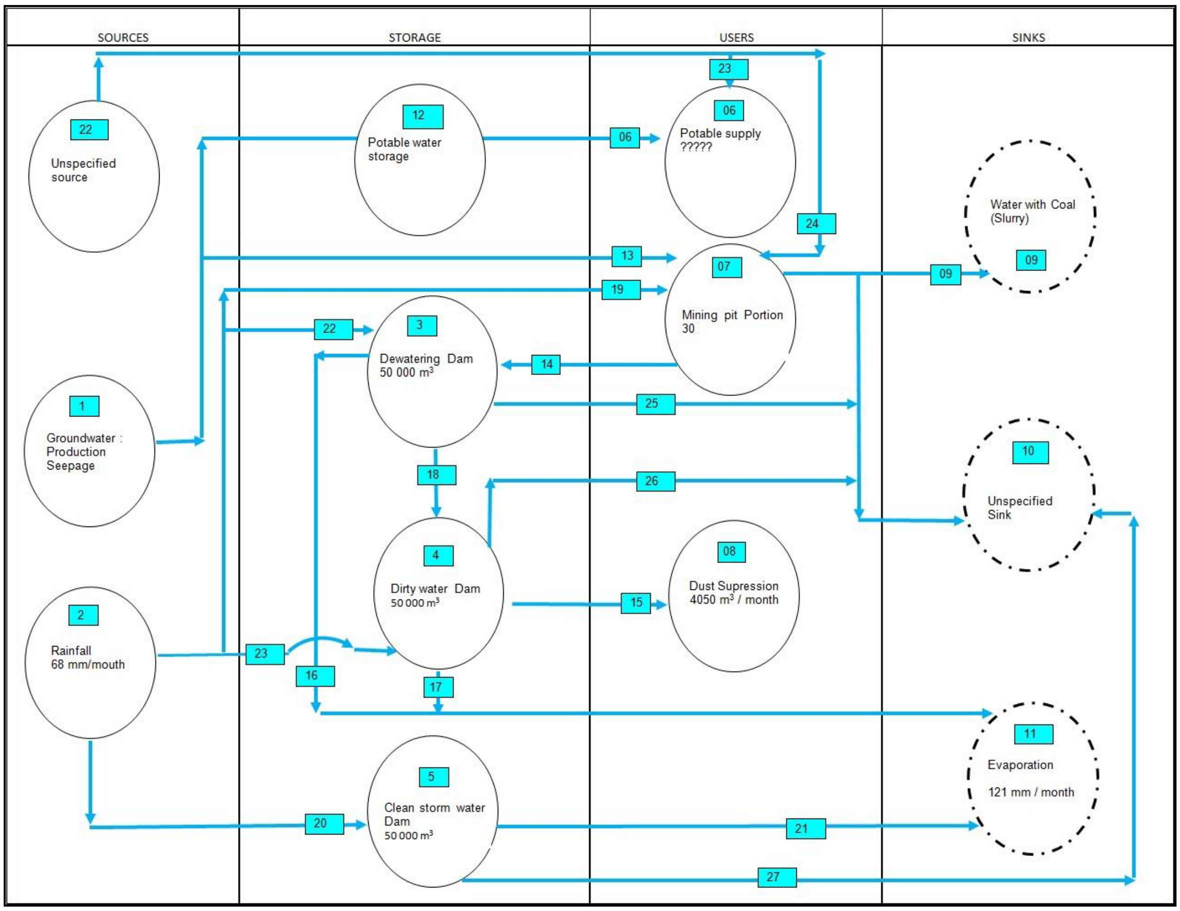

Figure 57: Generic Flow Diagram for Water Balance Alternative 3 (Portion 30)

Table 60: Description of Generic Water Balance Flow diagram for Alternative 3 (Portion 30)

Stream /Activity number	Description	Specific usage L/t)	Average Volume / Month
1	Total volume of ground water taken in by the mine for all uses, including boreholes production and ground water entering	2.09	748916.67
2	Total rain water taken in by the mine for all uses, including rain into pits, storage dams and stormwater runoff	1.18	422833.33
3	Total volume of water stored in the Dewatering dam		
4	Total volume of water stored in the Dirty water dam		
5	Total volume of water stored in the Clean water dam		
6	Total volume used for human needs	0.11	39416.67
7	Total volume used for mining in the pit area		
8	Total water need for dust suppression		4050000.00
9	Total water associated with slurry		
10	Total water of going to unspecified sink		
11	Total water evaporated from the portion	0.13	46583.33
12	Total Potable water stored		
13	Total volume of groundwater that seep into Open pit Area when operating		
14	Total volume of water pump from Open pit Area (ground water + Run-off water)to the dewatering dam		
15	To test water pump from dirty dam for dust suppression during operation		
16	Total volume of water evaporated from the dewatering dam		
17	Total volume of Dirty water drained to the dirty water dam		
18	Total volume of water pumped from dewatering Dam to the Dirty dam		
19	Total volume of rain water falling directly on the Open pit mining area including upstream run-off water		
20	Total volume of clean water drained to the clean water dam + volume of rain water falling directly on the dam		
21	Total volume of water evaporated from the clean water dam		
22	Total volume of unspecified source water		

23	Total volume of potable water supplied from unspecified sources		
24	Total volume of used in mine pit supplied from unspecified sources		
25	Total volume of water lost from dewatering dam to unspecified sinks		
26	Total volume of water lost from dirty water dam to unspecified sinks		
27	Total volume of water lost from clean water dam to unspecified sinks		

Table 61: Calculated initial Generic Water Balance for alternative 3 - portion 30 (195.2 ha)

Sources	Average monthly Volume (m^3)	Storage	Use	Sinks	Average monthly Volume (m^3)
Groundwater	202160.62			Evaporation	408981.8
Rain (Run-off)	309898.91			Unspecified sink	274082
Unspecified source	187104.49			Slurry	41.42
Total	699164.03				683105.2
Net Balance	16058.78				

4.10 ROAD, RAIL, AND POWER

The existing entrance to Glisa will be utilised by the Paardeplaats Coal Mine. Coal will be trucked out via the Spitskop Road (R33) to the Glisa siding where it will be transported to end users. The Traffic Impact Assessment undertaken determined that the number of additional vehicles as a result of the Paardeplaats operation will result in less than 100 additional vehicles, which is considered low in comparison to the roads design capacity. Due to the limited infrastructure required by the Paardeplaats Coal Mine all power that will be required will be diesel generated.

4.11 TRANSPORTATION OF RUN OF MINE

Run of Mine will be transported by truck and train utilising the same methods as the current Glisa operations.

4.12 LIST OF MAIN MINING ACTIONS, ACTIVITIES AND PROCESSES OCCURRING ON SITE

The main mining actions, activities and process that are planned to take place on site are listed in the table below. All actions, activities and processes have been grouped into each of the relevant project phases namely: pre-construction, construction, operation, decommissioning, rehabilitation and closure. For the purpose of this report, the following broad definitions apply:

- Pre-construction refers to the phase in which planning takes place;
- Construction refers to the phase in which infrastructure is established;
- Operation refers to the phase in which physical mining and production takes place;
- Decommissioning refers to the phase in which infrastructure is removed and rehabilitation efforts are applied and their success monitored; and
- Closure refers to the phase in which maintenance and rehabilitation monitoring are undertaken to ensure that the mines closure objectives are met.

Table 62: List of main action, activities or processes on site and per phase

Main Activity/Action/Process	Ancillary Activity	Pre-Construction	Construction	Operation	Decommissioning	Closure
Site preparation	Vegetation clearance		As required	As required	As required	
	Removal of infrastructure		As required	As required	As required	
	Planned placement of infrastructure		At start of phase	As required		
	Establishment of construction contractor area		At start of phase	As required		
Human resources management	Employment/recruitment		At start of phase	As required	As required	As required
	I&AP consultations		At start of phase	On-going	On-going	On-going
	CSI initiatives		At start of phase	On-going	On-going	On-going
	Skills development programmes	At start of phase	On-going	On-going	On-going	On-going
	Environmental awareness training		At start of phase	On-going	On-going	As required
	HIV/AIDS Awareness programmes		At start of phase	On-going	On-going	
	Integration with Municipalities' strategic long term planning	At start of phase	On-going	On-going	On-going	
Earthworks	Stripping and stockpiling of soils		At start of phase	As required	As required	
	Cleaning, grubbing and bulldozing		At start of phase	As required	As required	
	Removal of building waste and cleared vegetation		At start of phase	As required		
	Digging trenches and foundations		At start of phase	As required	As required	
	Blasting		As required	As required	As required	
	Establishment of external haul roads		At start of phase			
	Establishing stormwater management measures		At start of phase	As required	As required	
	Establishment of firebreak		At start of phase	As required	As required	
Civil Works	Establishment of infrastructure and services		At start of phase	As required		
	Mixing on concrete and		As required	As required		

Main Activity/Action/Process	Ancillary Activity	Pre-Construction	Construction	Operation	Decommissioning	Closure
	concrete works					
	Establishment of PCD's and pit dewatering dam		At start of phase	As required	On-going	
	Establishment of dewatering pipelines		At start of phase	As required		
	Establishment of mobile office and ablution block		At start of phase	As required	As required	
	Sewage and sanitation		At start of phase	On-going	On-going	
	Establishment of fuel storage area		At start of phase			
	Establishment of chemical storage area		At start of phase			
	Establishment of explosives storage area		At start of phase			
	Establishment of general waste area		At start of phase			
	Access control and security		At start of phase	As required	As required	
	General site management		On-going	On-going	On-going	On-going
Open pit mining	Drilling		As required	As required		
	Blasting		As required	As required		
	Excavations		As required	As required		
	Removal of overburden by dozing and load haul			As required		
	Establishment of internal haul roads			As required	As required	
	Removal of ore			On-going		
	Establishment of RoM stockpiles			As required	As required	
	RoM stockpile transport to NBC Glisa			On-going	On-going	
	De-watering of open pit			On-going	On-going	
	Pumping of water to PCD's			On-going	On-going	
	Waste rock dumps for backfilling			On-going	On-going	
	Soil management		On-going	On-going	On-going	On-going
	Water management		On-going	On-going	On-going	On-going
	Concurrent rehabilitation			On-going	On-going	On-going
	Water treatment			On-going	On-going	On-going

Main Activity/Action/Process	Ancillary Activity	Pre-Construction	Construction	Operation	Decommissioning	Closure
Infrastructure removal	Dismantling and demolition of infrastructure				As required	
	Blasting				As required	
	Safety control				On-going	On-going
Rehabilitation	Backfilling of pits and voids			On-going	On-going	
	Slope stabilisation			On-going	On-going	On-going
	Erosion control			On-going	On-going	On-going
	Landscaping			On-going	On-going	On-going
	Replacing topsoil			On-going	On-going	On-going
	Removal of alien/invasive vegetation			On-going	On-going	On-going
	Re-vegetation			On-going	On-going	On-going
	Restoration of natural drainage patterns				On-going	On-going
	Remediation of ground and surface water			On-going	On-going	On-going
	Rehabilitation of external roads				On-going	On-going
Maintenance	Initiate maintenance and aftercare program				At end of phase	On-going
	Environmental aspect monitoring			On-going	On-going	On-going
	Monitoring of rehabilitation					On-going

4.13 LIST OF ACTIVITIES IN TERMS OF NEMA EIA REGULATIONS

Table 63: Listed Activities triggered by the proposed Paardeplaats project

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):	Triggered by:
Activities for Basic Assessment:			
GNR 544 of 18 June 2010	Activity 9	The construction of a pipeline exceeding 1000m in length for the transportation of water	Dewatering Pipeline construction
GNR 544 of 18 June 2010	Activity 11	The construction of canals, channels, dams and bulk stormwater outlets to be constructed within a watercourse	Pollution Control Dam, Pit Dewatering Dam & Storm water Management Infrastructure
GNR 544 of 18 June 2010	Activity 12	The construction of infrastructure for the off-stream storage of water with a combined capacity of 5000 cubic m	Pollution Control Dam and Pit Dewatering Dam Construction
GNR 544 of 18 June 2010	Activity 13	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres	Construction of Diesel Storage Area.
GNR 544 of 18 June 2010	Activity 22	The construction of a road outside of urban areas: (i) with a reserve wider than 13,5m (ii) where no reserve exists where the road is wider than 8m	Haul Road Construction.
GNR 544 of 18 June 2010	Activity 26	Any process of activity identified in terms of Section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)	Proposed project is located in a vulnerable eco-system namely Easter Highveld Grassland.
GNR 544 of 18 June	Activity 47	The widening of a road by more than 6m or the lengthening of a road by more	Haul Road

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):	Triggered by:
2010		than 1Km: (i) where the existing reserve is wider than 13,5m (ii) Where no road reserve exists, where the existing road is wider than 8m	Construction
Activities for Scoping, EIA and EMP:			
GNR 545 of 18 June 2010	Activity 5	The construction of facilities/infrastructure for any process or activity which requires a permit or license in terms of the national or provincial legislation governing the generation/release of emissions, pollution or effluent and which is not identified in GNR 544 or included in the list of Waste Management Activities published in terms of NEMWA.	Construction and Operation of the Temporary General Waste Storage Area. Activity 5 will be applied for under the NEMWA Category A Activity 1
GNR 545 of 18 June 2010	Activity 15	Physical alteration of undeveloped, vacant or derelict land for industrial use where the total area to be transformed is 20 hectares or more	Open Pit Creation
GNR 545 of 18 June 2010	Activity 19	The construction of a dam where the highest part of the wall is 5m or higher or where the high water mark of the dam covers an area of 10 hectares or more	Construction of Pollution Control Dam and Pit Dewatering Dam
GNR 545 of 18 June 2010	Activity 20	Any activity which requires a mining right or renewal thereof as contemplated in Section 22 and 24 respectively of the MPRDA (Act. No. 28 of 2002)	Mining Right Application
Provincial Specific Activities:			
GNR 546 of 18 June 2010	Activity 12	The clearance of an area of 300 square metres of more where 75% constitutes indigenous vegetation within a critically endangered or endangered eco-system listed in terms of Section 52 of the NEMBA	Vegetation clearance of Eastern Highveld Grassland for the proposed mine.
GNR 546 of 18 June 2010	Activity 14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative covers constitutes indigenous vegetation in all	Vegetation clearance for the proposed mine

Indicate the number and date of the relevant notice:	Activity No (s) (in terms of the relevant or notice) :	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):	Triggered by:
		areas outside of urban area.	
GNR 546 of 18 June 2010	Activity 16	The construction of : (iii) Buildings with a footprint exceeding 10 square metres in size or (iv) Infrastructure covering 10 square metres or more Where such construction occurs within 32m of a watercourse	Construction of the Mobile Office and Ablution Block as well as Storm Water Management Infrastructure, Pollution Control Dam and Pit Dewatering Dam.
Activities for Waste Management License (WML) for Basic Assessment:			
Category A of July 2009	Activity 1	Construction and operation of the waste storage facility The storage, including temporary storage of general waste at a facility that can store in excess of 100 cubic m of waste at one time, excluding waste stored in a lagoon.	Storage of General Waste

4.14 PLANS SHOWING THE LOCATION AND AERIAL EXTENT OF PROPOSED OPERATIONS

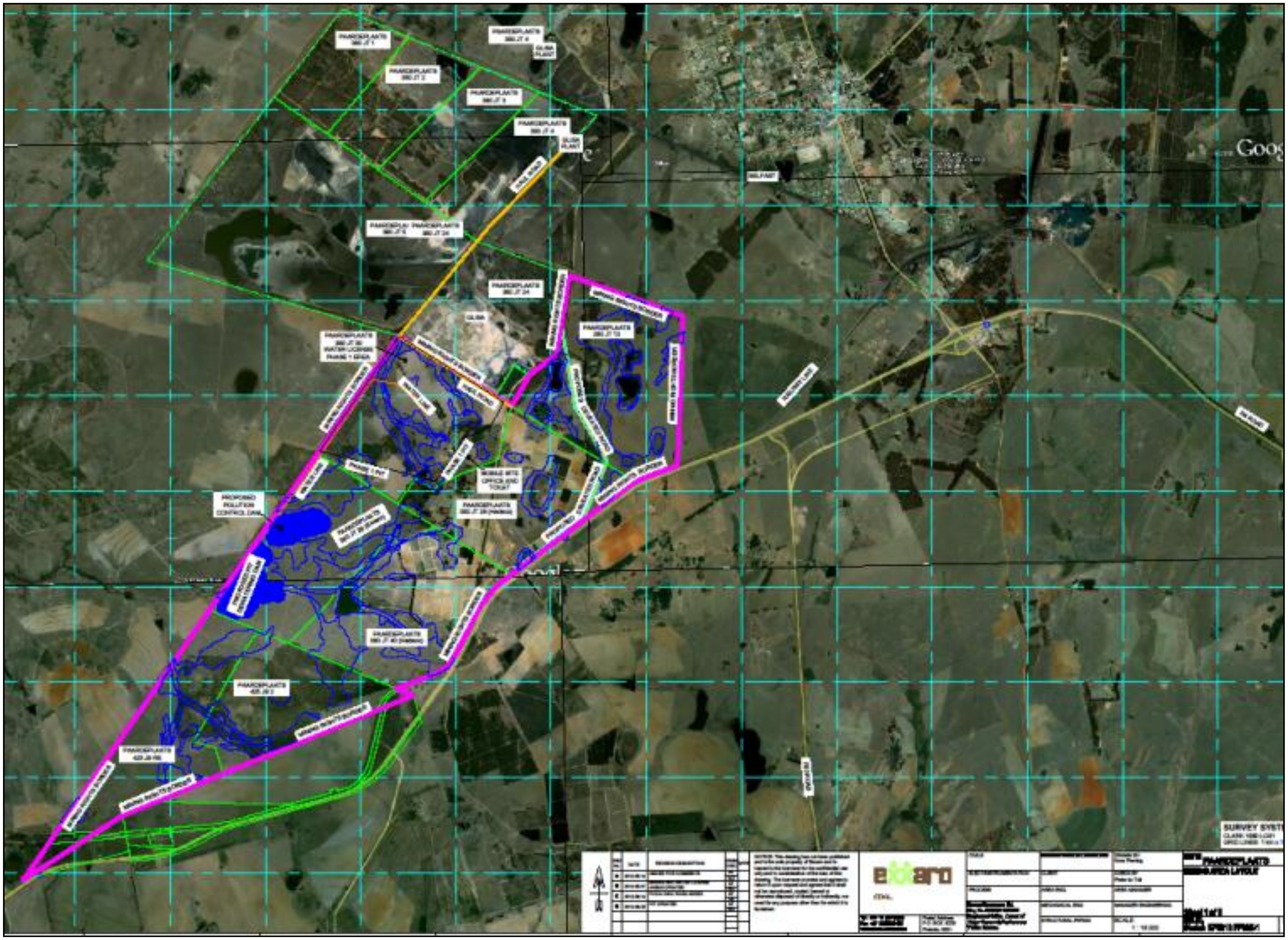

Figure 58: Layout of proposed mining activities

5 POTENTIAL IMPACTS OF THE MINING OPERATION

5.1 LIST OF POTENTIAL IMPACTS ON ENVIRONMENTAL ASPECTS

The identification of potential impacts for further assessment was undertaken through I&AP consultation, specialist in put and the development of an in depth understanding of the activities, actions and processes to be undertaken on site by the EAP. As such, the potential impacts on broad environmental aspects, in respect of each of the main project actions, activities and processes are provided below in tabular form.

Table 64: List of potential impacts on environmental aspects

Main Activity/Action/Process	Phase	Potential Impacts to environmental aspects
Site preparation	Construction Operation Decommissioning	Disturbance, damage and destruction of biodiversity
		Disturbance, damage and destruction of wetlands
		Air pollution
		Noise pollution
		Visual impacts
		Disturbance, damage and destruction of heritage features
Human resource	Pre-construction Construction Operation Decommissioning Closure	Loss of current land uses through bio-physical impacts
		Blasting hazards
		Vibration nuisance
		Noise nuisance
		Dust nuisance
		Relocation and resettlement
		Project related road use
		Economic impacts (positive and negative)
Earthworks	Construction Operation Decommissioning	Loss of soil resource
		Loss of land capability
		Disturbance, damage and destruction of biodiversity
		Disturbance, damage and destruction of wetlands
		Surface water pollution
		Alteration of natural drainage patterns
		Groundwater pollution/contamination
		Air pollution
		Noise pollution
		Visual impacts
		Disturbance, damage and destruction of heritage features
Civil works	Construction Operation Decommissioning	Loss and sterilisation of mineral resources
		Loss of soil resource
		Loss of land capability
		Disturbance, damage and destruction of biodiversity
		Disturbance, damage and destruction of wetlands

Main Activity/Action/Process	Phase	Potential Impacts to environmental aspects
		Surface water pollution
		Alteration of natural drainage patterns
		Groundwater pollution/contamination
		Air pollution
		Noise pollution
		Visual impacts
		Disturbance, damage and destruction of heritage features
Open pit mining	Construction Operation Decommissioning	Loss and sterilisation of mineral resources
		Loss of soil resource
		Loss of land capability
		Disturbance, damage and destruction of biodiversity
		Disturbance, damage and destruction of wetlands
		Surface water pollution
		Alteration of natural drainage patterns
		Groundwater pollution/contamination
		Pit dewatering
		Air pollution
		Noise pollution
		Visual impacts
		Blasting hazards
		Loss of current land uses
		Disturbance, damage and destruction of heritage features
Infrastructure removal	Pre-construction Construction Operation Decommissioning	Loss of soil resource
		Disturbance, damage and destruction of biodiversity
		Surface water pollution
		Alteration of natural drainage patterns
		Groundwater pollution/contamination
		Air pollution
		Noise pollution
		Blasting hazards
		Visual impacts
		Disturbance, damage and destruction of heritage features
Rehabilitation	Operation Decommissioning Closure	Loss of soil resource
		Disturbance, damage and destruction of biodiversity
		Surface water pollution
		Alteration of natural drainage patterns
		Groundwater pollution/contamination
		Visual impacts
Maintenance	Operation Decommissioning Closure	Loss and sterilisation of mineral resources
		Loss of soil resource through pollution
		Loss of land capability through pollution
		Alteration of natural drainage patterns
		Surface water pollution
		Groundwater contamination

5.2 LIST OF POTENTIAL CUMULATIVE IMPACTS

The potential cumulative impacts of the proposed Paardeplaats Coal Mine are listed below in broad terms. It should be noted that part of the methodology for assessing impacts includes the consideration of cumulative impacts. Please refer to Section 7.1 for information on the methodology applied.

Potential cumulative impacts on the environment include:

- Loss of soil resource;
- Loss of land capability;
- Disturbance, damage and destruction of biodiversity;
- Disturbance, damage, destruction of wetlands;
- Surface water pollution and contamination;
- Groundwater pollution and contamination;
- Alteration of natural drainage patterns;
- Air pollution;
- Blasting hazards;
- Noise pollution; and
- Visual impacts.

5.3 POTENTIAL FOR ACID MINE DRAINAGE

Acid-base accounting (ABA) is a screening procedure whereby the acid-neutralising potential and acid-generating potential of rock samples are determined and the difference (net neutralising potential) is calculated. The net neutralising potential and/or the ratio of neutralising potential to acid-generation potential are compared with a predetermined value, or set of values, to divide samples into categories that either require or do not require, further determinative acid potential test work. The potential for a given rock to generate and neutralise acid is determined by its mineralogical composition. This includes the quantitative mineralogical composition and also individual mineral grain size, shape, texture and spatial relationship with other mineral grains. The term "potential" is used because even the most detailed mineralogical analysis, when combined with ABA, can give only a "worst-case" value for potential acid production and, depending upon the NP procedure used, a "worst-case", "most likely case" or "best-case" value for potential neutralisation capability.

Neutralisation potential measures the total of carbonates, alkaline earths and bases available to neutralise acidity, and represents the most favourable condition. Calculations of maximum potential acidity and neutralisation potential are structured to equate the two measurements to a common basis for comparison. The resulting values, expressed as calcium carbonate equivalent, are compared to compute a net acid-producing or acid-neutralising potential. The primary advantages of the acid-base accounting method are:

- Short turn-around time for sample processing;
- Low cost;
- Relatively simple analytical procedures; and
- Relatively simple interpretation of results.

The principal disadvantages of acid-base accounting are:

- The method predicts maximum potential acidity and maximum neutralisation capability, and implies a 1:1 acid to base reaction. Actual acid production and neutralisation release rates cannot be predicted with this technique.
- Acid-Base Accounting assumes that all acid production is attributable to iron disulphide minerals (chiefly pyrite) and that no acid is produced by sulphate or

The overburden has a maximum %S of 0.11% and could therefore be classified in terms of its %S as having no potential to generate acidic drainage over the long term. However, the overburden will also not be able to neutralize any acidic drainage from other backfill rock since it has almost no neutralization potential. The overburden could be used as a cover material with rehabilitation.

The No. 4 Upper coal seam sample has a %S of 0.370 and could therefore be classified in terms of its %S as potentially acid generating. Because of the high neutralization potential the No. 4 Upper coal seam will not have a net potential to generate acidic drainage over the long-term.

The No. 4 Lower coal seam has a very high %S of 6.1% and could therefore be classified in terms of its %S as potentially acid generating. A significant portion of the No. 4 Lower coal seam will therefore generate acidic drainage over the long term. Some of the coal will remain in the pit in the discarded roof and floor waste rocks.

The mudstone above the No. 3 coal seam has a maximum %S of 0.05% and could therefore be classified in terms of its %S as having no potential to generate acidic drainage over the long term. The mudstone will have some potential to neutralize acidic drainage from other backfill rock because of its elevated NP.

The No. 3 coal seam sample has a %S of 0.25 and could be classified in terms of its %S as having no potential to generate acidic drainage over the long term. The No. 3 coal seam has a significant neutralization potential with a resultant NNP of >20 kg/t and a NP/AP of above 4. However, in the duplicate the NNP is <20 kg/t and the NP/AP is <2. The No. 3 coal seam will have a variable potential to generate acidic drainage over the long-term.

The siltstone above the No. 2 coal seam has a maximum %S of 0.06% and could therefore be classified in terms of its %S as having no potential to generate acidic drainage over the long term. The siltstone will have some very limited potential to neutralize acidic drainage from other backfill rock.

The No. 2 coal seam has a high %S of 0.45% (and 2.35 % in duplicate) and could therefore be classified in terms of its %S as potentially acid generating. The coal sample has a significant neutralization potential with a resultant NP/AP of 4.92. Because of the high %S the NP/AP in the duplicate is 0.951. A significant portion of the No. 2 coal seam will therefore generate acidic drainage over the long term.

The slurry has a high %S of 0.54% (and 0.31% in duplicate) and could therefore be classified in terms of its %S as potentially acid generating. The slurry has a significant neutralization potential with a resultant NP/AP of >4. Because of the high neutralization potential, the slurry will have no potential to generate acidic drainage over the long term. It is highly likely, that the proposed mining operation will result in a net acid producing potential.

Acid based Accounting results for newly drilled boreholes

Six samples, collected from the newly drilled boreholes, were submitted for ABA analysis. A summary of samples is presented in Table 65 and the results are presented in Table 66. Rock classification based on the ABA is presented in Table 67.

Table 65: Samples submitted for ABA analysis, 2013

Borehole Number	Sample depth (mbgl)	Sample Description	Coal Layer represented	Comments
BH1 A	26 to 30	Coal	Seam 4	Drill chip sample
BH1 A	23 to 24	Siltstone	Roof of seam 5	Drill chip sample
BH1 B	19 to 20	Coal	Seam 5	Drill chip sample
BH2 A	26 to 30	Coal	Seam 4	Drill chip sample
BH2 A	23 to 24	Coal	Seam 5	Drill chip sample
BH2 B	15 to 16	Siltstone	Roof of seam 5	Drill chip sample

The samples were taken to represent seam 4 coal, seam 5 coal and the siltstone at the roof of seam 5 coal.

The results indicate slight possibility of acid forming for three of the samples (BH1A (26-30 m), BH2B (16 m) and BH21A (24 m). Borehole BH1A (2 m) and BH1B (21 m) indicate that there are no acid forming potential.

Table 66: The results of the Acid base accounting for the newly drilled boreholes

Acid – Base Accounting Modified Sobek (EPA-600)	Sample Identification					
	BH 1A (26-30m)	BH 2A (26-30m)	BH 2B (15- 16m)	BH 1A (23-24m)	BH 1B (19-20m)	BH2A (23-24m)
Paste pH	7.8	7.9	7.3	7.9	8	7.9
Total Sulphur (%) (LECO)	0.94	0.72	0.32	0.16	0.1	0.72
Acid Potential (AP) (kg/t)	29.38	22.5	10	5	3.13	22.5
Neutralization Potential (NP)	16.46	22.7	2.75	8.22	9.05	16.19
Nett Neutralization Potential (NNP)	-12.91	0.2	-7.25	3.22	5.93	-6.31
Neutralizing Potential Ratio (NPR) (NP : AP)	0.56	1.01	0.28	1.64	2.9	0.72
Rock Type	I	II	I	III	III	I

- Negative NP values are obtained when the volume of NaOH (0.1N) titrated (pH: 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 – 2.5. Any negative NP values are corrected to 0.00.

Table 67: Rock classification

TYPE I	Potentially Acid Forming	Total S(%) > 0.25% and NP:AP ratio 1:1 or less
TYPE II	Intermediate	Total S(%) > 0.25% and NP:AP ratio 1:3 or less
TYPE III	Non-Acid Forming	Total S(%) < 0.25% and NP:AP ratio 1:3 or greater

Based on the ABA results of samples from the newly drilled boreholes and presented in the tables above, the following comments can be made:

- Samples of seam 5 show intermediate to potential characteristic to generate acid;
- Samples of the siltstone collected from the roof of the seam 5 potential to non potential acid generating characteristics;
- Seam 4 is likely to produce acid.

6 ALTERNATIVE LAND USE AND DEVELOPMENTS

6.1 DEVELOPMENT ALTERNATIVES

The identification and assessment of alternatives is a key component to the success of the EIA process. During the Scoping phase three feasible project alternatives were identified for further assessment during the EIA phase.

All three alternatives were assessed by all specialists appointed to the project. These three development alternatives are presented below, have been comparatively assessed, and a summary provided. As such, the development alternatives for the proposed Paardeplaats Coal Mine are as follows:

6.1.1 ALTERNATIVE 1: NO GO ALTERNATIVE

This alternative implies that no further development of the proposed Paardeplaats Coal Mine takes place on the areas under application. As such, the current receiving environment remains unaltered and represents a continuum of the status quo which currently includes activities such as commercial agriculture (arable and grazing), the highly specialised cold climate bulb farming operation of Hadeco, homesteads, “undisturbed” natural vegetation and the adjacent NBC Glisa mining operation.

In terms of overall biodiversity, the proposed project area remains high and displays signs of sound ecological health despite large scale current land uses such as NBC Glisa and Hadeco operations. 27% of the site is comprised of wetlands and both surface and ground water quality is relatively good but show indications of possible contamination from agricultural activities.

It is worth noting that whilst the proposed Paardeplaats study area is located in a relatively pristine environment, the continued operation of mines in the surrounding area represent a *potential* risk of eventually impacting negatively on the area making it less than ideal from an environmental perspective regardless of whether or not the Paardeplaats Coal Mine is to be developed.

The No Go Alternative will result in few if any mining related impacts being experienced by the receiving environment of the proposed site. The biophysical impacts likely to be experienced by the selection of this alternative include those related to agriculture, grazing and the Hadeco’s cold climate bulb operation. The No Go Alternative will also allow for the following:

- Continuation of the Hadeco operations;
- Continued employment of 60 + (12-150) seasonal workers; and

- Continued employment of an additional 85 employment positions at Hadeco's Head Office as a result of its Belfast operations.

However, if the proposed Paardeplaats mining development does not proceed it is likely that no additional socio-economic benefits would be created in the area, the mineral resource will be lost and future secure supply of coal to Eskom may be compromised. In addition, the continued operation of NBC Glisa Coal Mine is likely to be halted as the proposed Paardeplaats Coal Mine is envisaged to act as an extension of Glisa to assist in the current mines rapidly dwindling RoM and LoM. Further implications of the No-Go option include:

- Loss of approximately 161 employment opportunities at the NBC Glisa Coal Mine;
- Loss of economic input into the area; and
- Loss of regional socio-economic benefit.

6.1.2 ALTERNATIVE 2: MAXIMUM MINE PRODUCTION

In this alternative, the mining and production of coal is emphasised. Less restrictive mitigation measures will be used to protect the environmental features, thus allowing for maximum coal production. This approach will increase the financial viability of the proposed Paardeplaats Coal Mine at the potential cost of impacting on more environmental features than the Sensitivity Planning Approach. This alternative is likely to increase landscape character changes and impact on aspects such as land use, employment, hydrology and biodiversity, as mining operations will likely move through sensitive environmental features and mine the majority of the area under application.

The implications of Alternative 2 – the Maximum Mine Production Alternative, in socio-economic terms are as follow:

- Increase in resident complaints and conflict as mining moves closer exacerbated by historical grievances with Glisa;
- Mining operation will require the resettlement of the Hadeco Village;
- Loss of 60 permanent employment opportunities at Hadeco;
- Loss of 62 seasonal employment opportunities at Hadeco;
- Loss of 85 employment opportunities at Hadeco's Head Office;
- Disruption of livelihoods at the Hadeco Village;
- Removal of Hadeco's infrastructure;
- Loss of current grazing land;

- Retention of 161 employment opportunities at Glisa;
- Potential limited additional employment opportunities at Glisa;
- Increase in net income;
- Increased economic input into the area;
- Increase in regional socio-economic benefit;
- Increase in infrastructure investment; and
- Loss of *net employment* opportunities due to Hadeco Relocation, possibly abroad.

The Maximum Mine Production Alternative will have severe socio-economic impacts that will prove incredibly difficult to manage. In terms of bio-physical aspects, the Maximum Mine Production Alternative is likely to experience similar impacts in nature to the Sensitivity Planning Approach however these impacts will be exacerbated by the extension of both the temporal and spatial scale of the proposed mining operation. The increase in both scale and time is significant in terms of cumulative impacts and the capacity to manage impacts and remediate environmental contamination and pollution.

Notable impacts exacerbated by the selection of this Alternative include the destruction of 220 ha of wetland (within a stressed catchment), the possible relocation of 5 informal cemeteries with a total of 136 graves, inter catchment water quality impacts and increases in fall out dust and noise nuisances due to increased infrastructure requirements and as mining operations continue as well as the relocation of Hadeco and its employees which include 39 families.

6.1.3 ALTERNATIVE 3: SENSITIVITY PLANNING APPROACH

This alternative emphasises resource (bio-physical and socio-economic) protection and uses stringent measures to identify locations within the proposed area that are both (relatively) suitable and unsuitable for mining operations. This alternative relies heavily on specialist planning and evaluation to identify areas of consolidated sensitivities that should, as far as is practically possible, be avoided.

The proposed Paardeplaats Coal Mine is only economically viable if permission is granted to mine Portion 30 of the Farm Paardeplaats 380 JT as it is this portion that contains high grade (A-Grade and P58) coal as well as lower grade coal reserves. Fortunately, Portion 30 and Portion 40 display the lowest relative, overall bio-physical sensitivity of the land parcels included in the application area despite the presence of numerous wetlands.

However, Portion 40 is owned and operated by Hadeco and in consultations with Hadeco it has been confirmed that it is of critical importance to their operations. Portion 40 contains expensive, specialised infrastructure in the form of stores, cold treatment rooms, bulb treatment pits, dams for irrigation water, houses, a staff village, pumping station and main irrigation lines. This infrastructure is also used to support the processing, treatment and storage of flower bulb crops produced in both warmer and temperate climates, specifically Hadeco's primary export - Hippeastrum. Hadeco operations on portions 34, 35 and 36 (outside the application area) are also highly dependent on the infrastructure located on Portion 40. Based on this, Portion 40 was delineated as highly sensitive and demarcated as No Go.

As a result of the exclusion of Portion 40, the Exxaro owned Portion 30 was evaluated as a suitable stand-alone mining alternative instead. In terms of the bio-physical environment, the (relative) advantages of the Sensitivity Planning Approach Alternative are as follows:

- Located in an area of no mammalian importance;
- Located in an area of moderate to low with small area of very high avifauna importance;
- Located in an area not considered to have any herpetofauna conservation importance;
- In a location of equal parts natural, successional and transformed habitat;
- 46 ha of wetland (Two class D, one class C and a portion of a Class B);
- Ground water flow is toward Glisa;
- Lower impact in terms of fallout dust from vehicle entrainment;
- Mining activity restricted to a single sub-catchment that is already heavily impacted on by NBC Glisa; and
- Potential disturbance of 2 heritage structures and one informal cemetery with 2 graves.

The mining of only Portion 30 also allows for off-set planning in an eco-system displaying sound ecological health and opportunities for in-situ conservation. With regards to wetlands, if an off-set ratio of 5:1 is assigned then the remaining wetlands on site can be used to off-set the loss of 46 ha wetlands (as a result of mining Portion 30) and preserving 231.95 ha as well as habitat for fauna and flora, possibly turning the land into a designated conservation area thereby protecting it from further development and maintaining the ecological integrity of remaining areas within the second sub-catchment, into perpetuity.

In terms of the socio-economic environment, the (relative) advantages of the Sensitivity Planning Approach Alternative are as follows and pronounced:

- Retention of 161 employment opportunities at Glisa;
- Increased economic input into the area;
- Maintenance of regional socio-economic benefit;

- Retention of 60 permanent employment opportunities at Hadeco;
- Retention of 62 seasonal employment opportunities at Hadeco;
- Retention of 85 employment opportunities at Hadeco's Head Office;
- Maintenance of Hadeco's highly specialised operations on Portion 29 and 40 respectively;
- Maintenance of Hadeco's infrastructure;
- Maintenance of livelihoods at the Hadeco Village; and
- Net positive increase in both *employment* and *income*.

In summary, the advantages of Alternative 3, the Sensitivity Planning Approach are two-fold. Firstly, Alternative 3 allows for the continuation of existing land uses on other portions within the application area, most notably the highly specialised Hadeco cold climate bulb farming operation and for mining. This in turn provides the local economy a net gain in terms of both income and employment in a municipality in which both are required. The concurrent existence of both land uses also results in less socio-economic disruptions to the livelihoods of people living and working within the application area, particularly those of the Hadeco Village.

Secondly, Alternative 3 allows for a reduction in temporal and spatial scales of mining related impacts as the mining operation is confined to Portion 30 only. The reduction in both scale and time is significant in terms of cumulative impacts and the capacity to manage environmental impacts as well as remediate environmental contamination and pollution.

If the proposed Paardeplaats Coal Mine is to be approved, it is the recommendation of the EAP, which is supported by several of the specialists that Alternative 3 – Sensitivity Planning Approach be approved. Approval of this alternative is however on condition that strict environmental management measures and monitoring be discussed with Hadeco and employed to prevent unnecessary disruption to their operations by the mining operation.

6.2 ALTERNATIVE LAND USES

The current land uses on site comprises of a mixture of commercial agriculture (arable and grazing), the Hadeco cold climate bulb operation and farm homesteads for workers. Most of the commercial agriculture on site involves the farming of maize monoculture as well as grazing for livestock such as cattle, sheep, springbok, and blesbok. Some dams are present and used for trout fishing on a small commercial scale and recreationally by surface rights holders.

6.2.1 DESCRIPTION OF ALTERNATE LAND USES

6.2.1.1 Mining

Mining is the predominant activity within the area. Several active mines, predominantly coal mines, are located within the surrounding project area. The mining operations within the area are numerous and can be categorised as open cast operations and underground operations with surface access nodes. Additional supporting mining infrastructure is also present and includes slurry and co-disposal facilities, conveyor routes, haul roads, offices, pipelines, and power lines. The closest operating mine is NBC Glisa Coal Mine.

The Paardeplaats coal mine project will operate as an extension of Glisa to ensure that Exxaro is able to make optimum usage of the mineral resources within the project area and supply coal, essential for Eskom, to meet the growing energy demand of South Africa, making it both necessary and desirable.

6.2.1.2 Cultivated Land and Grazing

Farming is the second largest land use occurring within the area. The mining right area is surrounded by farms to the east, west, and south. Farms within the area are predominantly used for monocultures such as maize as well as grazing land for cattle and sheep. Within the Paardeplaats study area, this trend is also observable as it is dominated by maize farming and grazing land for cattle, sheep, blesbok, and springbok. The study area also contains irrigated land used by Hadeco for their highly specialised cold climate bulb operation.

Other than the Hadeco operation, most farming practices within the area take place on a very limited scale and many of the farms in the surrounding area are owned by mining companies and leased to farmers for utilisation. As such, and based on the close proximity of the existing NBC Glisa coal mine, it is not envisaged that large scale farming activities (except for highly specialised operations such as Hadeco’s) to be considered a feasible alternative to mining activities within the study area and the surrounding area in general.

6.2.1.3 Residential Development

Belfast is the nearest town to the proposed Paardeplaats coal mine. The character of Belfast is of a rural nature, in which farming and mining are the predominant economic activities. Residential development is not suitable for the Paardeplaats project area due to the close proximity of the NBC Glisa coal mine and other surrounding mining operations. Mining impacts such as dust, noise, blasting and ground vibration are unlikely to make the proposed Paardeplaats site any more attractive or feasible for residential development.

6.2.1.4 Tourism

The proposed Paardeplaats coal mine is located close to the town of Belfast, which is part of the Highlands Meander and a well-known fly-fishing destination. The Hadeco cold climate bulb operation is located within the proposed project area is a popular tourist destination in spring when the tulips are in bloom. The prevalent mining character of the area does limit the probability of further tourism success in the immediate area. As such, tourism potential and development in the immediate area is possible, but unlikely to be highly successful as an alternative land use at present.

6.2.2 DESCRIPTION OF MAIN FEATURES AND INFRASTRUCTURE RELATED TO ALTERNATIVE LAND USE

Cultivated land and grazing remain the only feasible alternative land use at present. This is due to prevailing land capability and the close proximity of an existing mine, namely NBC Glisa. As such, a description of the main features and infrastructure related to cultivated land and grazing as an alternative land uses is discussed below.

Cultivated land and grazing as land uses are dependent on two main environmental features both influenced by climate namely; agricultural soil potential and the availability of good quality water. Just over half the area under application (54.76% or 805 ha) is considered to have moderate to very high agricultural potential with few limitations except those related to restrictions in depths. The areas approximate grazing capacity level is 7-8 ha/LSU and is home to around 150-160 head of cattle. Good quality water is also present and the presence of irrigation, through a network of specially laid furrows is visible on properties owned and operated by Hadeco. Several dams are also present and used for regular crop irrigation. As such, the pre-mining land capability is suited to both cultivated land and grazing as alternative land uses.

The infrastructure related to cultivated land and grazing is dependent on supporting environmental features such as agricultural soil potential and the availability of good quality water but also the scale of the operation. In general, cultivated land uses for large scale or specialised farming practises (such as Hadeco) require more detailed infrastructure requirements than grazing. Infrastructure for cultivated land uses include (but are not limited to):

- Large storage sheds;
- Cold treatment rooms;
- Refrigeration units;
- Fuel storage;
- Fertiliser storage;

- Electrical transformers;
- Boilers;
- Dams;
- Boreholes;
- Pumps;
- Infrastructure (electrical cabling, field pumps etc.) crop fields;
- Underground irrigation lines; and
- Workers accommodation and ablution facilities.

Infrastructure for grazing land uses includes (but is not limited to):

- Feedlots;
- Fences;
- Laneways;
- Paddocks;
- Yards
- Fertiliser storage;
- Dams;
- Boreholes;
- Pumps; and
- Loading facilities.

The broad infrastructure requirements for both cultivated land and grazing as alternative land uses are notably less than the infrastructure required for mining as a land use.

6.2.3 MAP SHOWING THE LOCATION AND AERIAL EXTENT OF ALTERNATIVE LAND USE

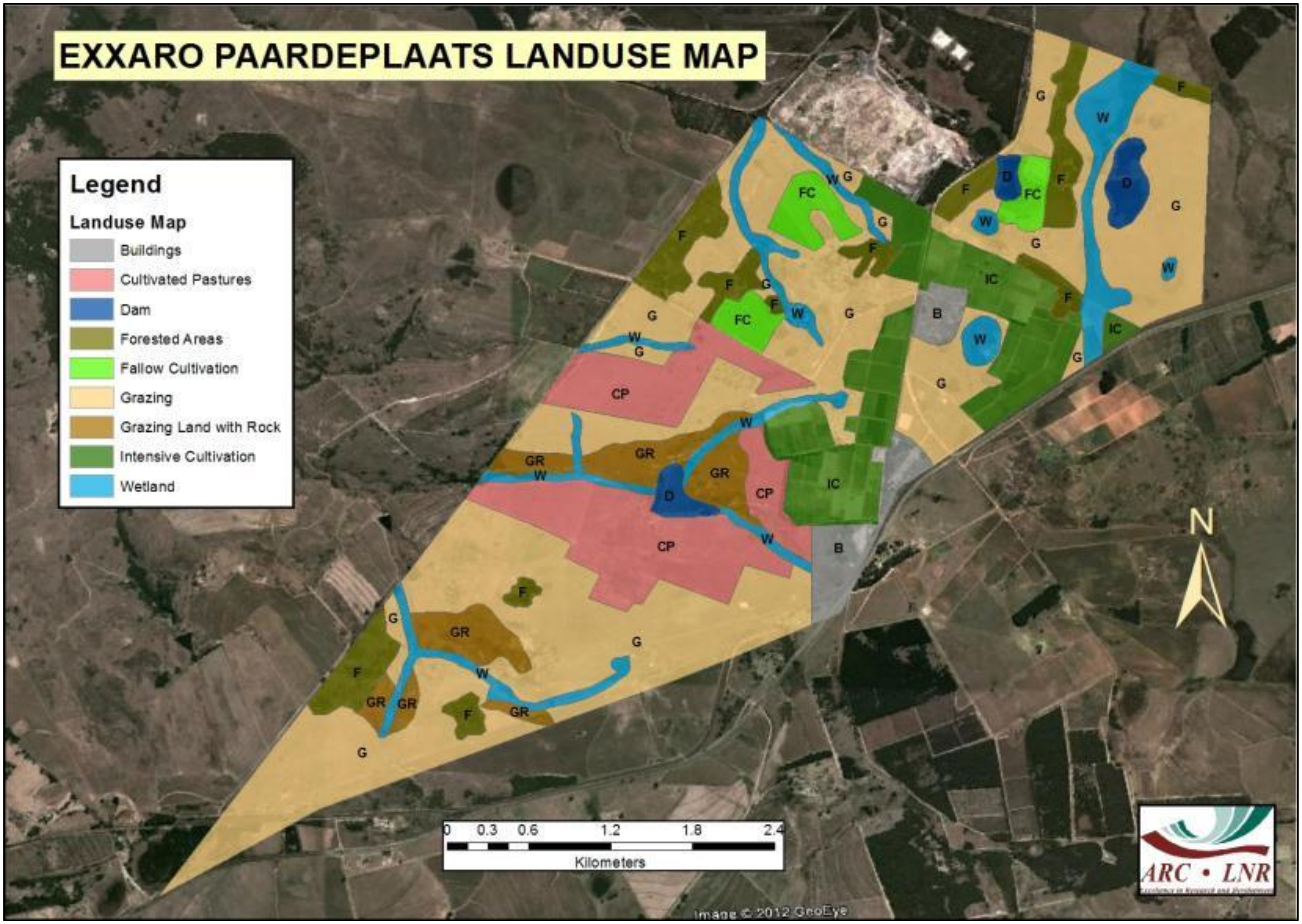

Figure 59: Land use in the study area

6.3 COMPARATIVE LAND USE ASSESSMENT

6.3.1 ALTERNATIVE LAND USES THAT COULD BE IMPACTED ON

The significant current land uses that will be impacted on by the proposed Paardeplaats Coal Mine include cultivated land (specifically Hadeco's cold climate bulb operations) and livestock grazing.

6.3.2 POTENTIAL IMPACTS OF ALTERNATIVE LAND USE OF DEVELOPMENT

As alternate land uses, the potential impacts of cultivated land and livestock grazing are broadly described below. Potential impacts include:

- Disturbance, damage and destruction of biodiversity through the preparation of crop fields and mass grazing;
- Loss of wetland resource through preparation of crop fields and uncontrolled grazing;
- Loss of soil resources through unsustainable farming practises;
- Loss of land capability through unsustainable farming practises such as overgrazing;
- Contamination of surface water through the use of fertilisers and other chemical additives;
- Contamination of groundwater through the use of fertilisers and other chemicals;
- The possible dispersion of nematodes (known to occur on Hadeco's quarantined operations); and
- Sterilisation of mineral resources.

The potential impacts listed above are broad and have not been assessed in any significant detail in this report and are a general indication of the likely impacts of these land uses on the receiving environment. It is worth noting that the likely impacts experienced as a result of the alternate land uses described above are significantly less than the impact of mining as a land use in terms of nature, extent and severity.

6.3.3 DESCRIPTION OF POTENTIAL CUMULATIVE IMPACTS OF ALTERNATIVE LAND USES OR DEVELOPMENTS

The potential cumulative impacts of the alternate land uses include the following:

- Disturbance, damage and destruction of biodiversity through the preparation of crop fields and mass grazing;
- Loss of wetland resource through preparation of crop fields and uncontrolled grazing;

- Loss of soil resources through unsustainable farming practises;
- Loss of land capability through unsustainable farming practises such as overgrazing;
- Contamination of surface water through the use of fertilisers and other chemical additives;
- Contamination of groundwater through the use of fertilisers and other chemicals; and
- Sterilisation of mineral resources.

The potential cumulative impacts listed above are broad and have not been assessed in any significant detail in this report and are a general indication of the likely impacts of the alternate land uses on the receiving environment likely to contribute toward cumulative impact.

6.3.4 LIST OF POTENTIAL IMPACTS IN SOCIO-ECONOMIC CONDITIONS OF THIRD PARTY LAND USE ACTIVITIES

Potential impacts on the socio-economic conditions of third party land use activities both on site and in the surrounding area are discussed in detail in Section 7 and broadly listed below:

- Loss and impedance of current land uses;
- Economic impacts (both positive and negative);
- Blasting hazards;
- Noise impacts;
- Dust impacts;
- Sense of place impacts; and
- Resettlement and relocation of current occupiers.

6.3.5 POTENTIAL IMPACT ON CULTURAL ASPECTS AND HERITAGE FEATURES

A large number of cultural and heritage features have been identified within the proposed Paardeplaats application area and surrounds. These features include cemeteries, graves, historical structures, historical mine shafts and a possible rock art site.

It is possible that that further cultural and heritage features may be uncovered during the proposed development of the Paardeplaats Coal Mine. As such, the potential impacts on cultural and heritage features include the loss of these resources for future generations through activities that may result in the disturbance, damage and destruction of these features. Regardless, these features and resources are protected by national legislation, specifically the National Heritage Resources Act (NHRA, Act No 25 of 1999.) and require mitigation prior to any disturbance.

6.3.6 QUANTIFICATION OF IMPACTS ON SOCIO-ECONOMIC CONDITIONS

In order to undertake the quantification of impacts on socio-economic conditions an Economic Impact Assessment for alternate land use was undertaken. The purpose of the study was to determine if the economy would benefit as a result of a change in current land use to a mining land use. As such, an economic analysis of the economic benefits and costs of the area under application was undertaken. The full report is attached in Appendix F.

The methodology used to evaluate the economic benefits and costs of land under application involved the determination of net employment and/or income generation over time. Employment is a familiar and easy concept to understand while income generation, as a concept is wider than simply household income and deserves further clarity. Income generation, in economic terms is essentially the sum of salaries, wages and operating profit. These variables together make up Economic Valued Added (EVA), also known as Gross Geographic Product (GGP) or Gross Domestic Product (GDP).

The context of the Economic Impact Assessment for alternate land use undertaken is contextualised as follows:

- The proposed Paardeplaats Coal Mine will result in the retention of approximately 161 employment opportunities at the existing NBC Glisa. As such, these employment opportunities have been viewed as “created” due to the potential opportunity for loss;
- The project development alternatives for the proposed Paardeplaats Coal Mine include:
    - Alternative 1 No Go; Alternative 2 Maximum Mine Production and Alternative 3 Sensitivity Planning Approach;
    - Alternative 2 Maximum Mine Production involves the displacement 477 ha owned and operated on by Hadeco;
    - Alternative 3 Sensitivity Planning Approach involves excluding mining activity on the land owned by Hadeco;
- The Hadeco operations are highly specialised and have been greatly invested in;
- The Hadeco operations occurring within the application area are also of strategic importance to their total operations;
- Hadeco employs full time (60) workers and additional (12-150) seasonal workers. Most of Hadeco's workers are also housed in a well-managed community on the farm that includes a school and is home to approximately 39 families As such the impact on the Hadeco cold climate bulb operation will not just be economic but also social; and

- The environmental impacts of coal mining, specifically coal dust and water (quality and quantity) pose a major risk for crop yields.

It is within the context described above that the study was undertaken and the key findings with respect to alternate land use are as follows:

- Alternative 1 (No Go) and Alternative 2 (Maximum Mine Production) is not economically desirable;
- In terms of Alternative 1, the economies will forfeit jobs and income; and
- In terms of Alternative 2, the economies will forfeit a small number of employment opportunities

These key findings in their various permutations are described below:

Firstly, the numerator and thus the statistical impact, is the net difference between mine addition and agricultural detraction (and not just the mine addition). The base scenario rated is that of Alternative 3 Sensitivity Planning Approach and over a forty year period. From this alternative it can be seen that depending on the time horizon and the geographical scale that the impacts are rated and range from low positive to very high positive

The very high impacts are over a ten year span and become lower as the temporal extent increase. This is due to the relatively shorter lifespan of the mine as a result of this alternative. As the spatial scale increases from local to regional, additional economic activity also becomes a smaller component of the GGP and Employment Denominators as communicated in Table 68 and Table 69 below.

Table 68: Economic multipliers

Scenarios	Alternative 3 Sensitivity Planning Approach After Multipliers		Alternative 2 Maximum Mine Production After Multipliers
	Ten Years	**Forty Years**	All negative impacts worsen and this alternative is not worth considering
Immediate and surrounding farms	All positive and negative impacts increase by a factor of 10:40 years	This scenario is rated below	
EMakhazeni Local Municipality			
Nkangala and wider areas			

Table 69: Economic impacts on a local and regional scale

Economic Impacts of Alternative 3 Sensitivity Planning Approach	Local		Regional	
	Ten years	**Forty Years**	**Ten Years**	**Forty Years**
Net employment	Very high positive	Medium Positive	Low positive	Very low positive
Net income	Very high positive	Medium Positive	Low positive	Very low positive

In summary, the following salient points are noted:

- The net difference between employment and income created and destroyed is moderate to low from a greater societal perspective measured over a forty year period;
- It is important to note that the jobs to be retained and created by the mine are adjusted downwards by its lifespan relative to an economic generation (essentially the expected 400 jobs are reduced to 100 new jobs. This is because it is multiplied by the LOM/Economic Generation: which will be (400x 10/40 = 100 Full Time Employment jobs)).
- Should one compare the jobs created/lost to the District (Nkangala), then these numbers become virtually insignificant (below a tenth of a per cent).
- The income and job creation potential of the proposed mine is relatively large over a ten year period as a result of the intensive capital nature of mining and its relatively high job creation per hectare as opposed to the agricultural sector. The high level of skills required to manage such an operation. In essence, the GDP per employee in mining is much larger than most other industries and is four times the number for GDP per employee in the agricultural sector. Please refer to Figure 60 below.

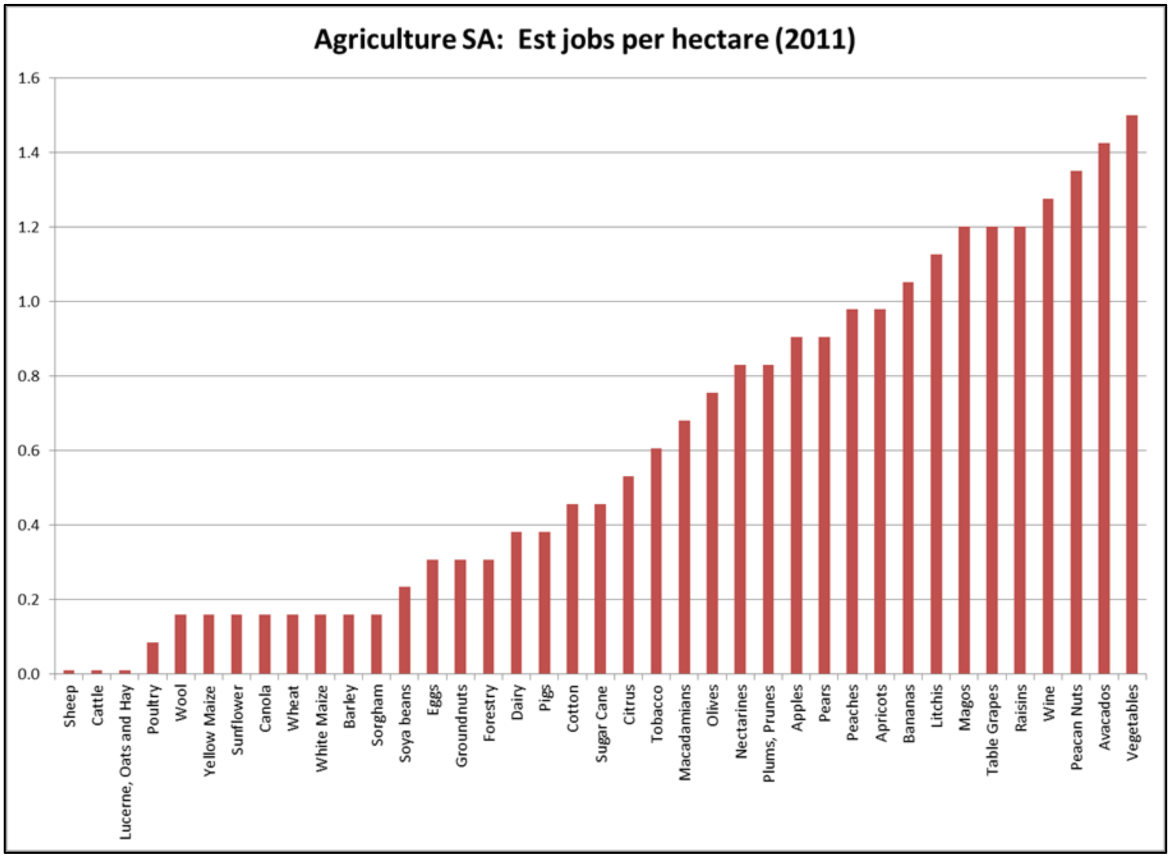

Figure 60: Established jobs per hectare in the agricultural sector of South Africa

- The new mine will create and retain almost 3 jobs per hectare compared to the 0.1-0.2 jobs per hectare lost in agriculture and forestry.
- Our conclusion is that Alternative 1 and Alternative 2 are not desirable. Mining on the Hadeco land would reduce the jobs available in the economy – even though by a minute number. Impacting the Hadeco flower operation also has far reaching social implications because workers have created a livelihood and this livelihood is certain, whereas the new jobs to be created have an uncertainty element to it. Not mining the non-Hadeco portions, assuming there are no other alternatives available, will be equally detrimental to the local economy, as income and employment is needed in the ELM as a whole;
- Furthermore, even though the mine will create more income to the economy mining on Hadeco land the key criterion is total happiness to society. It is more plausible that society will be happier with more jobs, rather than more income but less jobs. The dignity associated with a more jobs x less income outweighs the suffering associated with less jobs x more income. Thus the estimated 26 jobs lost if mining happens on Hadeco land are significant.

- Mining adjacent to Hadeco will have risks with respect to dust fall-out and water quality and in this regard the environmental mitigation measures need to be developed in conjunction with Hadeco and closely monitored.

7 ASSESSMENT AND EVALUATION OF POTENTIAL PROJECT IMPACTS

The following impact assessment evaluates the following alternatives as described in Section 6.1 above:

- Alternative 1: No-go;
- Alternative 2: Maximum Mine Production;
- Alternative 3: Sensitivity Planning Approach.

7.1 THE IMPACT ASSESSMENT METHODOLOGY

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations (2010). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E+D+M+R) \times N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 70:

Table 70: Criteria for determination of impact consequence

Aspect	Score	Definition

Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 71.

Table 71: Probability scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

ER= C x P

Table 72: Determination of environmental risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 73.

Table 73: Significance classes

Environmental Risk Score	
Value	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥ 9; < 17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/ mitigated.

In accordance with the requirements of Regulation 31 (2)(l) of the EIA Regulations (GNR 543), and further to the assessment criteria presented above it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

In addition it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority / significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/ mitigation impacts are implemented.

Table 74: Criteria for the determination of prioritisation

Public response (PR)	Low (1)	Issue not raised in public response.
	Medium (2)	Issue has received a meaningful and justifiable public

		response.
	High (3)	Issue has received an intense meaningful and justifiable public response.
Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 74. The impact priority is therefore determined as follows:

Priority = PR + CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (refer to Table 75).

Table 75: Determination of prioritisation factor

Priority	Ranking	Prioritisation Factor
3	Low	1
4	Medium	1.17
5	Medium	1.33
6	Medium	1.5
7	Medium	1.67
8	Medium	1.83
9	High	2

In order to determine the final impact significance the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 76: Environmental Significance Rating

Environmental Significance Rating	
Value	**Description**
< 15	Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
≥ 9; < 17	Medium (i.e. where the impact could influence the decision to develop in the area),
≥ 17	High (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

7.2 PRE-CONSTRUCTION PHASE IMPACTS

The list below is of the impacts likely to occur during the pre-construction phase. Each listed impact has been assessed and assigned a significance score. The impacts for each of the three project development alternatives are included for comparative purposes.

7.2.1 SOCIAL IMPACTS

7.2.1.1 Skills Development

The social and labour plan makes provision for significant skills development initiatives. This includes bursaries, learnerships and a training centre.

This aspect has been discussed with the communities that have been consulted and most reactions to the initiatives have been viewed positively. A number of positive secondary social impacts are associated with skills development. These include an increase in quality of life and general social well-being. From a social perspective skills development creates new resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	17.00	23.75	39.58
Maximum Mine Production	17.00	23.75	39.58
No-Go Alternative	N/A	N/A	N/A

Recommended measures to ensure positive skills development include the following:

- Ensure the local eMakhazeni communities are the beneficiaries of skills development initiatives;
- Implement the skills development initiatives that have been identified in the SL; and
- Establish a skills training centre as per the SLP.

7.2.1.2 Co-operative Governance

The government is an important role player in the project. If the mine and the government work together they have the potential to make a positive contribution to the local community.

This impact can have a high positive impact in affected communities if all the industries in the area work towards a common goal. This may be beneficial to all parties involved.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	12.00	17.50	20.42
Maximum Mine Production	12.00	17.50	20.42
No-Go Alternative	N/A	N/A	

Recommended measures to ensure co-operative governance include the following:

- Establish good working relationships with local and district government by attending their forums and individual interaction.

7.2.1.3 Resettlement of Hadeco Village

Hadeco Village and some traditional clay houses are located within the mining rights area. The affected people will be resettled if the full area is mined. This will impact on their livelihoods and social and community structures.

Several stakeholders expressed concern regarding this impact. Relocation leads to a number of secondary impacts and spin-offs and some relocated communities never recover economically or socially from the trauma of relocation. This is a severe negative impact that should be avoided. Social capital and community cohesion will be lost and it is unlikely that it will be replicated to the same extent in the host community.

Alternative	Pre-Mitigation	Post-Mitigation	Final

	Score	Score	Significance
Sensitivity Planning Approach	N/A	N/A	N/A
Maximum Mine Production	-17.00	-10.50	-21.00
No-Go Alternative	N/A	N/A	N/A

This impact should be avoided if possible. However, if it is necessary to resettle the community the recommended measures include the following:

- A relocation specialist should be appointed to compile a relocation action plan (RAP) in line with international best practice standards; and
- The RAP should be monitored and audited and implemented by a specialist.

7.2.2 NOISE IMPACTS

7.2.2.1 Noise Nuisance

Activities during the planning and design phase that normally have possible noise impact implications are those related to field surveys (such as seismic testing and geological test borehole drilling for prospecting purposes and/or investigation of founding conditions for large buildings/plant/equipment). As these activities are usually of short duration and take place during the day, they are unlikely to cause any major noise disturbance or nuisance in most adjacent areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-3.50	-3.50	-4.67
Maximum Mine Production	-3.50	-3.50	-4.67
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to reduce the noise nuisance to sensitive receptors:

- Provide portable acoustic screens to enclose the drill rigs and compressors where necessary.

7.3 CONSTRUCTION PHASE IMPACTS

The list below is of the impacts likely to occur during the construction phase. Each listed impact has been assessed and assigned a significance score. The impacts for each of the three project development alternatives are included for comparative purposes.

7.3.1 HERITAGE IMPACTS

7.3.1.1 Damage/Destruction of Graves and Cemeteries Within the Mining Footprint

The potential exists for the damage, destruction, or disturbance of graves and cemeteries within the mining footprint. Only two graves are impacted by Alternative 3 and the cumulative impact is seen as low. With Alternative 2, however, the total number of cemeteries directly impacted by the proposed mining foot print would be 6 accounting for 100 of a total of 141 graves identified inside the study area. The graves are irreplaceable but can be relocated thus minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.00	-10.00	-13.33
Maximum Mine Production	-16.00	-10.00	-16.67
No-Go Alternative	N/A	N/A	N/A

All graves that will be negatively affected should be relocated after a full grave process that includes comprehensive social consultation. Permits from the Burial Ground Unit of SAHRA and from the Mpumalanga Department of Health will be required for the relocation.

7.3.1.2 Damage/Destruction of Buildings and Structures Within the Mining Footprint

The potential exists for the damage, destruction, or disturbance of buildings and structures within the mining footprint. The destruction of all the structures within the mining area will result in a loss of structures adding to the cultural fabric of the area. No further cumulative effects on structures inside the Portion are foreseen. Documentation of the cultural characteristics of the structures will minimize the complete loss of information on the resource.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Sensitivity Planning Approach	-3.00	-3.00	-3.50
Maximum Mine Production	-15.00	-11.00	-14.67
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All buildings must be evaluated for the possible presence of infant burials through social consultation;
- A permit from the Provincial Heritage Resources Authority Mpumalanga would be required if heritage structures need to be demolished; and
- The remains of the buildings should be mapped and documented by photographs and drawings.

7.3.1.3 Damage/Destruction of Undiscovered Heritage Structures/Resources Within the Mining Footprint

The potential exists for damage, destruction, or disturbance to previously undiscovered heritage structures or resources. The discovery of any heritage features can add to the cumulative impact of the mine and all heritage resources are irreplaceable.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.00	-7.00	-9.33
Maximum Mine Production	-7.00	-7.00	-9.33
No-Go Alternative	N/A	N/A	N/A

A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction and mining employees. If a possible heritage site is discovered during mining activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions. Depending on the type of site this can include initiating a grave relocation process, documentation of structures or archaeological excavations.

7.3.1.4 Impact on Rock Art

The potential exists for the damage, destruction, or disturbance of a possible rock art site during mining activities. A possible rock art site was identified. The possible art is very faded and is situated on the southern side of an exposed rock bank which formed a slight overhang. An unusual isolated reddish marking, which could be the faded remains of two possible figures was identified. However, the marking was not very clear. Rock art is seen as one of the most rare of heritage resources and irreplaceable.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	N/A	N/A	N/A
Maximum Mine Production	-16.00	-4.00	-6.00
No-Go Alternative	N/A	N/A	N/A

It is recommended that the site be demarcated as a no-go area and that a specialist on rock art be contracted to evaluate and confirm the existence of the rock art and if confirmed develop further management recommendations for the site.

7.3.1.5 Damage/Destruction of Graves and Cemeteries Outside of the Mining Footprint

The potential exists for the damage, destruction, or disturbance to graves and cemeteries that fall within the mining right boundary but outside of the mining footprint. The total amount of cemeteries located within the mining right area but outside of the mining footprint is three accounting for 84 of a total of 141 graves identified inside the study area. The graves are irreplaceable but can be relocated thus minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.00	-10.00	-16.67
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

All graves that will be negatively affected should be relocated after a full grave process that includes comprehensive social consultation. Permits from the Burial Ground Unit of SAHRA and from the Mpumalanga Department of Health will be required for the relocation.

7.3.1.6 Damage/Destruction of Buildings and Structures Outside of the Mining Footprint

The potential exists for the damage, destruction, or disturbance to buildings and structures that fall within the mining right boundary but outside of the mining footprint. The destruction of all the structures within the mining area will result in a loss of structures adding to the cultural fabric of the area. No further cumulative effects on structures inside the Portion are foreseen. Documentation of the cultural characteristics of the structures will minimize the complete loss of information on the resource.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-11.00	-14.67
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All buildings must be evaluated for the possible presence of infant burials through social consultation;
- A permit from the Provincial Heritage Resources Authority Mpumalanga would be required if heritage structures need to be demolished; and
- The remains of the buildings should be mapped and documented by photographs and drawings.

7.3.1.7 Damage/Destruction of Undiscovered Heritage Resources Outside of the Mining Area

The potential exists for the damage, destruction, or disturbance to previously undiscovered heritage resources that fall within the mining right boundary but outside of the mining footprint. The discovery of any heritage features can add to the cumulative impact of the mine and all heritage resources are irreplaceable.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.00	-7.00	-9.33
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction and mining employees. If a possible heritage site is discovered during mining activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions. Depending on the type of site this can include initiating a grave relocation process, documentation of structures or archaeological excavations.

7.3.1.8 Damage/Destruction of Graves and Cemeteries in the Surrounding Area

The potential exists for the damage, destruction, or disturbance to graves and cemeteries that fall outside of the mining right area, particularly the Belfast Municipal Cemetery and the Belfast Concentration Camp Cemetery. There is a possible long term impact on tombstones due to blasting and vibrations. The graves are irreplaceable but can be relocated by doing so minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-9.00	-7.50	-8.75
Maximum Mine Production	-9.00	-7.50	-8.75
No-Go Alternative	N/A	N/A	N/A

It is recommended that there should be a base line documentation of the headstones and memorials before mining commence and on-going monitoring of the situation at the cemetery before during the operation of the Paardeplaats mine, as well as a fenced buffer of at least 20 metres around cemeteries inside the project area but outside the pit areas.

7.3.1.9 Damage/Destruction of Buildings and Structures in the Surrounding Area

The potential exists for the damage, destruction, or disturbance to buildings and structures that fall within the mining right boundary but outside of the mining footprint. The destruction and loss of integrity of any structures within the blasting zone will result in a loss of structures adding to the cultural fabric of the landscape. Documentation of the cultural characteristics of the structures will minimize the complete loss of information on the resource, and guide management of blasting during mining operations.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-8.25	-8.25
Maximum Mine Production	-13.00	-8.25	-8.25
No-Go Alternative	N/A	N/A	N/A

It is recommended that there should be a base line documentation of the structures associated with farmsteads, homesteads and ruins within the basting radius as identified in the blasting evaluation study, before mining commences and on-going monitoring of the structural integrity of these sites during the operation of the Paardeplaats mine.

7.3.2 SOCIAL IMPACTS

7.3.2.1 Increase in HIV/Aids and Other Infectious Diseases

HIV/AIDS is already a problem in the area, as a result of migrant workers employed by the mine and other industries in the area. Rumours of development will result in an influx of people into the area.

Impact has been mentioned by a number of stakeholders. This is an existing impact and the mine is not the only source of the impact. It is not possible to quantify the exact origin of the impact. Due to the presence of migrant labour this impact may spread to the labour-sending areas. The most important loss will be the loss of human capital and the associated skills since there is currently no cure for HIV/Aids. The treatment of the illness puts pressure on existing medical resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Sensitivity Planning Approach	-19.00	-13.50	-22.50
Maximum Mine Production	-19.00	-13.50	-22.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lessen the impact of disease on the population:

- Form a partnership with a Non Profit Organisation (NPO) to provide the necessary social services to people whose lives are affected by infectious diseases;
- Develop an in-house infectious diseases strategy to address health issues with the workforce; and
- Align strategy with community HIV strategy followed by NPO.

7.3.2.2 Conflict between Residents and Newcomers

There is a potential for social unrest and conflict between local residents and newcomers due to discrepancies in income and opportunities that is generated by the mine.

Issue has been brought up in the consultation process. This is an existing impact and other businesses in the area contribute to the impact. It cannot be mitigated in isolation. There is a risk of community unrest that may impact on the social capital of the community.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-10.00	-13.33
Maximum Mine Production	-15.00	-10.00	-13.33
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lessen the impact of conflict:

- Implement a community relations programme;
- Develop a business forum and ensure local SMME's are utilised for project;
- Implement local procurement policy; and
- Encourage and enable staff to live locally.

7.3.2.3 Expectations Regarding the Benefits of the Project

The community have a number of expectations regarding the benefits of the project. Not all the expectations are realistic, as some of the things the community expect from the mine are really the function of the government.

Expectations were confirmed during community consultation process. There are similar expectations of other mines in the area. Unless managed well there may be reputational risk to Exxaro.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-10.00	-13.33
Maximum Mine Production	-15.00	-10.00	-13.33
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to decrease the significance of this impact:

- Implement community relations strategy; and
- Communicate frequently with the affected stakeholders to ensure that they understand the processes and do not develop more unrealistic expectations.

7.3.2.4 Skills Development

The social and labour plan makes provision for significant skills development initiatives. This includes bursaries, learnerships and a training centre.

This aspect has been discussed with the communities that have been consulted and everybody reacted very positively towards it. A number of positive secondary social impacts are associated with skills development. These include an increase in quality of life and general social well-being. From a social perspective skills development creates new resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	17.00	23.75	39,58
Maximum Mine Production	17.00	23.75	39.58

No-Go Alternative	N/A	N/A	N/A

Recommended measures to ensure positive skills development include the following:

- Ensure the local eMakhazeni communities are the beneficiaries of skills development initiatives;
- Implement the skills development initiatives that have been identified in the SL; and
- Establish a skills training centre as per the SLP.

7.3.2.5 Impact on Infrastructure such as Roads and Buildings

Activities of the mine such as the transport of coal have a negative impact on the road infrastructure. There is not adequate housing available for staff, especially in the lower income group.

This impact has been mentioned by a number of stakeholders. Other industrial activities in the area contribute to the impact. Impact is already taking place. It may be a threat to natural resources if informal settlements are established. However, it is not currently a threat, as there are no informal settlements in the area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-7.50	-10.00
Maximum Mine Production	-13.00	-7.50	-10.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lessen this impact:

- Engage with the municipalities to discuss strategic long-term planning w.r.t. services such as road maintenance and housing;
- Coordinate the outcomes of the Social and Labour plan with the Integrated Development Plans of the municipalities; and
- Become a member of the IDP Forum.

7.3.2.6 Social Impact of Blasting

Farms in close proximity of the mine and residents of Belfast and Siyuthuthuka complain about cracks in their houses due to the blasting operations of the mine.

A number of people mentioned this as a concern. It is an existing impact, and any new impacts will become cumulative. The effects of blasting impact negatively on the financial resources of affected households.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-6.75	-9.00
Maximum Mine Production	-13.00	-6.75	-9.00
No-Go Alternative	N/A	N/A	N/A

In order to lessen the effect toft hi impact the following mitigation measures are recommended:

- Conduct a crack survey at properties in a certain radius of the mine; and
- Explore alternative blasting methods that may have a lower physical impact.

7.3.2.7 Social Impact of Dust

Coal dust has a negative impact on the livelihoods of the agricultural community since it affects the quality of their products.

Impact mentioned by a number of affected parties. Dust is already a problem in the area due to current mining activities. If the activities are moved closer to the receptors the impact will be greater. Some of the bulbs that Hadeco produces are only grown on this farm in South Africa. There are no other suitable areas to grow these bulbs in the country, and the only alternative would be to move the business abroad.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-8.25	-13.75
Maximum Mine Production	-13.00	-8.25	-13.75
No-Go Alternative	N/A	N/A	N/A

It is recommended that the applicant engage with the experts and the affected parties to find suitable solutions to this issue.

7.3.2.8 Co-operative Governance

The government is an important role player in the project. If the mine and the government work together they have the potential to make a positive contribution to the local community.

This impact can have a high positive impact in affected communities if all the industries in the area work towards a common goal. This may be beneficial to all parties involved.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	12.00	17.50	20.42
Maximum Mine Production	12.00	17.50	20.42
No-Go Alternative	N/A	N/A	N/A

Recommended measures to ensure co-operative governance include the following:

- Establish good working relationships with local and district government by attending their forums and individual interaction.

7.3.3 SOILS, LAND USE, AND LAND CAPABILITY IMPACTS

7.3.3.1 Loss of Soil Fertility During Site Clearance

Loss of fertile topsoil due to vegetation clearance during site clearance at the beginning of the construction phase is a potential impact. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-5.25	-6.13
Maximum Mine Production	-11.25	-6.00	-7.00
No-Go Alternative	N/A	N/A	N/A

It is recommended that vegetation clearance is restricted as far as possible.

7.3.3.2 Soil Erosion Hazard During Site Clearance

Increased susceptibility to erosion due to removal of vegetation cover is a potential impact resulting from site clearance. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-8.00	-5.25	-6.13
Maximum Mine Production	-9.00	-6.00	-7.00
No-Go Alternative	N/A	N/A	N/A

It is recommended that the applicant restricts vegetation removal to the minimum possible area and duration to mitigate against this impact.

7.3.3.3 Soil Compaction During Site Clearance

There is the potential for soil to be compacted during site clearing activities. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.00	-5.25	-6.13
Maximum Mine Production	-6.75	-5.25	-6.13
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of heavy machinery is restricted as far as possible to lessen the significance of this impact.

7.3.3.4 Loss of Soil Fertility During Site Establishment

Loss or reduction in soil fertility due to activities connected to mine infrastructure is a potential impact associated with the construction phase of mining operations. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-12.00	-16.00
Maximum Mine Production	-16.25	-12.00	-16.00
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented:

Retain maximum surface vegetation cover; and

Restrict footprint as far as possible

7.3.3.5 Soil Erosion Hazard During Site Establishment

Increased susceptibility to erosion due to removal of vegetation cover is a potential impact resulting from site establishment. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.00	-11.00	-12.83
Maximum Mine Production	-12.00	-11.00	-12.83
No-Go Alternative	N/A	N/A	N/A

It is recommended that the applicant restricts vegetation removal to the minimum possible area and duration to mitigate against this impact.

7.3.3.6 Soil Compaction During Site Establishment

There is the potential for soil to be compacted during site establishment. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-12.00	-16.00
Maximum Mine Production	-13.00	-12.00	-16.00
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of heavy machinery and the extent of the site footprint is restricted as far as possible lessen the significance of this impact.

7.3.3.7 Chemical Pollution of Soil

The potential exists for the contamination of soil due to spillage by chemicals, hydrocarbons, or contaminated water during construction. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-14.00	-17.33
Maximum Mine Production	-17.50	-14.00	-17.33
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented to address this impact:

- Implement correct procedures for containing water and runoff, including drains, berms etc.; and
- Protect wetland areas.

7.3.3.8 Change in Natural Landscape During Site Establishment

Mining activities have the potential to result in alteration of the prevailing terrain. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.00	-12.00	-16.00
Maximum Mine Production	-12.00	-12.00	-16.00
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented to address this impact:

- Reduce excavation to a minimum; and
- Avoid wetlands and depression areas.

7.3.4 IMPACTS ON ECOLOGY

7.3.4.1 Transformation of Vegetation

The new infrastructure associated with the mine will result in the removal of the remaining natural vegetation.

Loss of habitat which is represented by the remaining natural vegetation is a global issue, the disturbance of the natural vegetation and consequential displacement of fauna in close proximity to the development also creates opportunity for alien invasive species to establish. This is an additional factor that contributes to biodiversity loss on both global and regional scales. Loss of intact grassland, irrespective of ecological condition, could displace large terrestrial bird species such as Secretary Birds and Korhaan species. Many of these species are currently listed as threatened by the IUCN.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-12.00	-18.00
Maximum Mine Production	-17.50	-13.00	-19.50
No-Go Alternative	N/A	N/A	N/A

To minimise the loss of vegetation, the following mitigation measures should be implemented:

- Infrastructure should preferably be focused on already transformed areas e.g. cultivated lands or existing infrastructure e.g. homesteads; and
- Infrastructure should be condensed to prevent unnecessary sprawl into sensitive areas.

7.3.4.2 Damage to Habitat

Damage to habitat is associated with fragmentation due to the development of infrastructure and the exploitation of certain species by the workforce.

The reduction of habitat due to fragmentation will result in fauna species being displaced, thereby increasing competition among species in other areas (especially species that require large home ranges) or loss of vitality due to inbreeding, which would make the population sensitive to stochastic events/natural disasters (flooding, fire, drought, diseases). The exploitation of specific species, whether plant or animal has an influence on their availability and therefore the suitability of the area as habitat. This impact in strongly linked to losses of biodiversity. The disruption of migratory routes can pose a direct risk to faunal assemblages in the region. For example, many mammal species exhibit large home range sizes which are vital for food resource acquisition, territory maintenance and exchange of genetic material. Large scale establishment of infrastructure, if unplanned may permanently eliminate regional biodiversity. Similarly, the loss of ecological connectivity between avifaunal flyways (e.g. drainage lines and hillslope seeps) could disrupt seasonal altitudinal migration or daily commuting between roosting and foraging areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-11.00	-14.67
Maximum Mine Production	-15.00	-11.00	-14.67
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lessen the significance of this impact:

- Infrastructure should be designed to rather follow the edge of natural areas than crossing it;
- If crossing it is the only option, then the area should be transected so that one large area remains rather than two equally sized areas;

- The workforce should be informed that it is illegal to harvest natural resource without the relevant permits and should be prosecuted if found in transgression of the law;
- Appropriate culverts should be implemented in order to facilitate movement of mammals throughout the site and limit fragmentation; and
- All hillslope seeps areas, especially those that support contemporary as well as historical Broad-tailed Warbler and Grass Owl habitat should be adequately buffered.

7.3.4.3 Loss of Biodiversity

Individuals or populations of species whether flora or fauna are lost due to the destruction of their habitat or due to the exploitation of the species or the introduction of alien invasive species.

Biodiversity loss is a global issue, which occurs mainly through habitat loss and fragmentation and the invasion of natural areas by alien invasive species. Therefore activities which contribute to habitat loss and fragmentation as well as the introduction of alien invasive species will contribute to the cumulative biodiversity loss on both a local, regional and global scale.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-12.00	-20.00
Maximum Mine Production	-16.25	-12.00	-20.00
No-Go Alternative	N/A	N/A	N/A

The following measures are recommended to mitigate this impact:

- Where possible infrastructure should be kept on already transformed areas such as cultivated fields, forestry stand and existing homesteads;
- Existing infrastructure should rather be upgraded and development kept together rather than developing new infrastructure away from existing infrastructure; and
- Construction should be planned so that migratory corridors are not destroyed to allow for regional species viability.

7.3.4.4 Spread of Alien Invasive Species

The seeds of alien invasive species currently present in the landscape such as Wattle (*Acacia mearnsii)* and Blue gums are dispersed into a wider area from exotic stands and homesteads on the machinery and truck wheels as well as through the replacement of topsoil.

The introduction of foreign species can displace the naturally occurring species or outcompete them for resources (food and shelter), they can also exploit vulnerable species within the landscape, therefore their presence would contribute to the negative impacts already associated with mining activities such as habitat loss and fragmentation. However because the planned infrastructure does not involve the establishment of offices the probability of this impact occurring is lower. Persistent grazing and trampling of the natural vegetation by cattle will result in habitat disturbance and modification. Feral animals (e.g. cats) may cause both localised extinctions or contaminate local gene pools through hybridisation. In conjunction with habitat fragmentation, recolonisation becomes more difficult to the point of being irreversible.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-12.00	-20.00
Maximum Mine Production	-17.50	-12.00	-20.00
No-Go Alternative	N/A	N/A	N/A

The area should be assessed and the alien invasive species controlled prior to the commencement of the construction activities. The area should be monitored for the establishment and spread of alien invasive species during and after the construction phase. A full alien invasive action plan should be implemented.

7.3.4.5 Introduction of Foreign Animals

Domestic animals such as cat and dogs can become strays and live of the wildlife species present in the area, cattle and goats can modify the available vegetation resulting in a reduction in the quantity and quality of species present.

The introduction of foreign species can displace the naturally occurring species or outcompete them for resources (food and shelter), they can also exploit vulnerable species within the landscape, therefore their presence would contribute to the negative impacts already associated with mining activities such as habitat loss and fragmentation. However because the planned infrastructure does not involve the establishment of offices the probability of this impact occurring is lower. Persistent grazing and trampling of the natural vegetation by cattle will result in habitat disturbance and modification. Feral animals (e.g. cats) may cause both localised extinctions or contaminate local gene pools through hybridisation. In conjunction with habitat fragmentation, recolonisation becomes more difficult to the point of being irreversible.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.50	-5.25	-7.88
Maximum Mine Production	-8.25	-6.00	-9.00
No-Go Alternative	N/A	N/A	N/A

The staff of the mine should be educated/ informed about the risk that the introduction of foreign species has to the indigenous species. Abandoned homesteads should be monitored for the presence of domestic animals such as dogs and cats and appropriate control measures put in place. It is imperative that livestock remain isolated from the demarcated sensitive areas and that a “rotational” system of cattle camps be implemented depending on the grassland condition/trampling frequency to prohibit free-roaming of cattle.

7.3.5 IMPACTS ON AQUATIC ECOLOGY

7.3.5.1 Loss of Aquatic Ecosystems

The mining footprint extends across a number of delineated wetlands. These will be completely lost, including 3 dams. Aquatic biota within these wetlands will be lost, together with habitat and food availability for otter and other vertebrates (fish, frogs, birds), with a resultant decline in overall biodiversity.

This impact will contribute to existing wetland losses throughout the Steelpoort catchment. This may have far reaching effects on water quantity and quality. Mining activities will result in a total loss of wetlands from the area mined. Rehabilitated wetlands should not over lay mined out areas to prevent ingress.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-20.00	-18.75	-31.25
Maximum Mine Production	-21.25	-20.00	-36.67
No-Go Alternative	N/A	N/A	N/A

The only way to mitigate this impact is to change the footprint of the mined area. Biodiversity offsets (e.g. protection of off-site habitats or rehabilitation of alternative wetlands) may afford limited mitigation but rarely, if ever, compensate for the biota and habitats lost. Often off-set mitigation does not consider the exact species that were lost and do not recreate sustainable habitats with a similar biotic integrity.

7.3.5.2 Erosion and Sedimentation

Clearing of the footprints will expose soils to erosion and increase surface run-off, resulting in increased movement of sediment into surrounding streams and wetlands. Sediment deposition within the wetlands will likely lead to changes in wetland vegetation as sediments are colonised by species such as *Typha capensis* or *Phragmites australis*, often in monospecific stands. Disturbance to wetland habitats could also provide opportunity for an increase in alien vegetation within the wetlands. Water quality will also deteriorate as turbidity and suspended solid loads are increased downstream of the site. This may have a negative impact on aquatic fauna.

This impact will exacerbate impacts due to mining and agriculture further downstream within the catchment. Loss of habitats due to sedimentation may cause loss of species within the Steelpoort Catchment downstream of site 7.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-12.00	-14.00
Maximum Mine Production	-21.25	-14.00	-16.33
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- Limit the extent of footprint clearance, if possible. No development or disturbance should occur within the 1:100 year flood line of any drainage line (perennial and non-perennial streams) without a water use licence in accordance with the National Water Act (no. 36 of 1998).
- Limit vegetation clearing to the actual footprint of the proposed development.
- Fence off remaining wetland areas prior to construction activities commencing to prevent access into the wetland areas by heavy machinery and vehicles.
- Undertake construction activities in winter to minimise sediment transport due to run-off after rainfall events.

- Re-vegetate all bare areas not directly within the footprint of the developments as soon as possible. The extent of the disturbance should be limited to a minimum.
- A shallow berm should be constructed between the proposed opencast footprint and the downslope wetlands to prevent sediment rich runoff from the construction site entering the wetlands. These berms should thus be constructed prior to the commencement of construction on the opencast pit.
- Anti-erosion mitigation to diffuse and attenuate flows should be implemented where stormwater is diverted around construction activities.
- Implement an aquatic biomonitoring and water quality programme. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.

7.3.5.3 Decline in Water Quality

Erosion of soil during construction would lead to increased turbidity in receiving waterbodies. In addition, spillages of hazardous substances stored, used or disposed of on site during the construction process, e.g. diesel, cement and oil, could result in water quality deterioration, should these enter the watercourse. Water quality entering a dam at the boundary between Paardeplaats Portion 30 and Glisa Colliery is of a good quality (As tested in 2010) but deteriorates considerably as it flows through the colliery. As such, water quality in this dam will be compromised and further downstream impacts will be exacerbated. However, the good water quality recorded within the Steelpoort tributary at site 7 will be less impacted.

This impact will exacerbate impacts due to mining and agriculture further downstream within the Steelpoort catchment. Alternative may result in existing good water quality being permanently compromised, particularly downstream of Site 7 within the Steelpoort tributary. There may be loss of species due to declines in water quality.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-12.00	-18.00
Maximum Mine Production	-16.25	-12.50	-20.83
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to mitigate the effects of this impact:

- Effective mitigation for erosion prevention and control should be applied.

- Ensure separation of clean and dirty water and allow clean water to enter natural water bodies after effective attenuation and sediment trapping.
- To prevent spillages, vehicles should be well maintained Diesel and oil/grease should be stored in bunded areas that will allow any spillages to be easily and quickly isolated and prevent contamination of any soils or water.
- Spills should be cleaned up with approved absorbent material such as “Drizit” or “Spillsorb”. These should be kept in sufficient quantities on site to deal with small spills. Absorbent material and contaminated soil should be disposed of at a registered hazardous waste site.
- An emergency preparedness plan should be compiled and all construction staff aware of procedures in event of a spill.
- Hazardous waste should be stored in bunded/impermeable areas and disposed of appropriately at a registered landfill site. Potential spills or seepage of hazardous waste must be anticipated and prevented.
- Should cement be used on site, the following guidelines apply:
- Carefully control all on-site operations that involve the use of cement and concrete (this applies to areas other than the batching plant).
- Limit cement and concrete mixing to single sites where possible.
- Use plastic trays or liners when mixing cement and concrete: Do not mix cement and concrete directly on the ground.
- Dispose of all visible remains of excess cement and concrete after the completion of tasks. Dispose of in the approved manner (solid waste concrete may be treated as inert construction rubble, but wet cement and liquid slurry, as well as cement powder must be treated as hazardous waste).
- Implement an aquatic biomonitoring and water quality programme. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.

7.3.5.4 Altered Hydrological Regime

Construction of dams, trenches, berms and infrastructure alter the natural runoff of water into the aquatic ecosystems. The change can be both in terms of timing and duration, as well as quantity of water reaching the natural ecosystems. Alien vegetation encroachment due to disturbances can also have a significant impact on water levels in streams and rivers. Reduced flows will have an impact on the habitat availability for aquatic fauna and especially impact on those species/taxa with a preference for moderate to fast habitats. This impact will exacerbate impacts within Glisa Colliery.

This impact will contribute to existing abstraction volumes downstream within the Steelpoort Valley. Once the pits are in place, water will have to be permanently diverted round them.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-9.75	-14.63
Maximum Mine Production	-16.00	-10.50	-17.50
No-Go Alternative	N/A	N/A	N/A

The only way to effectively mitigate this impact is to locate mining areas outside of wetlands and watercourses. Where clean water is diverted away from mining areas, its point of re-entry into the natural watercourse should be well protected against erosion. In addition, sediments should be effectively trapped before re-entry. Limit use and abstraction of water from the surface and ground waters. Implement an alien vegetation control programme and continuously fight alien vegetation encroachment. Implement biomonitoring programme to detect any deterioration in aquatic biota.

7.3.5.5 Biodiversity Loss

Loss or decline in habitat suitability or availability and a decline in water quality in aquatic ecosystems downstream of construction areas may result in the loss of sensitive species. This may be a result of increased turbidity, loss of habitats due to sedimentation, and pollution from spills/leaks (e.g. cement, hydrocarbons, solid waste). The impact would vary in intensity between different species and different life stages and processes (spawning, feeding, etc.). The intolerant and moderately intolerant biota, as well as those with predatory behaviour, will especially be influenced by increased turbidity. Declines in aquatic biodiversity may have a knock-on effect on vertebrates higher up in the food chain as their habitats and food sources decline. Otter, frogs and fish are especially at risk.

Existing impacts to habitats and sensitive species may exceed threshold levels for survival. In addition, increasing habitat loss is affecting animals associated with aquatic ecosystems, such as otter. Populations of threatened fish species may be lost from downstream reaches, particularly within the Steelpoort Catchment.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-14.25	-9.00	-18.00
Maximum Mine Production	-15.00	-10.00	-20.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All mitigation for erosion prevention and control should be implemented.
- All mitigation for water quality impacts should be implemented.
- Limit the extent of the development footprint to exclude aquatic resources as far as possible. Limit surface soil disturbance (including vegetation removal) and implement proper erosion control measures (especially in or close to drainage lines).
- Implement an aquatic biomonitoring and water quality programme. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.

7.3.5.6 Spread of Alien Fish Species

Alien fish species (Common carp) already present downstream within Glisa colliery, and other alien fish species are often spread through the introduction of people in an area. The introduction of alien species is most often for angling/recreational purposes, but can also be driven by subsistence needs for protein. Alien fish species compete with indigenous fish species for habitat and food, and can have a devastating impact on natural aquatic biota through predation and habitat destruction.

This impact will exacerbate existing downstream impacts due to mining and agriculture. Alien fish species may out-compete indigenous fish species or destroy their habitats, either on site or downstream of the site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.00	-8.25	-12.38
Maximum Mine Production	-16.00	-8.25	-12.38

No-Go Alternative	N/A	N/A	N/A

It is recommended that the applicant prohibit the stocking of any alien fish species into dams or streams within the mining area. If alien fish species are present or observed within the mining area, they should be removed. Encourage removal of alien species and return of indigenous species with anglers. Should fish from the dams within the mining area be utilised as a food source, a Human Health Risk Assessment must first be done to ensure that the fish is safe for human consumption. Until such studies have been conducted, consumption of fish should be avoided.

7.3.5.7 Erosion and Dust from Roads and Stockpiles

Sediments may arise from runoff from roads or as dust from roads and soils stockpiles. Sediment deposition within the wetlands will likely lead to changes in wetland vegetation as sediments are colonised by species such as *Typha capensis* or *Phragmites australis*, often in monospecific stands. Disturbance to wetland habitats could also provide opportunity for an increase in alien vegetation within the wetlands. Water quality will also deteriorate as turbidity and suspended solid loads are increased downstream of the site. This may have a negative impact on aquatic fauna.

This impact will contribute to existing sedimentation impacts due to mining, in particular by Glisa Colliery. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-14.00	-6.50	-6.50
Maximum Mine Production	-14.00	-6.50	-6.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lower the significance of this impact:

- Ensure that roads are located outside of wetland areas;
- Ensure that dust suppression is used and that sediment trapping structures prevent sediments from entering wetland areas; and
- Soil stockpiles should also be located well outside of wetland areas.

7.3.6 IMPACTS ON WETLANDS

7.3.6.1 Loss of Wetland Habitat

All wetlands located directly within the proposed footprint of the Alternative 2 pit will be permanently destroyed by opencast mining. In the case of the Maximum Mine Production Alternative 228ha of wetlands will be permanently destroyed while with the Sensitivity Planning Approach Alternative 46ha of wetlands will be permanently destroyed. As opencast mining permanently alters the movement of water through the landscape through changes to soils structure as well as the stratigraphy, wetlands also generally do not form on the post-mining landscape. The majority of wetlands impacted by the proposed Sensitivity Planning Approach form the upper reaches of a system already significantly impacted by the mining activities taking place at the Glisa Coal Mine, and the section of wetland system immediately below the proposed pit has already been diverted as part of past mining activities.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland loss within the Mpumalanga Highveld. All wetlands within the opencast footprint will be permanently destroyed. As opencast mining permanently alters the movement of water through the landscape through changes to soil structure and underlying stratigraphy, wetlands generally cannot form on the post mining landscape.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-22.50	-22.50	-41.25
Maximum Mine Production	-23.75	-23.75	-43.54
No-Go Alternative	N/A	N/A	N/A

To minimise the loss of wetland habitat, the following mitigation measures should be implemented:

- The proposed mining footprint should be kept as small as possible;
- All stockpiles should be located outside wetland areas;
- Ideally wetland areas outside the direct opencast footprint should be fenced-off and all mining activities excluded from these areas; and

- Offsite mitigation should be explore as a means of offsetting the loss of wetland habitat through development of a detailed offset strategy according to the methodology outlined in the SANBI guidelines and using an offset multiplier as agreed with the competent authority.

7.3.6.2 Disturbance of Wetland Habitat

Wetlands located outside the direct footprint of mining activities are likely to be disturbed during the construction process, leading to habitat degradation. Injudicious driving of vehicles and machinery, increased human traffic on site, incorrect placement of temporary stockpiles etc. are all likely to contribute to disturbance of wetland habitat. In the case of alternative 3, the downstream area of the main wetland system to be affected constitutes a river diversion around past mining activity on Glisa Colliery.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. If unmitigated and uncontrolled, the disturbance of wetland habitat could result in degradation to levels that are irreversible. For example, preferential flow paths created by vehicle tracks following injudicious driving through wetland areas could result in the onset of erosion and formation of erosion gullies, with irreplaceable loss of the wetland sediments. Erosion gullies also lower the local water table within the affected wetland and lead to partial desiccation and terrestrialisation of the wetland habitat.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.50	-8.75	-14.58
Maximum Mine Production	-13.75	-10.00	-16.67
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All wetland areas not within the direct footprint of proposed mining activities should be excluded from all mining activities;

- Ideally the wetland areas should be fenced-off to prevent access to mining machinery and personnel;
- All mine staff should be informed as to the location, extent and importance of wetland areas on site;
- No temporary stockpiles, constructors camps etc. may be located within any wetland area on site;
- A management plan for remaining wetland areas should be compiled, including recommendations on fire management and grazing management;
- An alien vegetation management plan should also be drawn up and implemented already during the construction phase; and
- All wetland areas outside the direct mining footprint that are nonetheless impacted by mining activities should be rehabilitated as soon as possible according to the rehabilitation guidelines contained in the wetland assessment report.

7.3.6.3 Increased Transport and Sedimentation in Wetlands

Ongoing vegetation clearing and stripping of top soil as the opencast pit progresses will expose large areas of bare, unprotected soil to erosion. Increased surface runoff volumes and velocities in these areas will further increase the movement of sediment off these sites. Sediments are likely to be transported into adjacent wetland areas and deposited where slow flows down. Sediment deposition within wetland areas will lead to changes in vegetation with species such as Typha capensis and Phragmites australis typically dominating areas of sedimentation, often to the near exclusion of other species. Flow retardation due to establishment of reed beds could over time also lead to channel switching. In the case of alternative 3, the affected wetland catchment drains towards the Mahim Dam on Glisa Colliery. Mahim Dam is likely to act as a sediment trap in this regard.

The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. Through alteration of the wetland habitat and changes in species structure and composition, sensitive species could be lost from the affected wetland systems.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.75	-10.00	-15.00

Maximum Mine Production	-17.50	-11.00	-16.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to reduce this impact:

- Sediment transport off all bare soil areas should be minimised;
- Vegetation clearing of any area should be delayed for as long as possible;
- Vegetation stripping and clearing should thus be phased and only the minimum required area cleared at any one time;
- A shallow berm or sediment barrier (see wetland assessment report) should be installed along the downslope edge of any bare soil area to create a depositional environment outside wetland areas;
- A stormwater management plan must be in place to manage surface runoff during storm events; and
- Preferential flow paths created by vehicle ruts should be blocked. Water management infrastructure should incorporate sediment traps.

7.3.6.4 Water Quality Deterioration

Spills and leaks of hazardous substances such as oil, diesel, cement etc. used on site could result in water quality deterioration if these pollutants enter downslope water resources. In the case of Alternative 3, the downstream affected downstream water resources are located within Glisa Colliery and are already significantly impacted by mining activities.

Water quality within the upper Steelpoort River is generally still of a good quality. However, the cumulative impact of coal mining as well as industrial development in the neighbouring upper Olifants River Catchment has resulted in serious water quality concerns. Unmanaged, the same scenario is likely to develop within the Steelpoort River as well. Deterioration in water quality could lead to the loss of sensitive species within affected water resources, as well as make the water less fit for use. In this regard the construction of the De Hoop Dam lower down the Steelpoort River, which will be one of the receiving water resources, needs to be considered.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-11.00	-7.00	-9.33

Maximum Mine Production	-11.00	-7.00	-11.67
No-Go Alternative	N/A	N/A	N/A

To reduce water quality deterioration the following mitigation measures are recommended:

- All hazardous materials stored on site should be stored in designated and clearly marked areas equipped to prevent contamination due to spills and leaks;
- All hazardous substances should be stored on impervious surfaces that allow for the containment of spills and leakages (e.g. bunded areas);
- Should spills occur, these should be reported to the ECO. Sufficient clean-up material should be stored on site to deal with small spills. Larger spills will require the appointment of specialist clean-up teams to rehabilitate the affected area; and
- No hazardous materials may be stockpiled in any wetland area or within 100m of any wetland on site.

7.3.6.5 Erosion at Water Management Discharge Points

As part of the water management infrastructure, clean water flows from upslope the mining area will need to be diverted around the mining area and discharged into downslope water courses and wetlands. This will convert the predominantly diffuse, subsurface flows of the hillslope seepage wetlands to concentrated surface flows with significantly increased erosive energy. Erosion is likely to occur at the points of discharge, with deposition of eroded sediments further downstream in the wetlands.

The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. If unmitigated and uncontrolled, the disturbance of wetland habitat could result in degradation to levels that are irreversible. For example, the onset of erosion and formation of erosion gullies will result in irreplaceable loss of the wetland sediments, while erosion gullies also lower the local water table within the affected wetland and lead to partial desiccation and terrestrialisation of the wetland habitat.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-11.00	-6.75	-9.00
Maximum Mine Production	-12.00	-7.50	-12.50

No-Go Alternative	N/A	N/A	N/A

To prevent excessive erosion the following mitigation measures are recommended:

- All clean water should be diverted around the proposed mining activities;
- Diversions should preferably be vegetated with low slope sideslopes (1:5 or less) rather than simple trench excavations;
- Discharge points should be protected against erosion and should incorporate energy dissipaters and diffusers to ensure low velocity flows enter the downslope wetlands and that flows rapidly disperse; and
- Annual monitoring (end of wet season) of all discharge points for erosion with fixed point photography should also be undertaken and all erosion damage repaired.

7.3.7 SURFACE WATER IMPACTS

Surface water impacts are directly related to the impacts on wetlands, aquatic ecology and social aspects. These related surface water impacts have been identified and addressed in the relevant sections of the aspects mentioned above.

7.3.7.1 Alteration of Natural Drainage Patterns

The preparation of the site and construction of infrastructure such as dams, trenches, channels and berms have the potential to alter the sites natural, pre-existing surface water drainage patterns. Alteration of the natural, pre-existing drainage patterns directly influences the volume of water and how it enters the receiving environment and sensitive receptors such as wetlands.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-17.50	-35.00
Maximum Mine Production	-18.75	-18.75	-37.50
No-Go Alternative	N/A	N/A	N/A

The following mitigations measures are recommended to manage this impact:

- Areas should be sloped to allow for free runoff toward either clean and dirty water separation systems infrastructure and appropriately re-directed depending on whether water is either clean or dirty;

- Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and locations restrictions stipulated in GN 704 of the NWA;
- Clean and dirty water system infrastructure must allow for clean water to re-enter the receiving environment and dirty water to be contained in PCD's;
- It must be ensured that clean and dirty water system infrastructure is operating effectively and efficiently to separates clean and dirty water;
- Clean and dirty water system infrastructure must be located away from surface water resources and drainage lines; and
- Restrict the use and/or abstraction of surface water.

7.3.7.2 Increased Erosion and Sedimentation

The alteration of the sites natural, pre-existing surface water drainage patterns and the sloping of areas have the potential to result in significant increases in erosion and sedimentation which may enter receiving surface water bodies and deteriorate water quality and impact on aquatic ecology

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.50	-10.00	-16.67
Maximum Mine Production	-12.50	-12.50	-20.83
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- No development should occur within the 1:100 year flood line of any drainage line;
- Vegetation clearance and soil disturbances should be limited to the dry season and proper erosion control measures must be implemented;
- Movement of machinery and vehicles must be limited to the construction footprint and avoid all soil stockpiles;
- Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and locations restrictions stipulated in GN 704 of the NWA;

- Areas should be sloped to allow for free runoff toward either clean and dirty water separation systems depending on whether water is dirty or clean;
- Dams must be lined and equipped with a silt trap that is regularly cleaned and maintained; and
- Clean and dirty water system infrastructure must be located away from surface water resources and drainage lines.

7.3.7.3 Chemical Pollution of Surface Water

Site preparation, construction of infrastructure and the use of machinery and equipment have the potential to result pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-11.25	-5.25	-8.75
Maximum Mine Production	-11.25	-6.75	-11.25
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and location restrictions stipulated in GN 704 of the NWA;
- All hazardous substances must be stored and handled on impervious substrates and bunded areas that are able to contain potential spillages;
- Storage areas must be kept as dry as is practically possible and all storm and rain water collected in storage areas must be removed and disposed of in the PCD's;
- Waste handling and storage facilities to be constructed away from surface water resources and drainage lines;
- All vehicles and equipment must be kept in good working order and regularly services; and

- Should a spill occur then the spill response procedure as provided in this EMP should be followed.

7.3.8 GROUND WATER IMPACTS

Groundwater impacts are directly related to impacts on surface water, wetlands, aquatic ecology and social aspects. These related impacts have been identified and addressed in the relevant sections of the aspects mentioned above.

7.3.8.1 Chemical pollution of groundwater

Site preparation, construction of infrastructure and the use of machinery and equipment have the potential to result in pollution of groundwater. Pollution, as a result of spillages, seepages or leaks and improper waste handling, storage and disposal is able to infiltrate the groundwater regime and pollute the groundwater system.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-6.75	-2.50	-3.75
Maximum Mine Production	-6.75	-3.50	-5.25
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and location restrictions stipulated in GN 704 of the NWA;
- All hazardous substances must be stored and handled on impervious substrates and bunded areas that are able to contain potential spillages;
- Storage areas must be kept as dry as is practically possible and all storm and rain water collected in storage areas must be removed and disposed of in the PCD's;
- Waste handling and storage facilities to be constructed away from surface water resources and drainage lines;
- All vehicles and equipment must be kept in good working order and regularly services;
- Should a spill occur then the spill response procedure as provided in this EMP should be followed; and

- Continuous monitoring of water bodies must be undertaken.

7.3.8.2 Alteration of Groundwater Levels

The preparation and excavation of the initial box cut of the open pit mine has the potential to result in dewatering of the aquifer in close proximity of the pit. This impact is likely to be experienced as soon as the groundwater table is intercepted and result in groundwater seepage which will need to be pumped from the pit and into the pit dewatering dam and PCD's respectively.

Maximum Mine Production rate = 90 m^3/day

Sensitivity Planning Approach rate = 12 m^3/day

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.75	-13.75	-25.21
Maximum Mine Production	-13.75	-13.75	-27.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Keeping the pit dry and free of water is essential for mining activities and as such this impact cannot be mitigated however the following apply:
- Groundwater inflows into the pit must be pumped out and into the Pit dewatering dam and PCD's respectively;
- Liaise with and if need be compensate affected surface rights holders for loss of the use of boreholes which run dry due to dewatering located within the cone of depression; and
- Continue to monitor groundwater quality and levels.

7.3.8.3 Wetland dewatering

Open cast mining will result in the potential dewatering of the aquifer closest to the pits and inflow of groundwater into the pit. A maximum drop in water levels of approximately 38 m with Alternative 2 (for boreholes BH 9 and BH 2) and approximately 28 m with Alternative 3 (for springs VSFn1 and VSFn2) is anticipated and it is likely that all springs will run dry. As such, dewatering of the wetlands on site is anticipated as seepage, due to the cone of depression, to the pit increases.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-9.00	-9.00	-18.00
Maximum Mine Production	-13.75	-13.75	-27.50
No-Go Alternative	N/A	N/A	N/A

No mitigation measures are possible or this impact.

7.3.9 AIR QUALITY IMPACTS

7.3.9.1 Nuisance Dust Fallout

Nuisance dust fall occurs when dust-fall rates exceeding the residential guideline of 600 mg/m²/day, beyond the mine boundary.

Power generation, farming activities, and nearby mining add to the cumulative nature of this impact. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-9.00	-15.00
Maximum Mine Production	-12.00	-11.00	-18.33
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.3.9.2 Elevated PM10 Levels

Elevated PM_{10} levels outside of the mining boundary will affect the surrounding sensitive receptors. Public response for this impact has been significant. The cumulative impact of mining operations as well as other contributing sources will result in non-compliance with NAAQS even under the mitigated scenario. This non-compliance will be applicable during mining operations only. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.00	-11.00	-18.33
Maximum Mine Production	-14.00	-13.00	-21.67
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.3.9.3 Elevated PM2.5 Levels

Elevated $PM_{2.5}$ levels outside of the mining boundary will affect the surrounding sensitive receptors. Public response for this impact has been significant. Impact assessment included the cumulative impacts as a result of particulate emissions from the Glisa processing plant. It was not within the scope of this assessment to quantify other sources of airborne particulates, although sources are likely to include power generation, farming activities, and nearby mining. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-9.00	-13.50
Maximum Mine Production	-12.00	-11.00	-18.33
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.3.9.4 Impact of dust Fallout on Agriculture

Dust-fall rates exceeding 400 mg/m²/day, beyond the mine boundary, could impact the photosynthetic activity of crops and reduce the aesthetic appeal of flowers produced by Hadeco.

This impact has received a significant public response. During mining operations dust fall-out may exceed 400 $mg/m^2/day$ at locations beyond the mine boundary. Reduced photosynthetic rates in crop plants (sunflower and cotton) have been recorded at this deposition rate. A reduction in aesthetic appeal of flowers, produced by Hadeco, is also likely at 400 $mg/m^2/day$ or higher. This is applicable to 39ha of Hadeco cultivated areas near the Portion 30 boundary. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-11.00	-16.50
Maximum Mine Production	N/A	N/A	-N/A
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.3.10 NOISE IMPACTS

7.3.10.1 Noise Nuisance

The potential noise climate was established in general for the construction of the works related to the Paardeplaats project and on Paardeplaats property, inclusive of appurtenant works. The level and character of the construction noise will be highly variable as different activities with different plant/equipment will take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

There is a potential for several noise sensitive receptors to be impacted by construction noise from this open cast pit configuration (albeit at different periods of mining), and specifically during the night-time period. The noise impact of Alternative 3 is relatively smaller than that of Alternative 2, and there are fewer NSRs that could potentially be affected in the southern sector of the study area. There are more NSRs that could potentially be affected in the southern sector of the study area in Alternative 2.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Sensitivity Planning Approach	-6.00	-6.00	-8.00
Maximum Mine Production	-6.00	-6.00	-8.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to reduce the impact of noise nuisance on sensitive receptors:

- Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites;
- All construction vehicles and equipment are to be kept in good repair;
- Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds;
- Construction activities, and particularly the noisy ones, are to be confined to reasonable hours during the day and early evening;
- With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;
- In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993);
- Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA should wear ear protection equipment.

7.3.11 VISUAL IMPACTS

7.3.11.1 Visual Impact of Dust

Dust created due to the removal of vegetation, movement of heavy vehicles and construction activities affects the sensitive receptors in the area. This public response for this impact has been significant. The dust created by the Paardeplaats Coal Mine will have a cumulative impact as there is already dust that is being created by the Exxaro Glisa Coal Mine. During the construction phase site establishment will take place and vegetation will be removed. This phase can still be rehabilitated to a degree that is similar to the surrounding area. The visual resource value of the area is moderate as the area is similar to the surroundings.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-8.75	-14.58
Maximum Mine Production	-11.25	-10.00	-16.67
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- Dust suppression techniques should be in place at all times during the construction and operational phases;
- As mush vegetation as possible should be kept during site clearance; and
- Rehabilitate / restore exposed areas as soon as possible after construction activities are complete.

7.3.11.2 Day Time Visual Impact

Mining activities have an effect on the visual landscape and character of the area. The proposed activity will contribute to the cumulative impact of existing mining activities in the area as well the dust that is being created. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-10.00	-11.67
Maximum Mine Production	-10.00	-10.00	-13.33
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented in order to reduce the significance of this impact:

- Paint buildings and structures with colours that reflect and complement the natural browns of the surrounding landscape. Avoid pure light colours and pure blacks;
- To reduce the potential of glare external surfaces of buildings and structures should be articulated or textured to create interplay of light and shade; and

- Rehabilitate / restore exposed areas as soon as possible after construction activities are complete.

7.3.11.3 Night Time Visual Impact

Lights used at night for mining activities will affect the visual landscape and character. The proposed activity will contribute to the cumulative impact of existing mining activities in the area as well the dust that is being created. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.50	-6.75	-7.88
Maximum Mine Production	-8.75	-7.50	-8.75
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented in order to reduce the significance of this impact:

- Avoid high pole top security lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area; and
- Light public movement areas (pathways and roads) with low level 'bollard' type lights and avoid post top lighting.

7.3.12 TRAFFIC IMPACTS

7.3.12.1 Impact on Adjacent Road Network

There will be an increase in traffic on the adjacent road networks. From a traffic engineering perspective the impact is low. The traffic will be added to the existing road network. The environmental damage has already been done with the construction of the road within an existing road reserve, which may also include services and stormwater drainage. The mitigation measure may include road upgrades at the intersections on the road network. However these upgrades will be within the existing road reserve, where the environmental damage has already been done. To conclude the environmental impact can be described as neutral as the traffic is been added to the existing roads.

Alternative	Pre-Mitigation	Post-Mitigation	Final

	Score	Score	Significance
Sensitivity Planning Approach	-5.00	5.50	8.25
Maximum Mine Production	-5.00	5.50	8.25
No-Go Alternative	N/A	N/A	N/A

The following are suggestions for upgrading the road network:

- Minimum width of 4m for all lanes on approach to intersection;
- Increasing the corner radii to 20m to ensure abnormal roads do not run over the pavement; and
- Right turn refuges at all intersections that are able to accommodate two heavy vehicles without restricting the flow of traffic.

7.3.12.2 Impact on Bridges and Culverts

Additional heavy traffic over bridges and culverts is expected. The cumulative impact on the bridges and culverts on the adjacent road network will be low. All these are existing structures and should have been design to the correct standards to accommodate heavy vehicles. The report recommended that all culverts and bridges on possible heavy vehicle routes be assessed by a structural engineer and where necessary any remedial works to be undertaken. The impact on resources will be negligible as the culverts and bridges are on existing roads. Therefore any environmental damage has occurred during the construction of the bridges and culverts. There may be some additional impact should remedial works be required to repair or upgrade any bridges and culverts.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-2.00	2.50	2.92
Maximum Mine Production	-2.00	2.50	2.92
No-Go Alternative	N/A	N/A	N/A

The most appropriate mitigation strategy would be to avoid these environmentally sensitive areas, where possible, by designing the mine layout in such a way that the routes between the pit and the processing plant and other areas are the shortest possible, but avoid these sensitive areas as much as possible.

If it is not possible to avoid these areas, then the culverts should be designed to have the minimum impact on the environment as possible and should be temporary structures that can be removed as soon as that section of the road is not required.

For the external road network the impact will be determined following a structural assessment of the culverts themselves. This is required in order to determine the structural condition of these culverts. Once this has been carried out it will be possible to determine if these culverts have the structural integrity to cope with the expected loadings during the operational lifespan of the mine.

If mitigation measures are required then it is recommended that they are designed to have as little impact as possible and should be designed in such a way that they can be removed at a later stage, if required.

7.3.12.3 Impact on Communities

Additional heavy vehicles travelling through communities or urban areas will affect the normal usage of these roads. The addition of heavy vehicles on the road network that pass through local communities and urban areas will have some impact. Many of these routes already experience heavy vehicles operating on them. However this impact can be mitigated by the implementation of travel management plan. This will identify appropriate routes that heavy vehicles can use to avoid communities and urban areas. There will be no loss of resources as the additional heavy vehicles will be operating on existing roads.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-6.00	-6.00	-7.00
Maximum Mine Production	-6.00	-6.00	-7.00
No-Go Alternative	N/A	N/A	N/A

To minimise the impact on the adjacent communities a traffic management plan be should be prepared, which would identify appropriate routes for heavy vehicles to avoid communities and limit time of operation.

7.4 OPERATION PHASE IMPACTS

The list below is of the impacts likely to occur during the operation phase. Each listed impact has been assessed and assigned a significance score. The impacts for each of the three project development alternatives are included for comparative purposes.

7.4.1 HERITAGE IMPACTS

7.4.1.1 Damage/Destruction of Palaeontological Resources

During the construction phase of the mine, the mining direction and subsequent box cutting and earth works can possibly impact on palaeontological resources.

The potential to impact negatively on fossil floras will remain as long as mining continues to expose and destroy fossiliferous strata. In palaeontological terms any destruction of fossils is a permanent negative impact and must be regarded as potentially high impact significance. New taxa are fairly regularly encountered in plant fossil studies, and destruction of well-preserved, undescribed fossil beds could represent a heavy loss in terms of our understanding of historical biodiversity.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.00	-16.00	-24.00
Maximum Mine Production	-16.00	-16.00	-24.00
No-Go Alternative	N/A	N/A	N/A

When the potential exists for new fossils to be exposed through excavations, it is the responsibility of the on-site Environmental Control Officer (ECO) to monitor excavation activities and report the occurrence of any fossiliferous material to SAHRA and an appropriate palaeontological expert, to allow the material to be thoroughly assessed, recorded and professionally excavated or sampled.

7.4.1.2 Damage/Destruction of Graves and cemeteries Within the Mining Footprint

The potential exists for the damage, destruction, or disturbance of graves and cemeteries within the mining footprint. Only two graves are impacted by Alternative 3 and the cumulative impact is seen as low. With Alternative 2, however, the total number of cemeteries directly impacted by the proposed mining foot print would be 6 accounting for 100 of a total of 141 graves identified inside the study area. The graves are irreplaceable but can be relocated by thus minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Sensitivity Planning Approach	-7.50	-7.50	-7.50
Maximum Mine Production	-7.50	-7.50	-7.50
No-Go Alternative	N/A	N/A	N/A

All graves that will be negatively affected should be relocated after a full grave process that includes comprehensive social consultation. Permits from the Burial Ground Unit of SAHRA and from the Mpumalanga Department of Health will be required for the relocation.

7.4.1.3 Damage/Destruction of Buildings and Structures Within the Mining Footprint

The potential exists for the damage, destruction, or disturbance of buildings and structures within the mining footprint. The destruction of all the structures within the mining area will result in a loss of structures adding to the cultural fabric of the area. No further cumulative effects on structures inside the Portion are foreseen. Documentation of the cultural characteristics of the structures will minimize the complete loss of information on the resource.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-3.00	-3.00	-3.50
Maximum Mine Production	-15.00	-11.00	-14.67
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All buildings must be evaluated for the possible presence of infant burials through social consultation;
- A permit from the Provincial Heritage Resources Authority Mpumalanga would be required if heritage structures need to be demolished; and
- The remains of the buildings should be mapped and documented by photographs and drawings.

7.4.1.4 Damage/Destruction of Undiscovered Heritage Structures/Resources Within the Mining Footprint

The potential exists for damage, destruction, or disturbance to previously undiscovered heritage structures or resources. The discovery of any heritage features can add to the cumulative impact of the mine and all heritage resources are irreplaceable.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.00	-7.00	-9.33
Maximum Mine Production	-7.00	-7.00	-9.33
No-Go Alternative	N/A	N/A	N/A

A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction and mining employees. If a possible heritage site is discovered during mining activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions. Depending on the type of site this can include initiating a grave relocation process, documentation of structures or archaeological excavations.

7.4.1.5 Damage/Destruction of Graves and Cemeteries Outside of the Mining Footprint

The potential exists for the damage, destruction, or disturbance to graves and cemeteries that fall within the mining right boundary but outside of the mining footprint. The total amount of cemeteries located within the mining right area but outside of the mining footprint is three accounting for 84 of a total of 141 graves identified inside the study area. The graves are irreplaceable but can be relocated thus minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.50	-7.50	-7.50
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

All graves that will be negatively affected should be relocated after a full grave process that includes comprehensive social consultation. Permits from the Burial Ground Unit of SAHRA and from the Mpumalanga Department of Health will be required for the relocation.

7.4.1.6 Damage/Destruction of Buildings and Structures Outside of the Mining Footprint

The potential exists for the damage, destruction, or disturbance to buildings and structures that fall within the mining right boundary but outside of the mining footprint. The destruction of all the structures within the mining area will result in a loss of structures adding to the cultural fabric of the area. No further cumulative effects on structures inside the Portion are foreseen. Documentation of the cultural characteristics of the structures will minimize the complete loss of information on the resource.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-11.00	-14.67
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All buildings must be evaluated for the possible presence of infant burials through social consultation;
- A permit from the Provincial Heritage Resources Authority Mpumalanga would be required if heritage structures need to be demolished; and
- The remains of the buildings should be mapped and documented by photographs and drawings.

7.4.1.7 Damage/Destruction of Undiscovered Heritage Resources Outside of the Mining Footprint

The potential exists for the damage, destruction, or disturbance to previously undiscovered heritage resources that fall within the mining right boundary but outside of the mining footprint. The discovery of any heritage features can add to the cumulative impact of the mine and all heritage resources are irreplaceable.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.00	-7.00	-9.33
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction and mining employees. If a possible heritage site is discovered during mining activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions. Depending on the type of site this can include initiating a grave relocation process, documentation of structures or archaeological excavations.

7.4.1.8 Damage/Destruction of Graves and Cemeteries in the Surrounding Area

The potential exists for the damage, destruction, or disturbance to graves and cemeteries that fall outside of the mining right area, particularly the Belfast Municipal Cemetery and the Belfast Concentration Camp Cemetery. There is a possible long term impact on tombstones due to blasting and vibrations. The graves are irreplaceable but can be relocated by doing so minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-9.00	-7.50	-8.75
Maximum Mine Production	-9.00	-7.50	-8.75
No-Go Alternative	N/A	N/A	N/A

It is recommended that there should be a base line documentation of the headstones and memorials before mining commence and on-going monitoring of the situation at the cemetery before during the operation of the Paardeplaats mine, as well as a fenced buffer of at least 20 metres around cemeteries inside the project area but outside the pit areas.

7.4.1.9 Damage/Destruction of Buildings and Structures in the Surrounding Area

The potential exists for the damage, destruction, or disturbance to buildings and structures that fall within the mining right boundary but outside of the mining footprint. The destruction and loss of integrity of any structures within the blasting zone will result in a loss of structures adding to the cultural fabric of the landscape. Documentation of the cultural characteristics of the structures will minimize the complete loss of information on the resource, and guide management of blasting during mining operations.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-8.25	-8.25
Maximum Mine Production	-13.00	-8.25	-8.25
No-Go Alternative	N/A	N/A	N/A

It is recommended that there should be a base line documentation of the structures associated with farmsteads, homesteads and ruins within the basting radius as identified in the blasting evaluation study, before mining commences and on-going monitoring of the structural integrity of these sites during the operation of the Paardeplaats mine.

7.4.1.10 Impact on Rock Art

The potential exists for the damage, destruction, or disturbance of a possible rock art site during mining activities. A possible rock art site was identified. The possible art is very faded and is situated on the southern side of an exposed rock bank which formed a slight overhang. An unusual isolated reddish marking, which could be the faded remains of two possible figures was identified. However, the marking was not very clear. Rock art is seen as one of the most rare of heritage resources and irreplaceable.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	N/A	N/A	N/A
Maximum Mine Production	-16.00	-4.00	-6.00

No-Go Alternative	N/A	N/A	N/A

It is recommended that the site be demarcated as a no-go area and that a specialist on rock art be contracted to evaluate and confirm the existence of the rock art and if confirmed develop further management recommendations for the site.

7.4.2 SOCIAL IMPACTS

7.4.2.1 Increase in HIV/Aids and Other Infectious Diseases

HIV/AIDS is already a problem in the area, as a result of migrant workers employed by the mine and other industries in the area. Rumours of development will result in an influx of people into the area.

Impact has been mentioned by a number of stakeholders. This is an existing impact and the mine is not the only source of the impact. It is not possible to quantify the exact origin of the impact. Due to the presence of migrant labour this impact may spread to the labour-sending areas. The most important loss will be the loss of human capital and the associated skills since there is currently no cure for HIV/Aids. The treatment of the illness puts pressure on existing medical resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-19.00	-13.50	-22.50
Maximum Mine Production	-19.00	-13.50	-22.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lessen the impact of disease on the population:

- Form a partnership with a Non Profit Organisation (NPO) to provide the necessary social services to people whose lives are affected by infectious diseases;
- Develop an in-house infectious diseases strategy to address health issues with the workforce; and
- Align strategy with community HIV strategy followed by NPO.

7.4.2.2 Health Impacts

Health impacts such as asthma, sinusitis, allergies and other respiratory diseases are attributed by the local population to dust generated by the operation of the mine.

Issue has been mentioned by a number of stakeholders. This is an existing impact, and other industries in the area such as the agricultural, forestry and other mines contribute to the impact. This is a nuisance impact that affects people's quality of life, and at most may affect productivity in the working environment.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.00	-8.25	-11.00
Maximum Mine Production	-18.00	-8.25	-11.00
No-Go Alternative	N/A	N/A	N/A

The mitigation of the bio-physical dust impact will address this impact.

7.4.2.3 Conflict between Residents and Newcomers

There is a potential for social unrest and conflict between local residents and newcomers due to discrepancies in income and opportunities that is generated by the mine.

Issue has been brought up in the consultation process. This is an existing impact and other businesses in the area contribute to the impact. It cannot be mitigated in isolation. There is a risk of community unrest that may impact on the social capital of the community.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-10.00	-13.33
Maximum Mine Production	-15.00	-10.00	-13.33
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lessen the impact of conflict:

- Implement a community relations programme;
- Develop a business forum and ensure local SMME's are utilised for project;

- Implement local procurement policy; and
- Encourage and enable staff to live locally.

7.4.2.4 Expectations Regarding the Benefits of the Project

The community have a number of expectations regarding the benefits of the project. Not all the expectations are realistic, as some of the things the community expect from the mine are really the function of the government.

Expectations were confirmed during community consultation process. There are similar expectations of other mines in the area. Unless managed well there may be reputational risk to Exxaro.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-10.00	-13.33
Maximum Mine Production	-15.00	-10.00	-13.33
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to decrease the significance of this impact:

- Implement community relations strategy; and
- Communicate frequently with the affected stakeholders to ensure that they understand the processes and do not develop more unrealistic expectations.

7.4.2.5 Skills Development

The social and labour plan makes provision for significant skills development initiatives. This includes bursaries, learnerships and a training centre.

This aspect has been discussed with the communities that have been consulted and everybody reacted very positively towards it. A number of positive secondary social impacts are associated with skills development. These include an increase in quality of life and general social well-being. From a social perspective skills development creates new resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Sensitivity Planning Approach	17.00	23.75	39,58
Maximum Mine Production	17.00	23.75	39.58
No-Go Alternative	N/A	N/A	N/A

Recommended measures to ensure positive skills development include the following:

- Ensure the local eMakhazeni communities are the beneficiaries of skills development initiatives;
- Implement the skills development initiatives that have been identified in the SL; and
- Establish a skills training centre as per the SLP.

7.4.2.6 Impact on Infrastructure such as Roads and Buildings

Activities of the mine such as the transport of coal have a negative impact on the road infrastructure. There is not adequate housing available for staff, especially in the lower income group.

This impact has been mentioned by a number of stakeholders. Other industrial activities in the area contribute to the impact. Impact is already taking place. It may be a threat to natural resources if informal settlements are established. However, it is not currently a threat, as there are no informal settlements in the area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-7.50	-10.00
Maximum Mine Production	-13.00	-7.50	-10.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lessen this impact:

- Engage with the municipalities to discuss strategic long-term planning w.r.t. services such as road maintenance and housing;
- Coordinate the outcomes of the Social and Labour plan with the Integrated Development Plans of the municipalities; and
- Become a member of the IDP Forum.

7.4.2.7 Social Impact of Blasting

Farms in close proximity of the mine and residents of Belfast and Siyathuthuka complain about cracks in their houses due to the blasting operations of the mine.

A number of people mentioned this as a concern. It is an existing impact, and any new impacts will become cumulative. The effects of blasting impact negatively on the financial resources of affected households.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final significance
Sensitivity Planning Approach	-13.00	-6.75	-9.00
Maximum Mine Production	-13.00	-6.75	-9.00
No-Go Alternative	N/A	N/A	N/A

In order to lessen the effect toft hi impact the following mitigation measures are recommended:

- Conduct a crack survey at properties in a certain radius of the mine; and
- Explore alternative blasting methods that may have a lower physical impact.

7.4.2.8 Social Impact of Dust

Coal dust has a negative impact on the livelihoods of the agricultural community since it affects the quality of their products.

Impact mentioned by a number of affected parties. Dust is already a problem in the area due to current mining activities. If the activities are moved closer to the receptors the impact will be greater. Some of the bulbs that Hadeco produces are only grown on this farm in South Africa. There are no other suitable areas to grow these bulbs in the country, and the only alternative would be to move the business abroad.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-8.25	-13.75
Maximum Mine Production	-13.00	-8.25	-13.75
No-Go Alternative	N/A	N/A	N/A

It is recommended that the applicant engage with the experts and the affected parties to find suitable solutions to this issue.

7.4.2.9 Social Impact of Water Pollution

There are fear and perception around water pollution in the community, especially since areas in close proximity has been affected by incidents related to acid mine water.

This is a very controversial issue and should be addressed thoroughly. Water is a sensitive matter and the water resource in Mpumalanga is already under pressure. South Africa is a water-scarce country and damage to water resources will have a severe social impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-14.00	-7.50	-13.75
Maximum Mine Production	-14.00	-7.50	-13.75
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are taken to lessen the severity of this impact:

- Address community's fear by being open about monitoring data;
- Utilise experts to educate the community about the scientific facts; and
- Install and communicate pollution prevention measures.

7.4.2.10 Co-operative Governance

The government is an important role player in the project. If the mine and the government work together they have the potential to make a positive contribution to the local community.

This impact can have a high positive impact in affected communities if all the industries in the area work towards a common goal. This may be beneficial to all parties involved.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	12.00	17.50	20.42
Maximum Mine Production	12.00	17.50	20.42

No-Go Alternative	N/A	N/A	N/A

Recommended measures to ensure co-operative governance include the following:

- Establish good working relationships with local and district government by attending their forums and individual interaction.

7.4.3 ECONOMIC IMPACTS

7.4.3.1 Net Employment

The potential exists for net employment generated for the economy to increase due to mining activities. Just fewer than 99 FTE employees would be provided with jobs should the Hadeco land not be impacted. This is still not significant against the employment baseline. Four hundred employees will obtain/retain jobs for the life of mine of 10 years, but over an economic generation of 40 years this in essence reduce by 30/40, or three quarters. In the case of Alternative 2, just fewer than thirty jobs will be lost. The magnitude of the impact is in fact minor, considering that ELM has over 7 000 formally employed people. Strictly speaking, it is more appropriate to look at the District and in this regard Nkangala has over 200 000 formally employed. Against these denominators, a numerator of 26 is thus very low. Thus from a cumulative impact, the impact needs to be rated as minor. The irreplaceable loss will be agricultural land-use on the area to be farmed and the effectiveness of the rehabilitation measures will determine the permanence of the degree of irreplaceability.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	18.75	18.50	25.00
Maximum Mine Production	-16.25	-16.25	-21.67
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to improve the economic standing of the area:

- Establish economic plans for mine closures;
- Provide training to employees on wealth management. Thus the importance of saving and paying of bonds on properties to anticipate eventual retrenchment due to mine closure;

- Analyse avenues to undertake import substitution and material beneficiation to increase economic activities in the areas; and
- The mine needs to set up a Compensation Trust Fund.

7.4.3.2 Income Generation

The net income to the economy has the potential to increase due to mining activities. The magnitude of the economic increase on the local economy over forty years for Alternative 3 after multipliers is very small at 0.08%. The magnitude of the positive income generation for Alternative 2 is in fact relatively low. A total increase of 0.8% over a forty year period for a local economy is not high and this reduces to 0.1% for the total Nkangala economy. This low increase is due to the potential income lost by the Hadeco farm. The income losses from the Agricultural sector t replaced by the mining sector.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	14.00	14.00	25.67
Maximum Mine Production	12.00	12.00	22.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to improve the economic standing of the area:

- Establish economic plans for mine closures;
- Provide training to employees on wealth management. Thus the importance of saving and paying of bonds on properties to anticipate eventual retrenchment due to mine closure;
- Analyse avenues to undertake import substitution and material beneficiation to increase economic activities in the areas; and
- The mine needs to set up a Compensation Trust Fund.

7.4.4 SOILS, LAND USE, AND LAND CAPABILITY IMPACTS

7.4.4.1 Reduction of Agricultural Potential

The proposed mining activities have the potential to result in the loss of arable agricultural potential due to removal and storage of soil profile. The impact may become cumulative if area than one area is affected and it may result in the loss of irreplaceable resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-14.00	-23.33
Maximum Mine Production	-18.75	-14.00	-23.33
No-Go Alternative	N/A	N/A	N/A

It is recommended that the correct storage of removed soil material is undertaken in order to mitigate this impact.

7.4.4.2 Loss of Soil Fertility

Loss of fertile topsoil due to mining activities during the operational phase is a potential impact. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-14.00	-23.33
Maximum Mine Production	-18.75	-14.00	-23.33
No-Go Alternative	N/A	N/A	N/A

It is recommended that soil is stockpiled for the shortest time possible and that topsoil is retained with vegetation.

7.4.4.3 Soil Erosion Hazard

Increased susceptibility to erosion due to removal of vegetation cover is a potential impact resulting from mining activities. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-14.00	-13.00	-17.33
Maximum Mine Production	-14.00	-13.00	-17.33
No-Go Alternative	N/A	N/A	N/A

It is recommended that the stripped soils are stockpiled for the shortest time possible and that stockpile slopes are not steep.

7.4.4.4 Soil Compaction

There is the potential for soil to be compacted during mining operations. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-17.50	-29.17
Maximum Mine Production	-18.75	-17.50	-29.17
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of heavy machinery is restricted as far as possible to lessen the significance of this impact.

7.4.4.5 Chemical Pollution of Soil

The potential exists for the contamination of soil due to spillage by chemicals, hydrocarbons, or contaminated water during the operational phase. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-14.00	-21.00
Maximum Mine Production	-20.00	-15.00	-22.50
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented to address this impact:

- Control drainage from pit area, as well as around stockpile, such as drains, berms and collection areas; and
- Avoid contact with wetlands or streams.

7.4.4.6 Change in Natural Landscape

Mining activities have the potential to result in alteration of the prevailing terrain. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-17.50	-26.25
Maximum Mine Production	-18.75	-17.50	-26.25
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented to address this impact:

- Reduce excavation to a minimum;
- Spoil and soil to be handled correctly prior to replacement; and
- Avoid wetlands and depression areas.

7.4.5 IMPACTS ON ECOLOGY

7.4.5.1 Transformation of Vegetation

The new infrastructure associated with the mine will result in the removal of the remaining natural vegetation.

Loss of habitat which is represented by the remaining natural vegetation is a global issue, the disturbance of the natural vegetation and consequential displacement of fauna in close proximity to the development also creates opportunity for alien invasive species to establish. This is an additional factor that contributes to biodiversity loss on both global and regional scales. Loss of intact grassland, irrespective of ecological condition, could displace large terrestrial bird species such as Secretary Birds and Korhaan species. Many of these species are currently listed as threatened by the IUCN.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-12.00	-16.00
Maximum Mine Production	-16.25	-12.00	-16.00
No-Go Alternative	N/A	N/A	N/A

To minimise the loss of vegetation, the following mitigation measures should be implemented:

- Infrastructure should preferably be focused on already transformed areas e.g. cultivated lands or existing infrastructure e.g. homesteads; and
- Infrastructure should be condensed to prevent unnecessary sprawl into sensitive areas.

7.4.5.2 Damage to Habitat

Damage to habitat is associated with fragmentation due to the development of infrastructure and the exploitation of certain species by the workforce.

The reduction of habitat due to fragmentation will result in fauna species being displaced, thereby increasing competition among species in other areas (especially species that require large home ranges) or loss of vitality due to inbreeding, which would make the population sensitive to stochastic events/natural disasters (flooding, fire, drought, diseases). The exploitation of specific species, whether plant or animal has an influence on their availability and therefore the suitability of the area as habitat. This impact in strongly linked to losses of biodiversity. The disruption of migratory routes can pose a direct risk to faunal assemblages in the region. For example, many mammal species exhibit large home range sizes which are vital for food resource acquisition, territory maintenance and exchange of genetic material. Large scale establishment of infrastructure, if unplanned may permanently eliminate regional biodiversity. Similarly, the loss of ecological connectivity between avifaunal flyways (e.g. drainage lines and hillslope seeps) could disrupt seasonal altitudinal migration or daily commuting between roosting and foraging areas.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-11.00	-18.33
Maximum Mine Production	-17.50	-12.00	-20.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lessen the significance of this impact:

- Infrastructure should be designed to rather follow the edge of natural areas than crossing it;
- If crossing it is the only option, then the area should be transected so that one large area remains rather than two equally sized areas;
- The workforce should be informed that it is illegal to harvest natural resource without the relevant permits and should be prosecuted if found in transgression of the law;
- Appropriate culverts should be implemented in order to facilitate movement of mammals throughout the site and limit fragmentation; and
- All hillslope seeps areas, especially those that support contemporary as well as historical Broad-tailed Warbler and Grass Owl habitat should be adequately buffered.

7.4.5.3 Habitat Destruction

Habitat destruction involves the destruction/ transformation of sensitive landscape features such as outcrops, wetlands and dryland grassland on deep soils. Outcrops, wetlands and untransformed dryland grassland on deep soils are widely spaced and therefore limited within the semi-natural/ agricultural landscape of the study area. Therefore the destruction of these sensitive landscape features has an influence on the mobility and persistence of species, and their ability to survive stochastic events. Rehabilitation or reconstruction of these sensitive habitats to prior levels of ecological complexity is difficult at best and in all likelihood impossible. Therefore, construction activities should not infringe upon these habitats. Several red data species with poor dispersal abilities rely on these habitats.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	N/A	N/A	N/A
Maximum Mine Production	-18.75	-13.00	-23.83
No-Go Alternative	N/A	N/A	N/A

The destruction of the remaining sensitive landscape features should be avoided through effective planning. In areas where the destruction cannot be avoided, these features should be re-introduced in the post mining landscape along with monitoring. It is vital that trained zoologists/ecologists assist with the recreation of former natural habitat during post construction (in the event of damage/destruction). Appropriate culverts should be implemented in order to facilitate movement of mammals throughout the site and to limit fragmentation. Finally, buffering of sensitive habitats away from construction activities is essential.

7.4.5.4 Loss of Biodiversity

Individuals or populations of species whether flora or fauna are lost due to the destruction of their habitat or due to the exploitation of the species or the introduction of alien invasive species. Biodiversity loss is a global issue, which occurs mainly through habitat loss and fragmentation and the invasion of natural areas by alien invasive species. Therefore activities which contribute to habitat loss and fragmentation as well as the introduction of alien invasive species will contribute to the cumulative biodiversity loss on both a local, regional and global scale.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-12.00	-24.00
Maximum Mine Production	-18.75	-13.00	-26.00
No-Go Alternative	N/A	N/A	N/A

Where possible, infrastructure should be kept on already transformed areas such as cultivated fields, forestry stand and existing homesteads. Existing infrastructure should rather be upgraded and development kept together rather than developing new infrastructure away from existing infrastructure. Construction should be planned so that migratory corridors are not destroyed to allow for regional species viability. Monitoring of animal movements (especially keystone or apex species) must be implemented during operation in order to facilitate dispersal of fauna, which is vital in maintaining biodiversity.

7.4.5.5 Direct and Indirect Mortality

This impact is caused by the increase in traffic volumes as well as the influx of humans to the area. As the habitat is lost while the mine's footprint expands the fauna are displaced and need to move to find alternative habitat. The development of the mining infrastructure provides access to areas previously not within reach of humans and therefore the resource is exploited. Interaction with vehicles (road kills) has the potential to drastically reduce populations of slow-moving fauna e.g. frogs.

Direct fauna mortalities that occur through interaction with vehicles (road kill) are expected to increase due to the mining and other associated activities. Individuals lost can disrupt the social structures of the fauna which can contribute to a decrease in population numbers. Indirect impacts lead to the displacement and increased competition among species, resulting in individuals moving further to find mating partners, thereby increasing their risk of being killed or exploited. The influx of humans could lead to high levels of poaching and harvesting of natural resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-11.00	-18.33
Maximum Mine Production	-20.00	-12.00	-20.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures should be implemented:

- Roads and berms should be designed to accommodate the movement of fauna;
- Vehicles should travel at low speeds (e.g. implement traffic calming infrastructure); and
- The mining area should be monitored for road kills and areas with high mortality rates should be identified and addressed by the construction of culverts and amphibian underpasses (with amphibian fences).

7.4.5.6 Red Data and Protected Species

Due to the transformation of the remaining natural vegetation as the boxcuts are developed, both habitat and individuals of red data or provincial and nationally protected species are lost.

Although some protected species are quite abundant in the landscape, they are however targeted for commercial purpose, resulting in a decrease in their populations within the landscape, especially outside of conservation areas and in close proximity to human settlements. The majority of threatened Red Data List species, whether plants or animals, are on the list due to the destruction of their specific habitat. Therefore the mining activities will contribute to habitat loss and fragmentation at all scales, namely local, regional and global. Protected and red-data faunal species are usually highly susceptible to localised extinctions. With concurrent habitat fragmentation, the chances of recolonisation are severely reduced which may lead to irreplaceable resource losses.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-21.25	-13.00	-23.83
Maximum Mine Production	-22.50	-14.00	-25.67
No-Go Alternative	N/A	N/A	N/A

An alternative method should be considered which results in less disruption of the landscape surface, underground mining or gasification should be considered or even alternative energy resources, which lowers the need to exploit the area for coal. High quality habitat (diverse areas) should be set aside and managed for the conservation and protection of the local biodiversity along with adequate buffers to eliminate unwanted edge-effects. Sensitive habitats for protected and red data fauna should be maintained, and red-data fauna monitoring programs, carried out during the operation phase should be implemented as part of the overall management strategy.

7.4.5.7 Spread of Alien Invasive Species

The seeds of alien invasive species currently present in the landscape such as Wattle (*Acacia mearnsii)* and Blue gums are dispersed into a wider area from exotic stands and homesteads on the machinery and truck wheels as well as through the replacement of topsoil.

The introduction of alien invasive species and their subsequent spread is a global issue, the disruption of the soil and the additional movement of seed bearing vehicles increases the risk that the alien invasive species will spread into areas where they have not previously occurred. If infestations occur close to drainage system, the seeds are dispersed even further.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Sensitivity Planning Approach	-18.75	-12.00	-20.00
Maximum Mine Production	-20.00	-13.00	-21.67
No-Go Alternative	N/A	N/A	N/A

The area should be assessed and the alien invasive species controlled prior to the commencement of the construction activities. The area should be monitored for the establishment and spread of alien invasive species during and after the construction phase. A full alien invasive action plan should be implemented.

7.4.5.8 Introduction of Foreign Animals

Domestic animals such as cat and dogs can become strays and live of the wildlife species present in the area, cattle and goats can modify the available vegetation resulting in a reduction in the quantity and quality of species present.

The introduction of foreign species can displace the naturally occurring species or outcompete them for resources (food and shelter), they can also exploit vulnerable species within the landscape, therefore their presence would contribute to the negative impacts already associated with mining activities such as habitat loss and fragmentation. However because the planned infrastructure does not involve the establishment of offices the probability of this impact occurring is lower. Persistent grazing and trampling of the natural vegetation by cattle will result in habitat disturbance and modification. Feral animals (e.g. cats) may cause both localised extinctions or contaminate local gene pools through hybridisation. In conjunction with habitat fragmentation, recolonisation becomes more difficult to the point of being irreversible.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-6.75	-5.25	-7.88
Maximum Mine Production	-8.25	-6.00	-9.00
No-Go Alternative	N/A	N/A	N/A

The staff of the mine should be educated/ informed about the risk that the introduction of foreign species has to the indigenous species. Abandoned homesteads should be monitored for the presence of domestic animals such as dogs and cats and appropriate control measures put in place. It is imperative that livestock remain isolated from the demarcated sensitive areas and that a "rotational" system of cattle camps be implemented depending on the grassland condition/trampling frequency to prohibit free-roaming of cattle.

7.4.6 IMPACTS ON AQUATIC ECOLOGY

7.4.6.1 Decline in Water Quality: Seepage

Water quality deterioration related to seepage from stockpiles and dirty water dams or runoff containing coal dust or other contaminants will result in increased salts (particularly sulphates), metals and changes in pH. Stormwater runoff may also contain contaminants from leaks arising from faulty machinery/vehicles, pollution control facilities and waste water treatment facilities, while spills may include hydrocarbons, cement, etc. from inadequate storage or waste disposal facilities. Contaminated dust and sediments can also be blown (from roads and stockpiles) or washed (in stormwater) into wetland areas. Water quality deterioration will affect aquatic species intolerant to water quality alteration. This impact is likely to affect the wetland that drains into Glisa Colliery, where existing water quality impacts are evident. It is uncertain what groundwater linkages exist but contamination of other watercourses could potentially occur through groundwater seepage.

This impact will exacerbate impacts due to mining further downstream within the Steelpoort catchment. The existing good quality water within the upper Steelpoort will be compromised, thus setting the stage for future mining within the catchment. Existing good water quality is likely to be permanently affected within the Steelpoort tributary (downstream of Site 7). Sensitive species may be lost due to water quality deterioration.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-21.25	-18.75	-28.13
Maximum Mine Production	-21.25	-18.75	-31.25
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All mitigation for erosion prevention and control should be applied;
- Ensure separation of clean and dirty water and allow clean water to enter natural water bodies;
- To prevent spillages and leaks:

- Vehicles should be well maintained;
- Diesel and oil/grease should be stored in bunded areas that will allow any spillages to be easily and quickly isolated and prevent contamination of any soils or water;
- Spills should be cleaned up with approved absorbent material such as “Drizit” or “Spillsorb”. These should be kept in sufficient quantities on site to deal with small spills. Absorbent material and contaminated soil should be disposed of at a registered hazardous waste site;
- An emergency preparedness plan should be compiled and all construction staff aware of procedures in event of a spill;
- Hazardous waste should be stored in bunded/impermeable areas and disposed of appropriately at a registered landfill site. Potential spills or seepage of hazardous waste must be anticipated and prevented; and
- An aquatic biomonitoring and water quality programme should be implemented. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.

7.4.6.2 Decline in Water Quality: Sedimentation and Turbidity

The process of opencast coal mining will also require the establishment of soil and overburden stockpiles. The bare side slopes of these stockpiles, together with the steep slopes, provide an ideal environment for the erosion of these stockpiles and the movement of the eroded sediments into adjacent wetlands. Sediment deposition within the wetlands will likely lead to changes in wetland vegetation as sediments are colonised by species such as *Typha capensis* or *Phragmites australis*, often in monospecific stands. Water quality will also deteriorate as turbidity and suspended solid loads are increased.

This impact will exacerbate impacts due to mining and agriculture further downstream within the Steelpoort catchment. Habitats may be permanently affected within the upper reaches of the Steelpoort tributary. This may result in species loss.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-10.50	-15.75
Maximum Mine Production	-21.25	-11.25	-18.75

No-Go Alternative	N/A	N/A	N/A

Mitigation measures should include the construction of a low berm, approximately 1m high by 2-3m wide between the stockpiles and the wetlands. These berms would serve to intercept flows containing suspended sediments and create a depositional environment. They should be located outside the wetland boundaries and should be created prior to construction and vegetation clearing on the stockpile footprint commencing. The top soil stockpiles should also be vegetated.

7.4.6.3 Biodiversity Loss

Loss or decline in habitat suitability or availability and a decline in water quality in aquatic ecosystems downstream of construction areas may result in the loss of sensitive species. This may be a result of increased turbidity, loss of habitats due to sedimentation, and pollution from spills/leaks (e.g. cement, hydrocarbons, solid waste). The impact would vary in intensity between different species and different life stages and processes (spawning, feeding, etc.). The intolerant and moderately intolerant biota, as well as those with predatory behaviour, will especially be influenced by increased turbidity. Declines in aquatic biodiversity may have a knock-on effect on vertebrates higher up in the food chain as their habitats and food sources decline. Otter, frogs and fish are especially at risk.

Existing impacts to habitats and sensitive species may exceed threshold levels for survival. In addition, increasing habitat loss is affecting animals associated with aquatic ecosystems, such as otter. Populations of threatened fish species may be lost from downstream reaches, particularly within the Steelpoort Catchment.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-20.00	-9.50	-17.42
Maximum Mine Production	-20.00	-10.00	-20.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All mitigation for erosion prevention and control should be implemented.
- All mitigation for water quality impacts should be implemented.

- Limit the extent of the development footprint to exclude aquatic resources as far as possible. Limit surface soil disturbance (including vegetation removal) and implement proper erosion control measures (especially in or close to drainage lines).
- Implement an aquatic biomonitoring and water quality programme. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.

7.4.6.4 Water Quality Deterioration: Transport and Stockpiles

Impacts resulting from the stockpiling and transport of coal all relate to the potential deterioration in water quality due to polluted runoff from coal stockpiles entering water resources or from spillages or dust from coal trucks. Spillages from coal trucks are greater than spillages from a coal conveyor for example, and can result in the pollution of road run-off. Where such road-runoff enters wetlands and rivers, the water quality within these ecosystems will also deteriorate which may cause a loss of aquatic biota. Typical impacts on water quality include increased salinity and sulphate levels, as well as turbidity (affecting visual predators) and a decline in habitat suitability (affecting biota with specialised substrate requirements). In addition, seepage from coal stockpiles is likely to be acidic, high in salts, sulphates and metals, and therefore contributing to acid mine drainage. It is assumed that for Alternative 3, existing roads will be used so no additional wetland crossings were considered.

This impact will contribute to existing sedimentation impacts due to mining, in particular by Glisa Colliery. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.00	-13.00	-15.17
Maximum Mine Production	-20.00	-14.00	-16.33
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to lower the significance of this impact:

- The coal product stockpiles must be located within the dirty water are of the mine and all runoff from the stockpiles should be captured in the dirty water system;
- No dirty water may be discharged into any wetland or water resource on site unless treated to the required standards;

- Overloading of coal trucks must be prohibited and strictly enforced to reduce spillages;
- Dust control measures must be employed;
- Runoff from the vehicle washbays must be directed into the dirty water system and oil effectively trapped;
- Spills should be prevented;
- Ensure that roads are located outside of wetland areas;
- Ensure that dust suppression is used and that sediment trapping structures prevent sediments from entering wetland areas; and
- Soil stockpiles should also be located well outside of wetland areas.

7.4.6.5 Altered Hydrological Regime

Construction of dams, trenches, berms and infrastructure alter the natural runoff of water into the aquatic ecosystems. The change can be both in terms of timing and duration, as well as quantity of water reaching the natural ecosystems. Alien vegetation encroachment due to disturbances can also have a significant impact on water levels in streams and rivers. Reduced flows will have an impact on the habitat availability for aquatic fauna and especially impact on those species/taxa with a preference for moderate to fast habitats. This impact will exacerbate impacts within Glisa Colliery.

This impact will contribute to existing abstraction volumes downstream within the Steelpoort Valley. Once the pits are in place, water will have to be permanently diverted round them.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-9.00	-15.00
Maximum Mine Production	-16.00	-9.75	-16.25
No-Go Alternative	N/A	N/A	N/A

The only way to effectively mitigate this impact is to locate mining areas outside of wetlands and watercourses. Where clean water is diverted away from mining areas, its point of re-entry into the natural watercourse should be well protected against erosion. In addition, sediments should be effectively trapped before re-entry. Limit use and abstraction of water from the surface and ground waters. Implement an alien vegetation control programme and continuously fight alien vegetation encroachment. Implement biomonitoring programme to detect any deterioration in aquatic biota.

7.4.6.6 Spread of Alien Fish Species

Alien fish species (Common carp) already present downstream within Glisa colliery, and other alien fish species are often spread through the introduction of people in an area. The introduction of alien species is most often for angling/recreational purposes, but can also be driven by subsistence needs for protein. Alien fish species compete with indigenous fish species for habitat and food, and can have a devastating impact on natural aquatic biota through predation and habitat destruction.

This impact will exacerbate existing downstream impacts due to mining and agriculture. Alien fish species may out-compete indigenous fish species or destroy their habitats, either on site or downstream of the site.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.00	-8.25	-12.38
Maximum Mine Production	-16.00	-8.25	-12.38
No-Go Alternative	N/A	N/A	N/A

It is recommended that the applicant prohibit the stocking of any alien fish species into dams or streams within the mining area. If alien fish species are present or observed within the mining area, they should be removed. Encourage removal of alien species and return of indigenous species with anglers. Should fish from the dams within the mining area be utilised as a food source, a Human Health Risk Assessment must first be done to ensure that the fish is safe for human consumption. Until such studies have been conducted, consumption of fish should be avoided.

7.4.6.7 Decline in Habitat Suitability and Availability

Soil erosion and dusts (especially from blasting and ore transportation) may lead to the input of sediment into the surrounding wetland systems. In addition, dust and eroded sediments from mining activities, stockpiles, waste dumps and roads contain metals and salts that contaminate surface water and also cause increases in turbidity. Sedimentation within the wetland may lead to changes in wetland vegetation as sediments are colonised by species such as Typha capensis or Phragmites australis, often in monospecific stands. Disturbance to riparian habitats could also provide opportunity for an increase in alien vegetation within the wetlands. In addition, substrate and pool habitats may be altered thus affecting certain fish species. The dam situated immediately downstream of Portion 30 within the Glisa Colliery is likely to be considerably transformed by sedimentation.

This impact may contribute to existing wetland losses throughout the Steelpoort catchment. This may, in turn, have far-reaching effects on water quantity and quality. Loss of aquatic habitats may result. Wetlands cannot be rehabilitated as wetlands should not overly mined out areas to prevent ingress.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-10.50	-15.75
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures should be implemented:

- Development and disturbance should be minimised within wetlands (including wetland buffers). In particular, infrastructure that may release dust or sediments (e.g. roads, stockpiles, waste dumps, tailings dams) should we located well outside of wetland areas (including wetland buffer zones). Blasting should be kept to a minimum within the 1:100 year floodline;
- Mitigation measures should include the construction of a low berm, approximately 1m high by 2-3m wide between the mining activities and the wetlands. These berms would serve to intercept flows containing suspended sediments and create a depositional environment. They should be located outside the wetland boundaries and should be created prior to construction and vegetation clearing on the stockpile footprint commencing. The top soil stockpiles should also be vegetated;
- Limit surface soil disturbance (including vegetation removal) and implement proper erosion control measures (especially in or close to drainage lines);
- Trucks should use tarpaulins to prevent spillage/dust from loads;
- Dust suppression of roads will assist in keeping dust levels down; and
- Apply all mitigation relating to water quality and erosion.

7.4.7 IMPACT ON WETLANDS

7.4.7.1 Erosion at Water Management Discharge Points

As part of the water management infrastructure, clean water flows from upslope the mining area will need to be diverted around the mining area and discharged into downslope water courses and wetlands. This will convert the predominantly diffuse, subsurface flows of the hillslope seepage wetlands to concentrated surface flows with significantly increased erosive energy. Erosion is likely to occur at the points of discharge, with deposition of eroded sediments further downstream in the wetlands.

The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. If unmitigated and uncontrolled, the disturbance of wetland habitat could result in degradation to levels that are irreversible. For example, the onset of erosion and formation of erosion gullies will result in irreplaceable loss of the wetland sediments, while erosion gullies also lower the local water table within the affected wetland and lead to partial desiccation and terrestrialisation of the wetland habitat.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-11.00	-6.75	-9.00
Maximum Mine Production	-12.00	-7.50	-12.50
No-Go Alternative	N/A	N/A	N/A

To prevent excessive erosion the following mitigation measures are recommended:

- All clean water should be diverted around the proposed mining activities;
- Diversions should preferably be vegetated with low slope sideslopes (1:5 or less) rather than simple trench excavations;
- Discharge points should be protected against erosion and should incorporate energy dissipaters and diffusers to ensure low velocity flows enter the downslope wetlands and that flows rapidly disperse; and
- Annual monitoring (end of wet season) of all discharge points for erosion with fixed point photography should also be undertaken and all erosion damage repaired.

7.4.7.2 Disturbance of Wetland Habitat

Wetlands located outside the direct footprint of mining activities are likely to be disturbed during the ongoing mining activities, leading to habitat degradation. Injudicious driving of vehicles and machinery, increased human traffic on site, incorrect placement of temporary stockpiles etc. are all likely to contribute to disturbance of wetland habitat. In the case of Alternative 3, the downstream area of the main wetland system to be affected constitutes a river diversion around past mining activity on Glisa Colliery.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. If unmitigated and uncontrolled, the disturbance of wetland habitat could result in degradation to levels that are irreversible. For example, preferential flow paths created by vehicle tracks following injudicious driving through wetland areas could result in the onset of erosion and formation of erosion gullies, with irreplaceable loss of the wetland sediments. Erosion gullies also lower the local water table within the affected wetland and lead to partial desiccation and terrestrialisation of the wetland habitat.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.50	-7.00	-11.67
Maximum Mine Production	-15.00	-10.00	-18.33
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All wetland areas not within the direct footprint of proposed mining activities should be excluded from all mining activities;
- Ideally the wetland areas should be fenced-off to prevent access to mining machinery and personnel;
- All mine staff should be informed as to the location, extent and importance of wetland areas on site;

- No temporary stockpiles, constructors camps etc. may be located within any wetland area on site;
- A management plan for remaining wetland areas should be compiled, including recommendations on fire management and grazing management;
- An alien vegetation management plan should also be drawn up and implemented already during the construction phase; and
- All wetland areas outside the direct mining footprint that are nonetheless impacted by mining activities should be rehabilitated as soon as possible according to the rehabilitation guidelines contained in the wetland assessment report.

7.4.7.3 Water Quality Deterioration

Spills and leaks of hazardous substances such as oil, diesel, cement etc. used on site could result in water quality deterioration if these pollutants enter downslope water resources. In the case of Alternative 3, the downstream affected downstream water resources are located within Glisa Colliery and are already significantly impacted by mining activities.

Water quality within the upper Steelpoort River is generally still of a good quality. However, the cumulative impact of coal mining as well as industrial development in the neighbouring upper Olifants River Catchment has resulted in serious water quality concerns. Unmanaged, the same scenario is likely to develop within the Steelpoort River as well. Deterioration in water quality could lead to the loss of sensitive species within affected water resources, as well as make the water less fit for use. In this regard the construction of the De Hoop Dam lower down the Steelpoort River, which will be one of the receiving water resources, needs to be considered.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-8.25	-6.75	-11.25
Maximum Mine Production	-9.00	-6.75	-12.38
No-Go Alternative	N/A	N/A	N/A

To reduce water quality deterioration the following mitigation measures are recommended:

- All hazardous materials stored on site should be stored in designated and clearly marked areas equipped to prevent contamination due to spills and leaks;

- All hazardous substances should be stored on impervious surfaces that allow for the containment of spills and leakages (e.g. bunded areas);
- Should spills occur, these should be reported to the ECO. Sufficient clean-up material should be stored on site to deal with small spills. Larger spills will require the appointment of specialist clean-up teams to rehabilitate the affected area; and
- No hazardous materials may be stockpiled in any wetland area or within 100m of any wetland on site.

7.4.7.4 Increased Transport and Sedimentation in Wetlands

Ongoing vegetation clearing and stripping of top soil as the opencast pit progresses will expose large areas of bare, unprotected soil to erosion. Increased surface runoff volumes and velocities in these areas will further increase the movement of sediment off these sites. Sediments are likely to be transported into adjacent wetland areas and deposited where slow flows down. Sediment deposition within wetland areas will lead to changes in vegetation with species such as *Typha capensis* and *Phragmites australis* typically dominating areas of sedimentation, often to the near exclusion of other species. Flow retardation due to establishment of reed beds could over time also lead to channel switching. In the case of alternative 3, the affected wetland catchment drains towards the Mahim Dam on Glisa Colliery. Mahim Dam is likely to act as a sediment trap in this regard.

The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. Through alteration of the wetland habitat and changes in species structure and composition, sensitive species could be lost from the affected wetland systems.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-9.00	-13.50
Maximum Mine Production	-17.50	-11.00	-16.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to reduce this impact:

- Sediment transport off all bare soil areas should be minimised;
- Vegetation clearing of any area should be delayed for as long as possible;

- Vegetation stripping and clearing should thus be phased and only the minimum required area cleared at any one time;
- A shallow berm or sediment barrier (see wetland assessment report) should be installed along the downslope edge of any bare soil area to create a depositional environment outside wetland areas;
- A stormwater management plan must be in place to manage surface runoff during storm events; and
- Preferential flow paths created by vehicle ruts should be blocked. Water management infrastructure should incorporate sediment traps.

7.4.8 SURFACE WATER IMPACTS

7.4.8.1 Chemical pollution of surface water

Operational activities related to open cast mining and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-11.25	-6.00	-10.00
Maximum Mine Production	-13.75	-7.50	-12.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Clean and dirty water system infrastructure installed prior to construction activities must be maintained and kept in good working order;
- All hazardous substances must be stored and handled on impervious substrates and bunded areas that are able to contain potential spillages;
- Storage areas must be kept as dry as is practically possible and all storm and rain water collected in storage areas must be removed and disposed of in the PCD’s;
- Waste handling and storage facilities to be constructed away from surface water resources and drainage lines;

- All vehicles and equipment must be kept in good working order and regularly services; and
- Should a spill occur then the spill response procedure as provided in this EMP should be followed.

7.4.8.2 Surface water contamination

Clean surface water may enter the open cast pit and become contaminated resulting in water quality deterioration. The ingress of surface water (including storm water and rain water) into the pit will require extensive pumping to dewater In addition, clean surface water may also become contaminated through contact with pollutants on site as a result of spills, seepages, leaks and improper waste handling.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-15.00	-30.00
Maximum Mine Production	-18.75	-18.75	-37.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Clean and dirty water system infrastructure installed prior to construction activities must be maintained and kept in good working order;
- Upstream clean and dirty water system infrastructure must be installed close to the edge of the pit in order to effectively deviate clean water flow around the pit and prevent it from entering;
- Upstream clean and dirty water system infrastructure must be protected from erosion through the installation of surface water energy disruptors to reduce storm water velocity;
- Dirty water contained and pumped from the pit must be stored in lined PCD's and Pit dewatering dam all equipped with silt traps;
- The ECO is to constantly re-assess clean and dirty water system infrastructure and its placement to maximise system efficiency and effectiveness; and
- Continue with concurrent rehabilitation efforts and backfilling to keep the open pit as small as is practically possible reduce the amount of surface water able to come in contact with the pit and contaminated water.

7.4.8.3 Flood Risk

There is the risk of flooding due to alteration of the hydrological regime.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-4.50	-4.50	-7.50
Maximum Mine Production	-5.25	-5.25	-8.75
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- The stormwater management plan must be adhered to.

7.4.9 GROUND WATER IMPACTS

7.4.9.1 Chemical pollution of groundwater

Operational activities such physical mining, use of explosives and the use of machinery and equipment have the potential to result in pollution of groundwater. Pollution, as a result of spillages, seepages or leaks and improper waste handling, storage and disposal is able to infiltrate the groundwater regime and pollute the groundwater system.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-6.75	-6.00	-9.00
Maximum Mine Production	-6.75	-6.00	-9.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and location restrictions stipulated in GN 704 of the NWA;
- All hazardous substances must be stored and handled on impervious substrates and bunded areas that are able to contain potential spillages;

- Storage areas must be kept as dry as is practically possible and all storm and rain water collected in storage areas must be removed and disposed of in the PCD's;
- Waste handling and storage facilities to be constructed away from surface water resources and drainage lines;
- All vehicles and equipment must be kept in good working order and regularly services; and
- Should a spill occur then the spill response procedure as provided in this EMP should be followed.

7.4.9.2 Alteration of groundwater levels

Open cast mining will result in the potential dewatering of the aquifer closest to the pits and resultant inflow of groundwater into the pit. Groundwater flow directions in the area will reverse to flow toward the open pit and a cone of depression, due to dewatering, is likely to result in a substantial drop in water levels. A maximum drop in water levels of approximately 38 m with Alternative 2 (for boreholes BH 9 and BH 2) and approximately 28 m with Alternative 3 (for springs VSFn1 and VSFn2) is anticipated and it is likely that all identified springs will run dry.

Dewatering is also likely to significantly impact the wetlands on site, in particular those fed by groundwater. It is anticipated that the furthest measurable influence on the groundwater will be within a 2 km radius. Notable borehole users that will be affected include the surface rights holders of Portion 13 and Hadeco's cold climate bulb operations.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-18.75	-37.50
Maximum Mine Production	-18.75	-18.75	-37.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Keeping the pit dry and free of water is essential for mining activities and as such this impact cannot be mitigated however the following apply:
- Groundwater inflows into the pit must be pumped out and into the Pit dewatering dam and PCD's respectively;

- Compensate affected surface rights holders for loss of the use of boreholes which run dry due to dewatering located within the cone of depression; and
- Continue to monitoring groundwater quality and levels. Extent of monitoring must expand with cone of depression

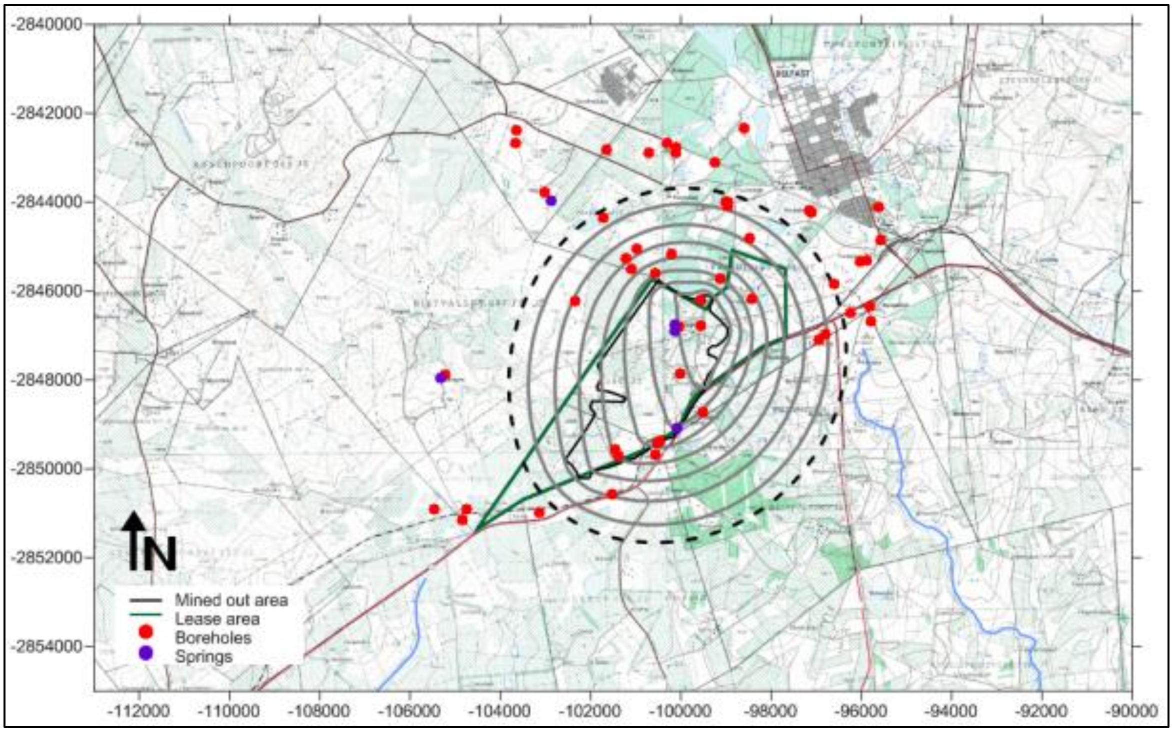

Figure 61: Cone of depression for Alternative 2

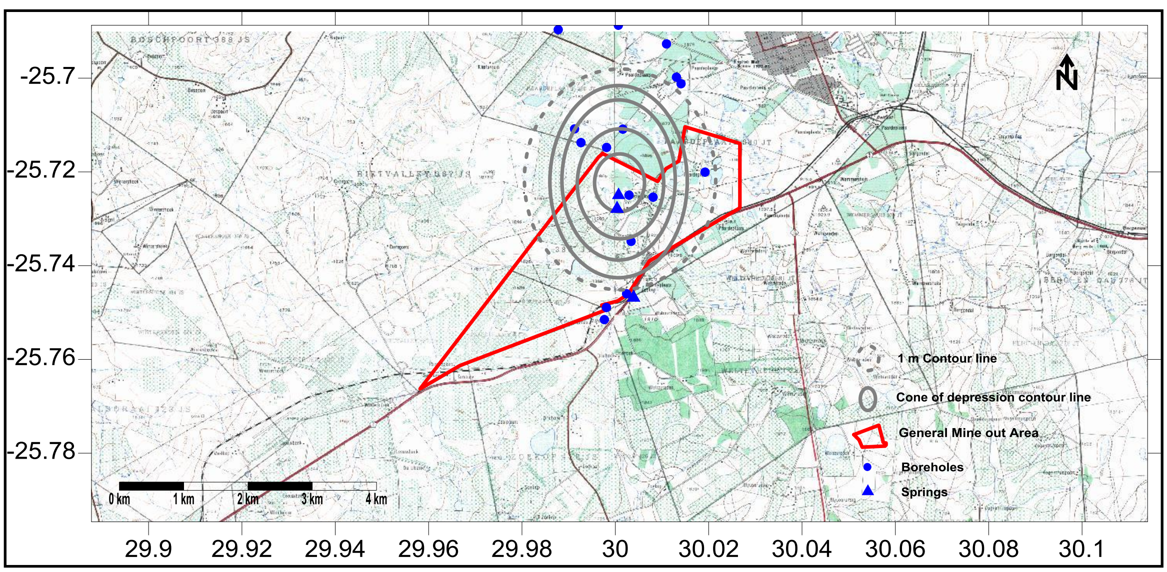

Figure 62: Cone of depression for Alternative 3

Table 77: Influence of dewatering of Alternative 2 on boreholes and springs

Feature	Drop in water level (m)
Boreholes	
Hen1	1
Hen2	1
Bh12	3
BH21	3
EvD1	3
PRBR1	6
PRBR1	6
N4BH1	10
FJ3	9
BH13	13
BH6	14
BH15	17
BH7	25
BH8	25
VB1	22
BH8	25
BH9	38
BH2	38
AEC28	28
FBH1	25
BH1	20
BH2	20
N4BH	22
Springs	
VSFn1	33
VSFn2	33
Hftn	30

Table 78: Influence of dewatering of Alternative 3 on boreholes and springs

Feature	Drop in water level (m)
Boreholes	
BH13	8
BH15	12
BH7	22
BH8	22
BH1	16
BH2	16
Springs	
VSFn1	28
VSFn2	28
Hftn	25

7.4.9.3 Contamination of groundwater

Open cast mining will result in geochemical changes as a result of disturbing geological strata. These geochemical changes will result in the contamination of groundwater as a result of sulphur mineral oxidation and the leachate of salts. Expected sulphide concentrations are expected to be as high as 2000 mg/l in some instances. Most of the pollution, transported by contaminated groundwater, is anticipated to move toward the open cast pit where it will be pumped to and contained in the Pit dewatering dam and PCD's respectively.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-18.75	-37.50
Maximum Mine Production	-18.75	-18.75	-37.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Keeping the pit dry and free of water is essential for mining activities and as such this impact cannot be mitigated however the following apply:
- Pits must be kept as dry as is practically possible in order to reduce contact time of water and oxygen with exposed rock material and keep contamination to a minimum;
- Continue to keep contamination to a minimum in order to draw contamination to the pit and contain it within the mine property;
- Undertake and ensure that continuous backfilling is correctly done;
- Groundwater inflows into the pit must be pumped out and into the Pit dewatering dam and PCD's respectively;
- Compensate affected surface rights holders for loss of the use of contaminated boreholes; and
- Continue to monitoring groundwater quality and levels.
- Strip coal as cleanly as possible. Least amount of coal discard should be left behind.

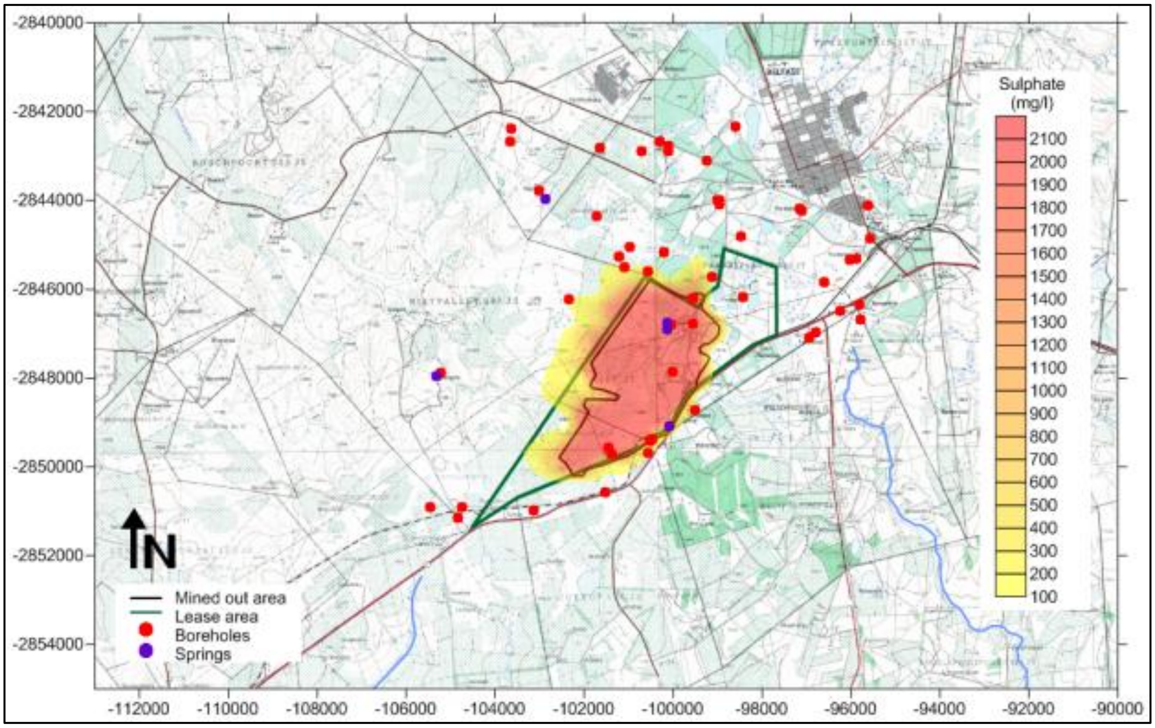

Figure 63: Contamination plume for Alternative 2 after 10 years

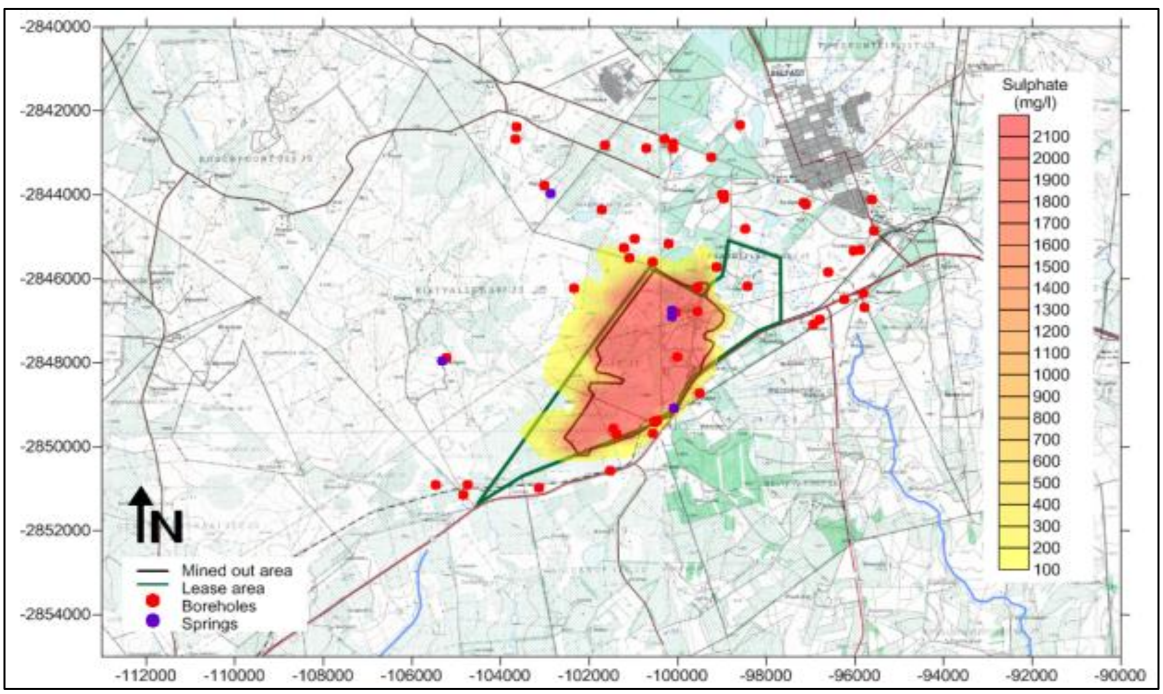

Figure 64: Contamination plume for Alternative 2 after 20 years

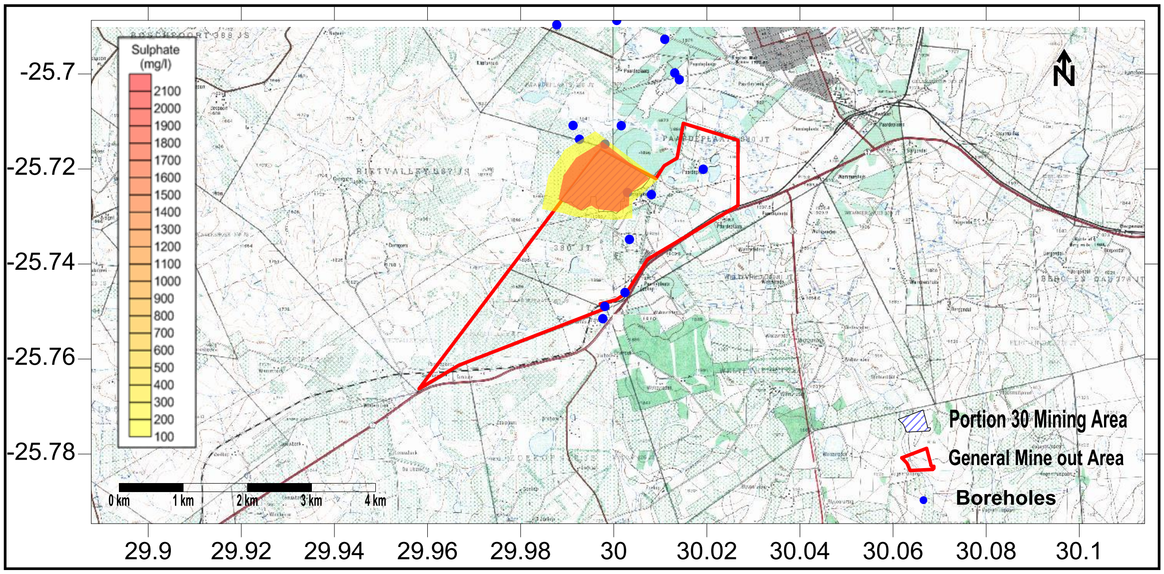

Figure 65: Contamination plume for Alternative 3 after 10 years

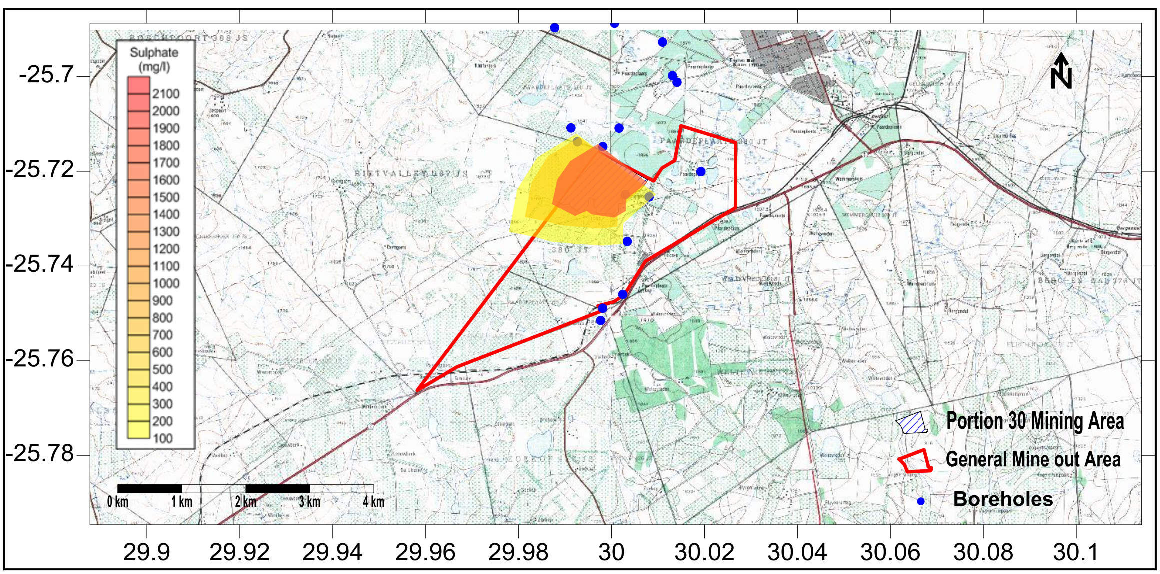

Figure 66: Contamination plume for Alternative 3 after 20 years

7.4.9.4 Wetland dewatering

Open cast mining will result in the potential dewatering of the aquifer closest to the pits and inflow of groundwater into the pit. A maximum drop in water levels of approximately 28 m (for springs VSFn1 and VSFn2) is anticipated and it is likely that all springs will run dry. As such, dewatering of the wetlands on site is anticipated as seepage, due to the cone of depression, to the pit increases.

Alternative	Pre-Mitigation	Post-Mitigation	Final

	Score	Score	Significance
Sensitivity Planning Approach	-18.75	-18.75	-37.50
Maximum Mine Production	-20.00	-20.00	-40.00
No-Go Alternative	N/A	N/A	N/A

No mitigation measures possible.

7.4.10 AIR QUALITY IMPACTS

7.4.10.1 Dust Fall Out

Nuisance dust fall occurs when dust-fall rates exceeding the residential guideline of 600 $mg/m^2/day$, beyond the mine boundary.

Power generation, farming activities, and nearby mining add to the cumulative nature of this impact. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-9.00	-13.50
Maximum Mine Production	-12.00	-11.00	-16.50
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

The maximum monthly dust fall out predicted for Alternative 2 and Alternative 3 are provided in Figure 67 and Figure 68 below.

7.4.10.2 Elevated PM10 Levels

Elevated PM_{10} levels outside of the mining boundary will affect the surrounding sensitive receptors. Public response for this impact has been significant. The cumulative impact of mining operations as well as other contributing sources will result in non-compliance with NAAQS even under the mitigated scenario. This non-compliance will be applicable during mining operations only. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.00	-11.00	-18.33
Maximum Mine Production	-14.00	-13.00	-21.67
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

The predicted annual average PM_{10} concentrations for Alternative 2 and Alternative 3 are provided in Figure 69 and Figure 70 below.

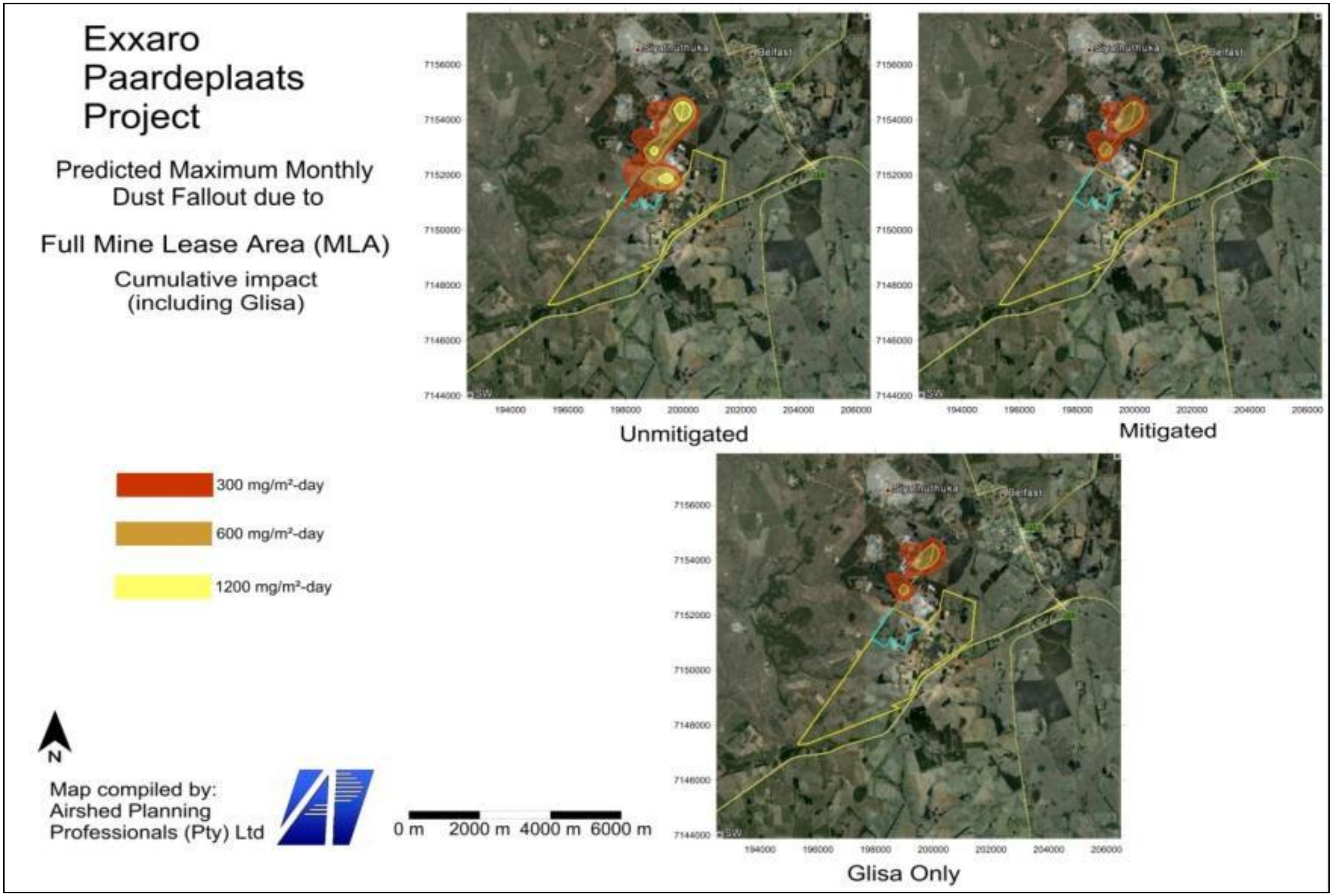

Figure 67: Predicted maximum monthly dust fall out for Alternative 2

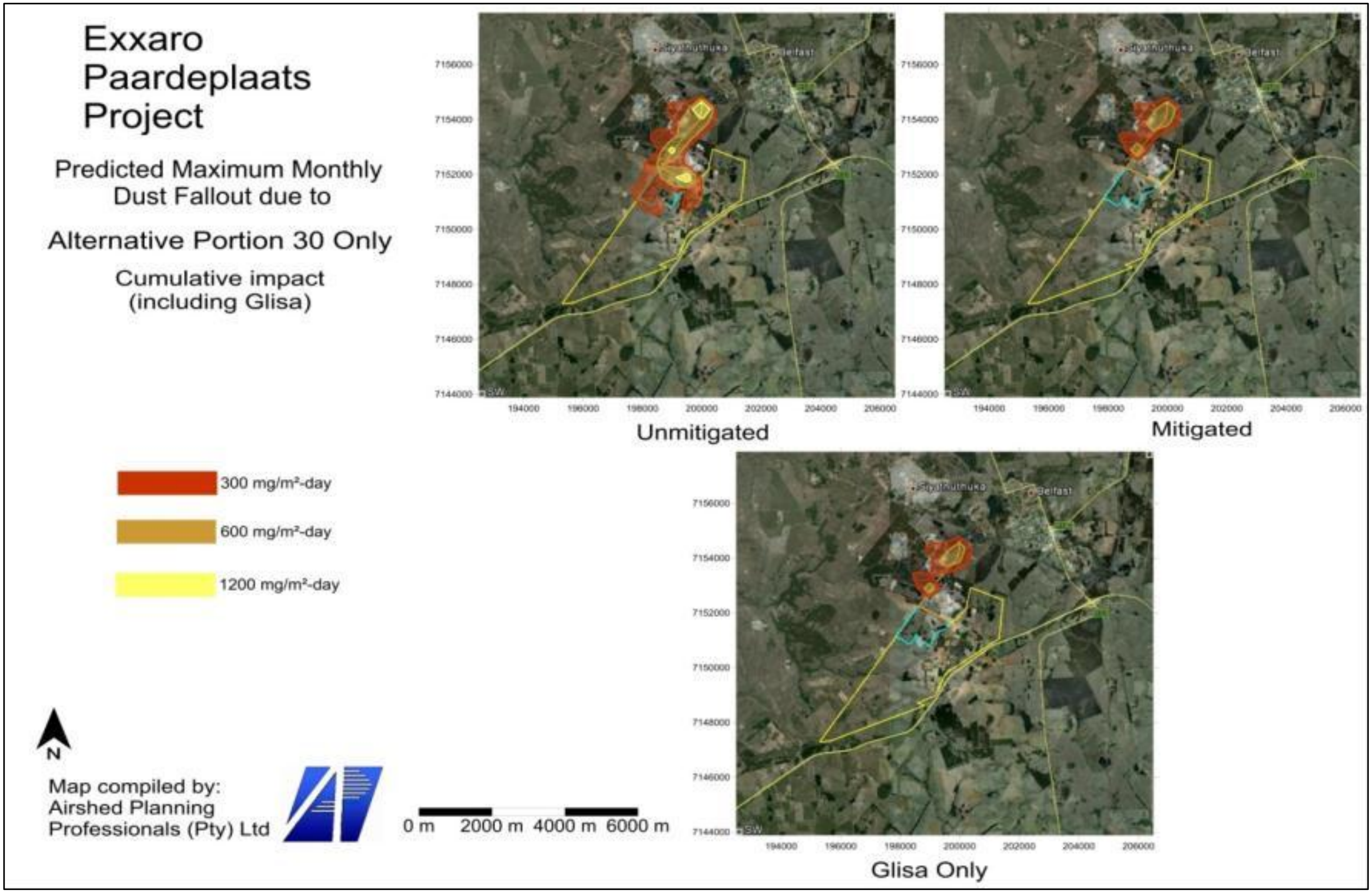

Figure 68: Predicted maximum monthly fallout dust for Alternative 3

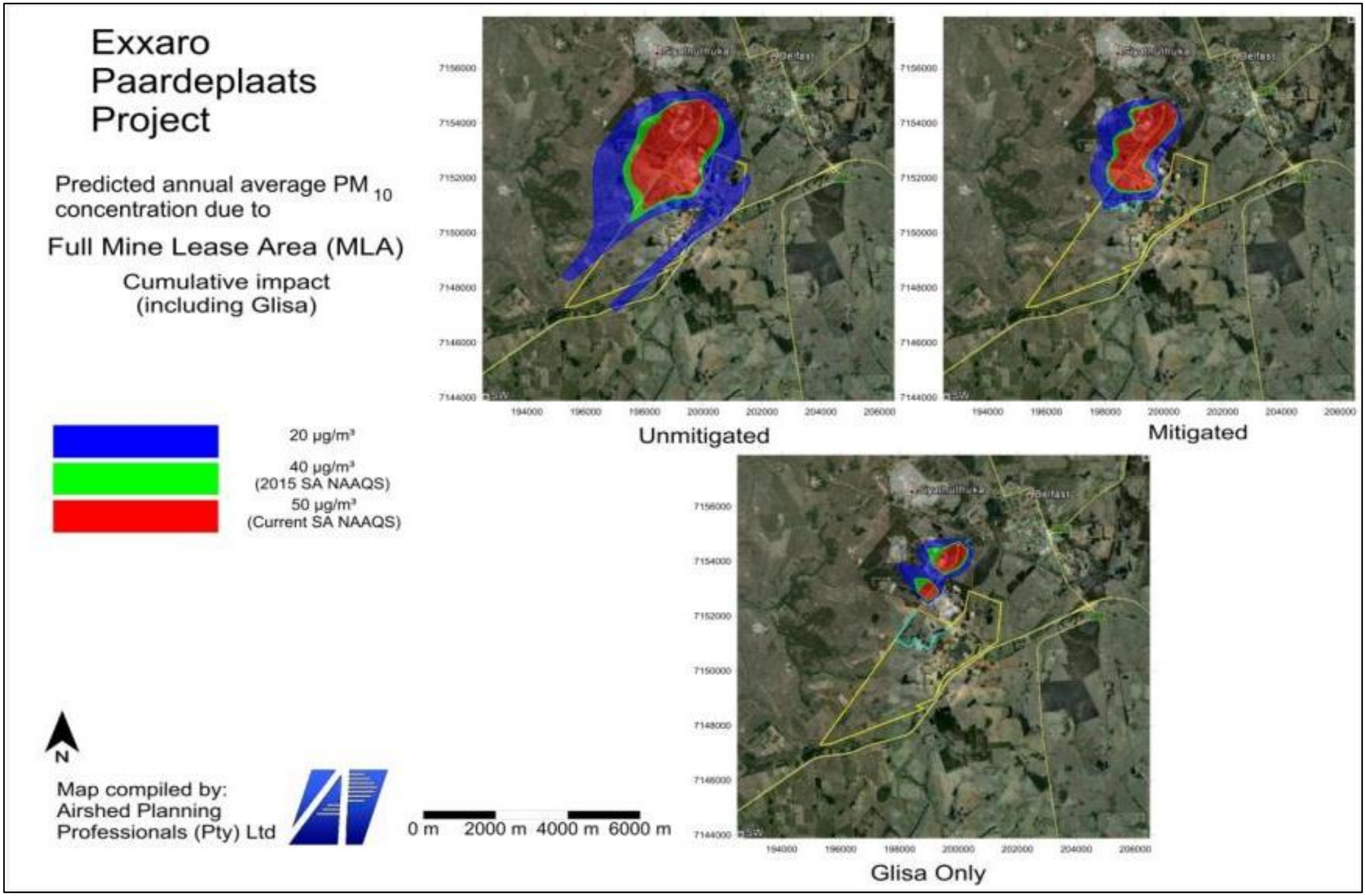

Figure 69: Predicted annual average PM_{10} concentration for Alternative 2

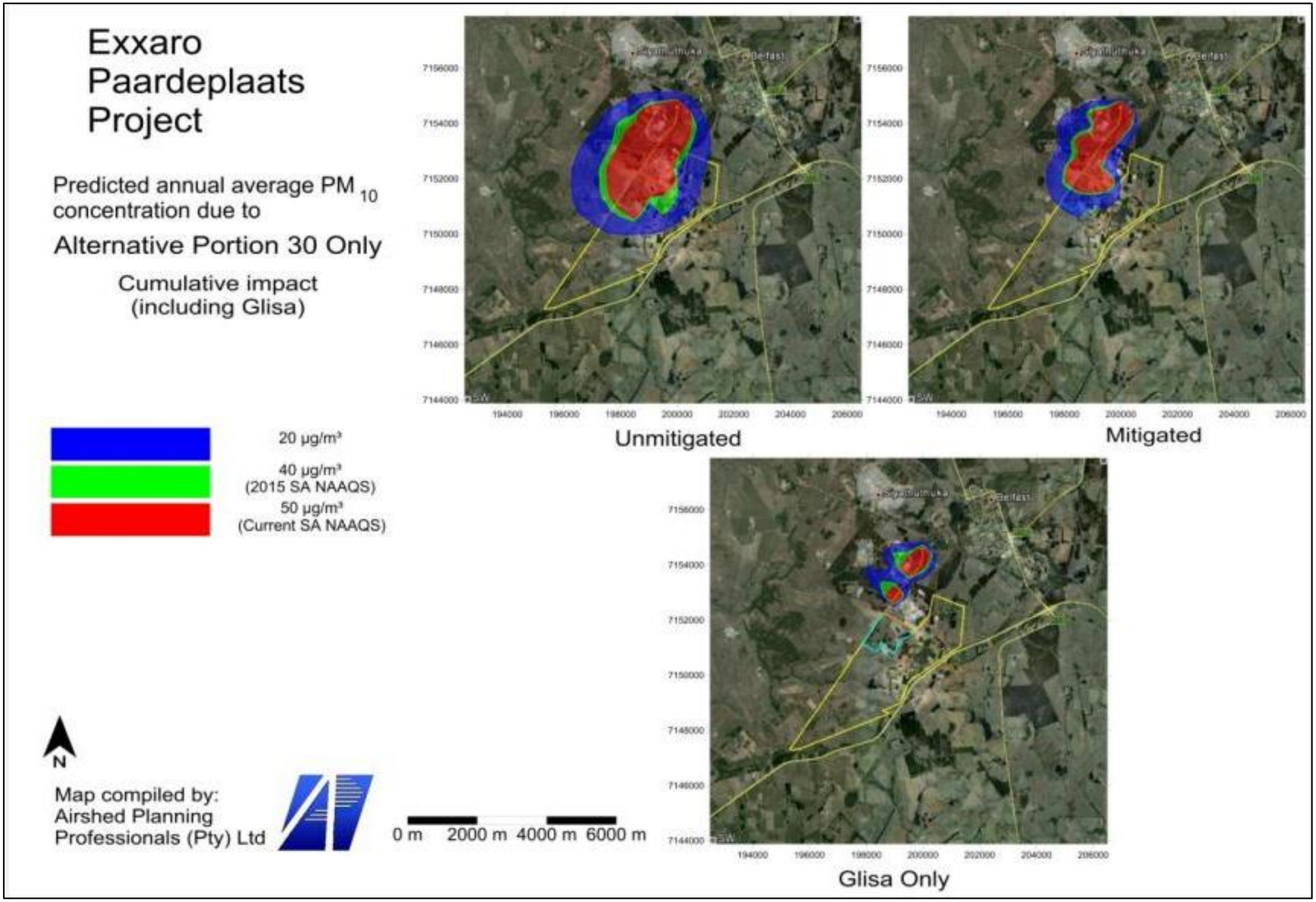

Figure 70: Predicted annual average PM_{10} concentration for Alternative 3

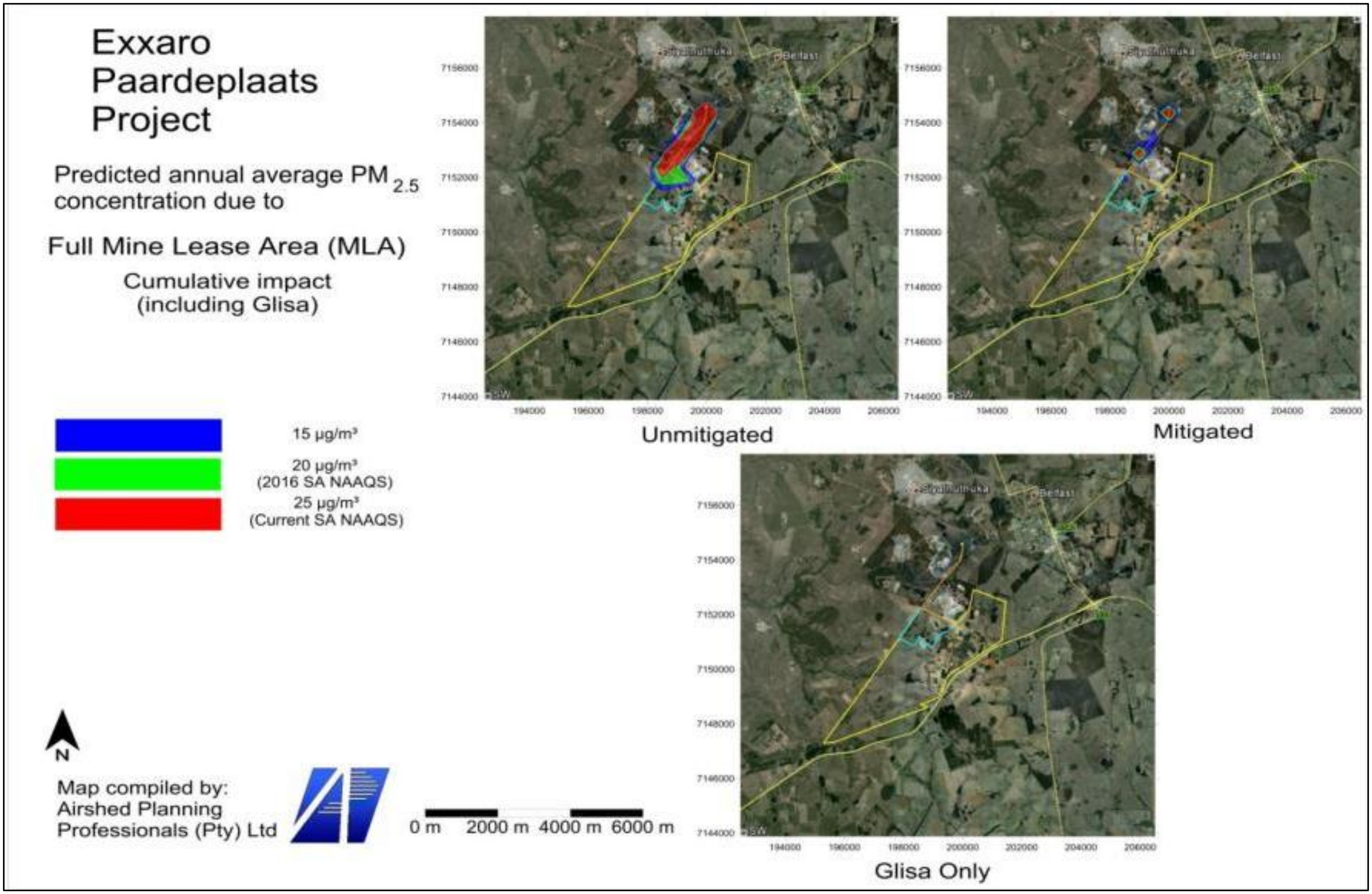

Figure 71: Predicted annual average $PM_{2.5}$ concentration for Alternative 2

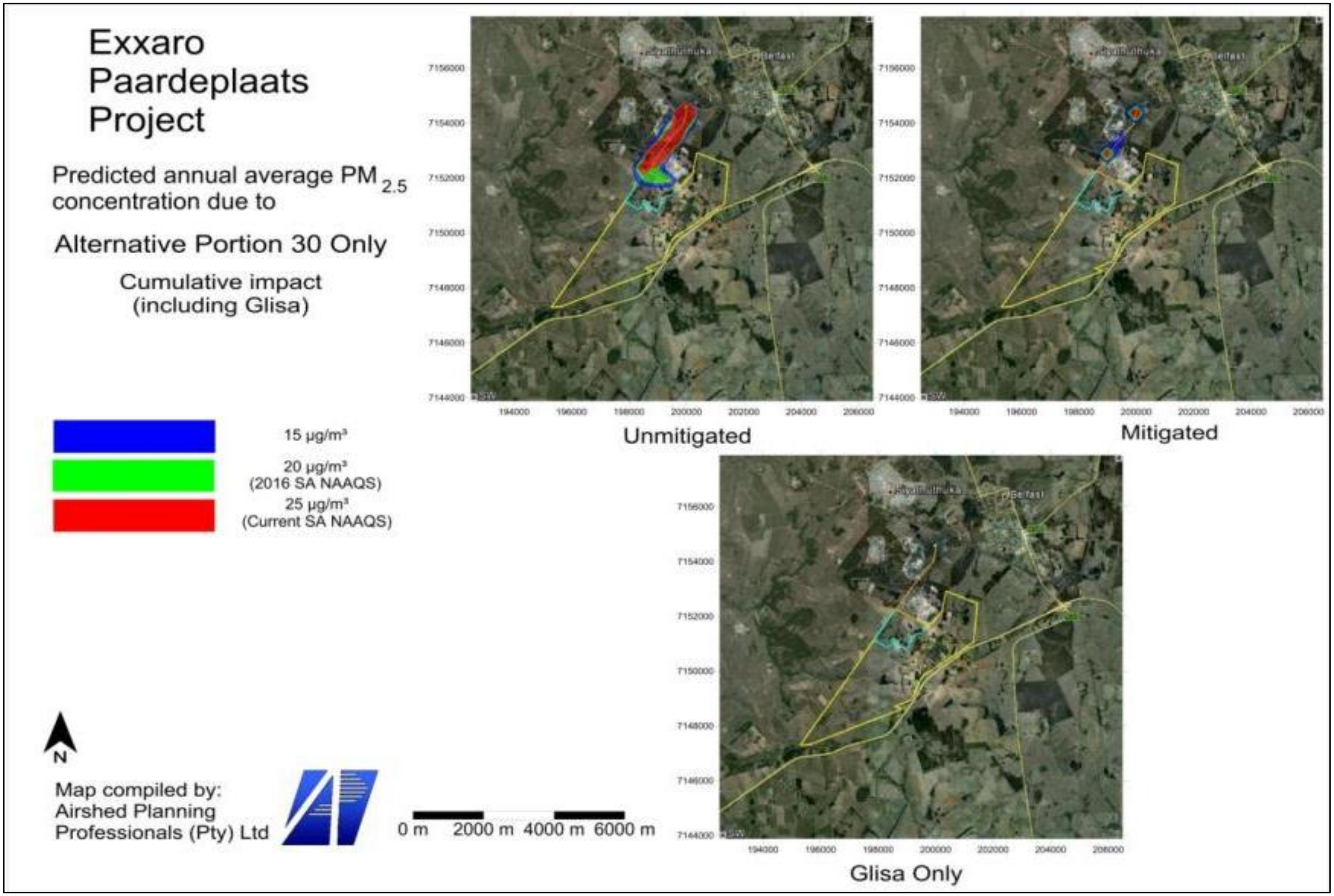

Figure 72: Predicted annual average $PM_{2.5}$ concentration for Alternative 3

7.4.10.3 Elevated PM2.5 Levels

Elevated $PM_{2.5}$ levels outside of the mining boundary will affect the surrounding sensitive receptors. Public response for this impact has been significant. Impact assessment included the cumulative impacts as a result of particulate emissions from the Glisa processing plant. It was not within the scope of this assessment to quantify other sources of airborne particulates, although sources are likely to include power generation, farming activities, and nearby mining. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-9.00	-13.50
Maximum Mine Production	-12.00	-11.00	-16.50
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

The predicted average annual $PM_{2.5}$ concentration for Alternative 2 and Alternative 3 are provided in Figure 71: Predicted annual average $PM_{2.5}$ concentration for Alternative 2 and Figure 72 above.

7.4.10.4 Impact of Dust Fall Out on Agriculture

Dust-fall rates exceeding 400 mg/m²/day, beyond the mine boundary, could impact the photosynthetic activity of crops and reduce the aesthetic appeal of flowers produced by Hadeco. This impact has received a significant public response. During mining operations dust fall-out may exceed 400 mg/m^2/day at locations beyond the mine boundary. Reduced photosynthetic rates in crop plants (sunflower and cotton) have been recorded at this deposition rate. A reduction in aesthetic appeal of flowers, produced by Hadeco, is also likely at 400 mg/m^2/day or higher. This is applicable to 39 ha of Hadeco cultivated areas near the Portion 30 boundary. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation	Post-Mitigation	Final

	Score	Score	Significance
Sensitivity Planning Approach	-13.00	-11.00	-16.50
Maximum Mine Production	N/A	N/A	-N/A
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.4.11 NOISE IMPACTS

7.4.11.1 Noise Nuisance

The noise contours for both operational alternatives represent the total noise envelope covering all situations over the full mining period (life of mine) in each case. The noise levels from blasting are likely to be very loud at noise sensitive receptors relatively close to the opencast pit and can create a major noise nuisance. This will be dependent on the times and frequency of blasting.

There is a potential for several noise sensitive receptors to be impacted by the mining operation noise from this pit configuration (albeit at different periods of mining), and specifically during the night-time period. The noise footprint is relatively smaller for the sensitivity Planning approach than for the Maximum Mine Production Alternative, and there are fewer NSRs affected in the southern sector of the study area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-13.00	-17.33
Maximum Mine Production	-13.00	-13.00	-17.33
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to reduce the impact of noise nuisance on sensitive receptors:

- With drilling operations in preparation for blasting in the pit, portable acoustic shields should be considered to enclose the drills;
- The insulation of particularly noisy equipment;

- The stockpiles of spoil rock and overburden (berms) from the opencast pit excavations should, where possible, be used as interim or long-term noise attenuation barriers. Berms should particularly be considered around the whole periphery of the pit;
- Where possible, very noisy activities should not take place at night (between the hours of 20h00 to 06h00). Specifically, blasting should take place to a regular programme and should be restricted to the period between 08h00 and 16h00;
- All equipment and vehicles are to be kept in good repair.

The noise profile for mining activities for Alternative 2 and Alternative 3 are indicated in Figure 73 and Figure 74 below.

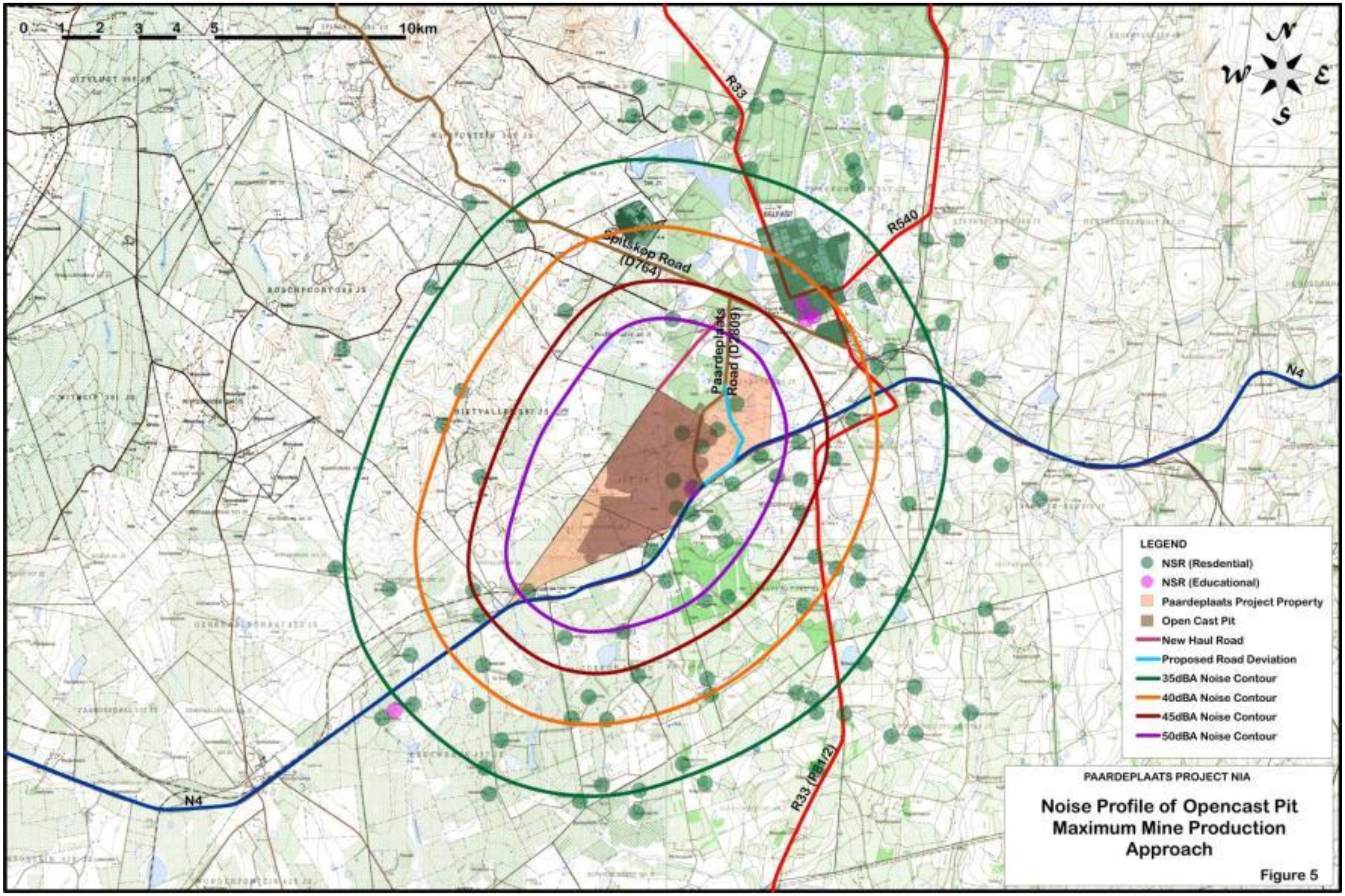

Figure 73: Noise profile of mining activities for Alternative 2

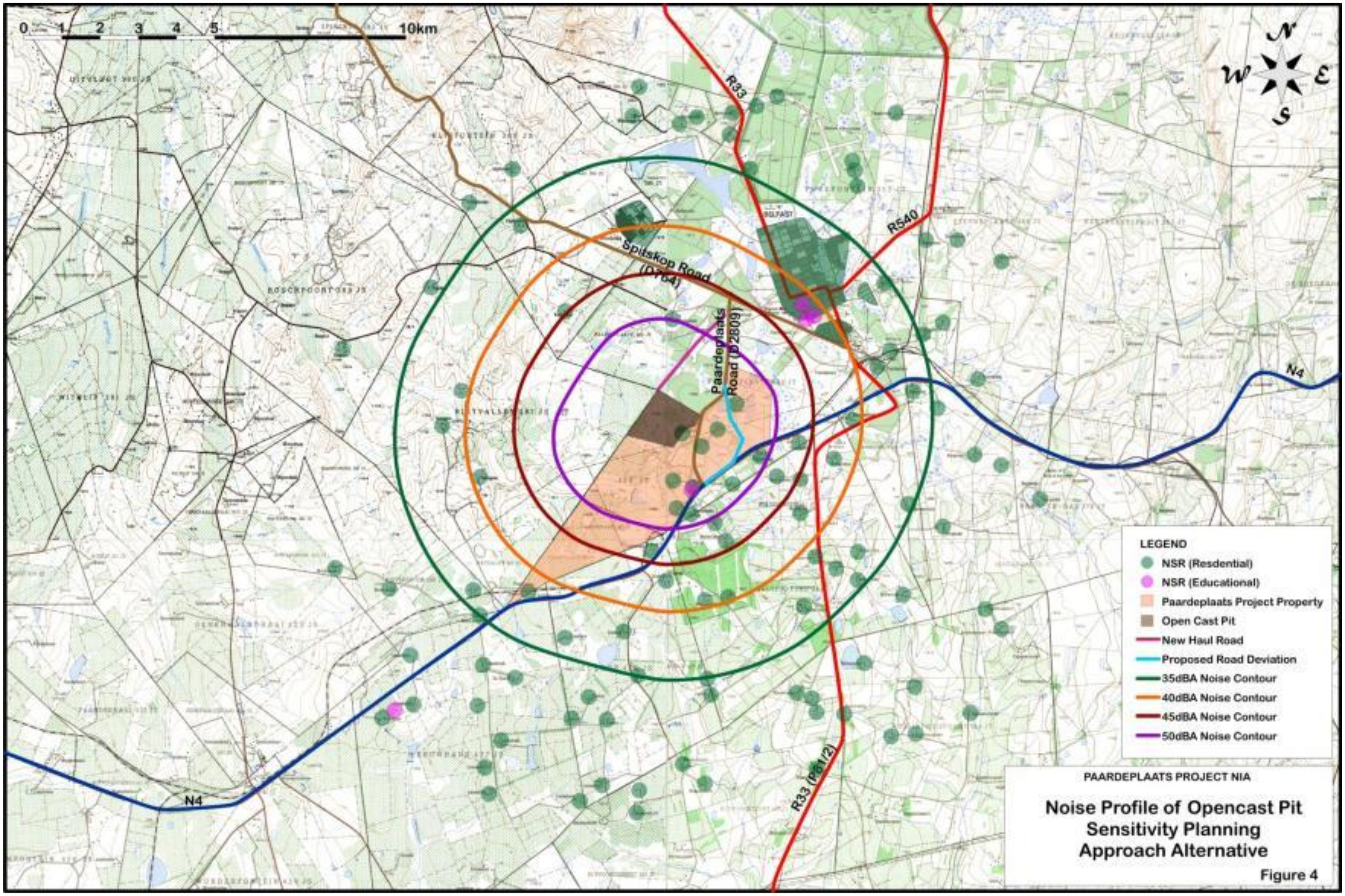

Figure 74: Noise profile of mining activities for Alternative 3

7.4.12 VISUAL IMPACTS

7.4.12.1 Visual Impact of Dust

Dust created due to the removal of vegetation, movement of heavy vehicles and mining activities affects the sensitive receptors in the area. This public response for this impact has been significant. The dust created by the Paardeplaats Coal Mine will have a cumulative impact as there is already dust that is being created by the Exxaro Glisa Coal Mine. During the construction phase site establishment will take place and vegetation will be removed. This phase can still be rehabilitated to a degree that is similar to the surrounding area. The visual resource value of the area is moderate as the area is similar to the surroundings.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-15.00	-27.50
Maximum Mine Production	-15.00	-15.00	-27.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- Dust suppression techniques should be in place at all times during the construction and operational phases;
- As much vegetation as possible should be kept during site clearance; and
- Rehabilitate/restore exposed areas as soon as possible after construction activities are complete.

7.4.12.2 Day Time Visual Impact

Mining activities have an effect on the visual landscape and character of the area. The proposed activity will contribute to the cumulative impact of existing mining activities in the area as well the dust that is being created. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-15.00	-22.50

Maximum Mine Production	-17.50	-17.50	-26.25
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented in order to reduce the significance of this impact:

- Paint buildings and structures with colours that reflect and complement the natural browns of the surrounding landscape. Avoid pure light colours and pure blacks;
- To reduce the potential of glare external surfaces of buildings and structures should be articulated or textured to create interplay of light and shade; and
- Rehabilitate / restore exposed areas as soon as possible after construction activities are complete.

7.4.12.3 Night Time Visual Impact

Lights used at night for mining activities will affect the visual landscape and character. The proposed activity will contribute to the cumulative impact of existing mining activities in the area as well the dust that is being created. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.50	-11.25	-15.00
Maximum Mine Production	-15.00	-12.50	-16.67
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented in order to reduce the significance of this impact:

- Avoid high pole top security lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area; and
- Light public movement areas (pathways and roads) with low level 'bollard' type lights and avoid post top lighting.

7.4.13 BLASTING AND VIBRATION IMPACTS

7.4.13.1 Ground Vibration

Ground vibration could cause damage to structures in the surrounding area and upset the local communities. If more than one site is affected this impact can become cumulative. Alternative 2 will result in the direct loss of four boreholes, while Alternative 3 will result in the loss of one borehole.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-9.00	-5.00	-7.50
Maximum Mine Production	-9.75	-5.50	-8.25
No-Go Alternative	N/A	N/A	N/A

To minimise the impacts of ground vibration, the following mitigation measures should be implemented:

- Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast; and
- Calculate expected ground vibration levels for blast to be done and if necessary re-design to reduce change mass per delay, use of electronic initiation of blast, drilling smaller diameter blastholes that will reduce charge per blasthole and per delay.

7.4.13.2 Air Blast

Air blast as a result of blasting operations could cause damage to structures and induce effects that will upset homeowners. It is possible for this impact to become cumulative. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.00	-5.00	-7.50
Maximum Mine Production	-14.00	-5.50	-8.25

No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to result in a reduction of air blast:

- Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast;
- Use of proper stemming lengths of between 25 and 30 blasthole diameters;
- Use of crushed aggregate of 10% the blasthole diameter as stemming material;
- Record stemming lengths for each blast and correct if necessary prior to every blast blasted; and
- Monitor each blast done.

7.4.13.3 Fly Rock

Fly rock from blasting operations could cause damage to structures, injure people or animals. It is possible for this impact to become cumulative. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-9.00	-5.00	-7.50
Maximum Mine Production	-9.75	-5.50	-8.25
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to result in a reduction of fly rock:

- Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast;
- Use of proper stemming lengths of between 25 and 30 blasthole diameters;
- Use of crushed aggregate of 10% the blasthole diameter as stemming material;
- Record stemming lengths for each blast and correct if necessary prior to every blast blasted; and
- Monitor each blast done.

7.4.14 TRAFFIC IMPACTS

7.4.14.1 Impact on Adjacent Road Network

There will be an increase in traffic on the adjacent road networks. From a traffic engineering perspective the impact is low. The traffic will be added to the existing road network. The environmental damage has already been done with the construction of the road within an existing road reserve, which may also include services and stormwater drainage. The mitigation measure may include road upgrades at the intersections on the road network. However these upgrades will be within the existing road reserve, where the environmental damage has already been done. To conclude the environmental impact can be described as neutral as the traffic is been added to the existing roads.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-5.00	5.50	8.25
Maximum Mine Production	-5.00	5.50	8.25
No-Go Alternative	N/A	N/A	N/A

The following are suggestions for upgrading the road network:

- Minimum width of 4m for all lanes on approach to intersection;
- Increasing the corner radii to 20m to ensure abnormal roads do not run over the pavement; and
- Right turn refuges at all intersections that are able to accommodate two heavy vehicles without restricting the flow of traffic.

7.4.14.2 Impact on Bridges and Culverts

Additional heavy traffic over bridges and culverts is expected. The cumulative impact on the bridges and culverts on the adjacent road network will be low. All these are existing structures and should have been design to the correct standards to accommodate heavy vehicles. The report recommended that all culverts and bridges on possible heavy vehicle routes be assessed by a structural engineer and where necessary any remedial works to be undertaken. The impact on resources will be negligible as the culverts and bridges are on existing roads. Therefore any environmental damage has occurred during the construction of the bridges and culverts. There may be some additional impact should remedial works be required to repair or upgrade any bridges and culverts.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-2.00	2.50	2.92
Maximum Mine Production	-2.00	2.50	2.92
No-Go Alternative	N/A	N/A	N/A

The most appropriate mitigation strategy would be to avoid these environmentally sensitive areas, where possible, by designing the mine layout in such a way that the routes between the pit and the processing plant and other areas are the shortest possible, but avoid these sensitive areas as much as possible.

If it is not possible to avoid these areas, then the culverts should be designed to have the minimum impact on the environment as possible and should be temporary structures that can be removed as soon as that section of the road is not required.

For the external road network the impact will be determined following a structural assessment of the culverts themselves. This is required in order to determine the structural condition of these culverts. Once this has been carried out it will be possible to determine if these culverts have the structural integrity to cope with the expected loadings during the operational lifespan of the mine.

If mitigation measures are required then it is recommended that they are designed to have as little impact as possible and should be designed in such a way that they can be removed at a later stage, if required.

7.4.14.3 Impact on Communities

Additional heavy vehicles travelling through communities or urban areas will affect the normal usage of these roads. The addition of heavy vehicles on the road network that pass through local communities and urban areas will have some impact. Many of these routes already experience heavy vehicles operating on them. However this impact can be mitigated by the implementation of travel management plan. This will identify appropriate routes that heavy vehicles can use to avoid communities and urban areas. There will be no loss of resources as the additional heavy vehicles will be operating on existing roads.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-6.00	-6.00	-7.00
Maximum Mine Production	-6.00	-6.00	-7.00
No-Go Alternative	N/A	N/A	N/A

To minimise the impact on the adjacent communities a traffic management plan be should be prepared, which would identify appropriate routes for heavy vehicles to avoid communities and limit time of operation.

7.5 DECOMMISSIONING PHASE IMPACTS

7.5.1 HERITAGE IMPACTS

7.5.1.1 Damage/Destruction of Graves and Cemeteries

The potential exists for the damage, destruction, or disturbance of graves and cemeteries within the mining footprint. Only two graves are impacted by Alternative 3 and the cumulative impact is seen as low. With Alternative 2, however, the total number of cemeteries directly impacted by the proposed mining foot print would be 6 accounting for 100 of a total of 141 graves identified inside the study area. The graves are irreplaceable but can be relocated by thus minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.50	-7.50	-7.50
Maximum Mine Production	-7.50	-7.50	-7.50
No-Go Alternative	N/A	N/A	N/A

All graves that will be negatively affected should be relocated after a full grave process that includes comprehensive social consultation. Permits from the Burial Ground Unit of SAHRA and from the Mpumalanga Department of Health will be required for the relocation.

7.5.1.2 Damage/Destruction of Buildings and Structures

The potential exists for the damage, destruction, or disturbance of buildings and structures within the mining footprint. The destruction of all the structures within the mining area will result in a loss of structures adding to the cultural fabric of the area. No further cumulative effects on structures inside the Portion are foreseen. Documentation of the cultural characteristics of the structures will minimize the complete loss of information on the resource.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-3.00	-3.00	-3.50
Maximum Mine Production	-15.00	-11.00	-14.67
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All buildings must be evaluated for the possible presence of infant burials through social consultation;
- A permit from the Provincial Heritage Resources Authority Mpumalanga would be required if heritage structures need to be demolished; and
- The remains of the buildings should be mapped and documented by photographs and drawings.

7.5.1.3 Damage/Destruction of Graves and Cemeteries Outside of the Mining Footprint

The potential exists for the damage, destruction, or disturbance to graves and cemeteries that fall within the mining right boundary but outside of the mining footprint. The total amount of cemeteries located within the mining right area but outside of the mining footprint is three accounting for 84 of a total of 141 graves identified inside the study area. The graves are irreplaceable but can be relocated thus minimising the impact.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.50	-7.50	-7.50
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

All graves that will be negatively affected should be relocated after a full grave process that includes comprehensive social consultation. Permits from the Burial Ground Unit of SAHRA and from the Mpumalanga Department of Health will be required for the relocation.

7.5.1.4 Damage/Destruction of Buildings and Structures Outside of the Mining Footprint

The potential exists for the damage, destruction, or disturbance to buildings and structures that fall within the mining right boundary but outside of the mining footprint. The destruction of all the structures within the mining area will result in a loss of structures adding to the cultural fabric of the area. No further cumulative effects on structures inside the Portion are foreseen. Documentation of the cultural characteristics of the structures will minimize the complete loss of information on the resource.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-15.00	-11.00	-14.67
Maximum Mine Production	N/A	N/A	N/A
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- All buildings must be evaluated for the possible presence of infant burials through social consultation;
- A permit from the Provincial Heritage Resources Authority Mpumalanga would be required if heritage structures need to be demolished; and
- The remains of the buildings should be mapped and documented by photographs and drawings.

7.5.2 SOILS, LAND USE, AND LAND CAPABILITY IMPACTS

7.5.2.1 Reduction in Agricultural Potential

The proposed mining activities have the potential to result in the loss of arable agricultural potential due to removal and storage of soil profile. The impact may become cumulative if area than one area is affected and it may result in the loss of irreplaceable resources.

Alternative	Pre-Mitigation	Post-Mitigation	Final

	Score	Score	Significance
Sensitivity Planning Approach	-13.00	-13.00	-19.50
Maximum Mine Production	-14.00	-13.00	-19.50
No-Go Alternative	N/A	N/A	N/A

It is recommended that the correct storage of removed soil material is undertaken in order to mitigate this impact.

7.5.2.2 Soil Compaction

There is the potential for soil to be compacted during mining operations. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-13.00	-19.50
Maximum Mine Production	-13.00	-12.00	-18.00
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of heavy machinery is restricted as far as possible to lessen the significance of this impact.

7.5.2.3 Soil Erosion Hazard

Increased susceptibility to erosion due to removal of vegetation cover is a potential impact resulting from mining activities. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-13.00	-17.33

Maximum Mine Production	-13.00	-13.00	-19.50
No-Go Alternative	N/A	N/A	N/A

It is recommended that the stripped soils are stockpiled for the shortest time possible and that stockpile slopes are not steep.

7.5.3 IMPACTS ON ECOLOGY

7.5.3.1 Transformation of Vegetation

All of the remaining natural vegetation which has been removed, inclusive of sensitive landscape features such as rocky outcrops and wetlands has the potential to be transformed by decommissioning activities.

Loss of habitat which are represented by the remaining natural vegetation is a global issue, the disturbance of the natural vegetation in close proximity to the development also creates opportunity for alien invasive species, which are an additional factor which contributes to biodiversity loss on both a global and regional scale. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-21.25	-16.00	-26.67
Maximum Mine Production	-22.50	-17.00	-28.33
No-Go Alternative	N/A	N/A	N/A

Unless an alternative method was used to utilise the available resources, it would be very time consuming and costly to reconstruct the habitat that was present. The post mining environment should be planned with specific land uses in mind which would prevent the additional transformation of natural areas in the landscape. Local landscape features such as rocky outcrops and wetlands should be re-constructed in areas which would facilitate the movement of fauna in the area. Trained zoologists/ecologists should advise on the recreation of destroyed landscape features in order to optimize rehabilitation.

7.5.3.2 Spread of Alien Invasive Species

The seed of alien invasive species currently present in the landscape such as Wattle (*Acacia mearnsii*) and Blue gums are dispersed into a wider area from exotic stands and homestead on the machinery and truck wheels as well as the replacement of topsoil.

The introduction of alien invasive species and their subsequent spread is a global issue, the disruption of the soil and the additional movement of seed bearing vehicles increases the risk that the alien invasive species will spread into areas where they have not previously occurred. If an infestation occurs close to drainage system, the seeds are dispersed even further. This impact may result in the irreplaceable loss of resources of high value.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-12.00	-20.00
Maximum Mine Production	-20.00	-13.00	-21.67
No-Go Alternative	N/A	N/A	N/A

The area should be assessed and the alien invasive species controlled. The area should be monitored for the establishment and spread of alien invasive species during and after the decommission phase until a closure certificate had been received. A full alien invasive action plan should be implemented.

7.5.4 IMPACTS ON AQUATIC ECOLOGY

7.5.4.1 Decline in Water Quality: Acid Mine Drainage and Decant

After closure, the pits are likely to fill with water (from groundwater ingress/surface runoff). Water within the pit will become acidic and contaminated, notably by salts (especially sulphates and chlorides) and metals (especially iron and aluminium). Contaminated water could potentially contaminate surrounding groundwater and surface water either through seepage (Acid Mine Drainage) or decant. This could continue to contaminate downstream reaches indefinitely. There is also a risk of residual AMD occurring below former product stockpiles/waste rock dumps.

This impact will exacerbate impacts due to mining further downstream within the Steelpoort catchment. The existing good quality water within the upper Steelpoort catchment will be compromised, thus setting the stage for future mining within the catchment. Existing good water quality is likely to be permanently affected within the Steelpoort tributary (downstream of Site 7)

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-23.75	-17.00	-34.00
Maximum Mine Production	-23.75	-18.00	-36.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures should be implemented:

- Ensure adequate rehabilitation and removal of all pollution sources (stockpiles, waste dumps);
- At this stage no mitigation for AMD and decant are available. Therefore, ingress of water into the pit should be prevented as far as possible;
- Ensure continued water quality and biomonitoring programmes post-closure. Should any monitoring (biomonitoring, groundwater or surface water monitoring or environmental audits) detect any signs of deterioration or pollution, rectifying actions should be taken; and
- Rehabilitated surfaces should be free draining to ensure no pooling of water that could lead to infiltration or AMD.

7.5.4.2 Biodiversity Loss

Decant and AMD could lead to water of poor quality (mainly due to acidity, salts and metals) to enter the surface water (either directly through overflowing, decanting or seepage into groundwater that reaches surface water ecosystems), resulting in continued loss of sensitive aquatic biota and overall biodiversity as predators higher up in the food chain (e.g. frogs, birds, otter) may also be affected. Furthermore, the decline in habitats due to ongoing deposition of sediments, may result in continued declines in abundance and species composition. These impacts may be carried downstream, affecting ecosystem downstream of the study site.

Existing impacts to habitats and sensitive species may exceed threshold levels for survival. In addition, increasing habitat loss is affecting animals associated with aquatic ecosystems, such as otter. Populations of threatened fish species may be lost from downstream reaches, particularly within the Steelpoort Catchment.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Sensitivity Planning Approach	-20.00	-13.50	-24.75
Maximum Mine Production	-20.00	-14.25	-26.13
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- Implement all mitigation measures given for erosion, sedimentation and water quality;
- Implement all mitigation measures regarding effective rehabilitation; and
- Ensure continued water quality and biomonitoring programmes post-closure. Should any monitoring (biomonitoring, groundwater or surface water monitoring or environmental audits) detect any signs of deterioration or pollution, rectifying actions should be taken.

7.5.4.3 Decline in Water Quality: Sedimentation and Turbidity

Deconstruction of infrastructure and rehabilitation will cause mobilisation of sediments and erosion. This will result in increased sediment loads being carried downstream. The consequences of this include:

- Increased turbidity;
- Increased settling out of sediments in downstream reaches, causing changes in benthic habitat suitability and colonisation by monospecific reed beds

This impact may exacerbate impacts due to mining and agriculture further downstream within the Steelpoort catchment. Habitats may be permanently affected within the upper reaches of the Steelpoort tributary. This may result in species loss.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-12.00	-14.00
Maximum Mine Production	-16.25	-13.00	-19.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures should be implemented:

- Deconstruction activities should be confined to a minimum area, which should be clearly demarcated. Delineated wetlands should be considered no-go areas as far as possible;
- Sediment trapping mechanisms should prevent soils from being washed into wetlands;

- Movement of machinery and vehicles during the infrastructure removal process must be strictly controlled to prevent disturbance to wetland areas. Rehabilitated areas should be re-vegetated as soon as possible to minimise erosion; and
- The affected landscape should be rehabilitated in such a way that overland flow is diffuse and free-draining, with no constrictions or risk of preferential flow paths being created. Within rehabilitated areas, steep slopes and concentrated run-off should also be avoided to prevent erosion. The rehabilitated areas should be revegetated as soon as possible following completion of the earthworks to minimise erosion. Regular long-term follow up of rehabilitated areas will be required to ensure the successful establishment of vegetation and to survey for any erosion damage on site. Erosion damage should be repaired immediately.

7.5.4.4 Decline in Water Quality: Spills and Leaks

Deterioration in water quality due to spills, leaks and dust: It is likely that residual seepage of pollutants will take place from contaminated soils left on site. Dust and sediments may contain contaminants that can pollute surface water. Storm water flushing old stockpile areas, as well as dust, can also carry pollutants into receiving water bodies. Spills or leaks from vehicles and storage areas during decommissioning also pose a risk to water quality.

This impact will exacerbate impacts due to mining further downstream within the Steelpoort catchment. Sensitive species may be lost.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-9.75	-11.38
Maximum Mine Production	-20.00	-11.25	-15.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures should be implemented:

- Ensure separation of clean and dirty water and allow clean water to enter natural water bodies;
- To prevent spillages, vehicles should be well maintained;
- Diesel and oil/grease should be stored in bunded areas that will allow any spillages to be easily and quickly isolated and prevent contamination of any soils or water;

- Spills should be cleaned up with approved absorbent material such as “Drizit” or “Spillsorb”. These should be kept in sufficient quantities on site to deal with small spills. Absorbent material and contaminated soil should be disposed of at a registered hazardous waste site;
- An emergency preparedness plan should be compiled and all construction staff aware of procedures in event of a spill;
- Hazardous waste should be stored in bunded/impermeable areas and disposed of appropriately at a registered landfill site. Potential spills or seepage of hazardous waste must be anticipated and prevented; and
- Implement an ongoing aquatic biomonitoring and water quality programme. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.

7.5.5 IMPACTS ON WETLANDS

7.5.5.1 Increased Surface Run-Off

Rehabilitated opencast areas are likely to be shaped to be free-draining and characterised by shallow, compacted soils with sparse vegetation cover. These conditions will be conducive to the generation of significantly increased surface runoff compared to the ore-mining environment. Downslope wetlands are thus likely to receive increased flow volumes and velocities. Surface runoff is also likely to be sediment rich.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-16.25	-24.38
Maximum Mine Production	-18.75	-16.25	-24.38
No-Go Alternative	N/A	N/A	N/A

This impact is difficult to mitigate. Soil depth on the rehabilitated areas should be maximised. Replaced spoils should be shaped to approximate the natural landscape profile and be free-draining, but avoid steep slopes that will erode. Once soils have been replaced, revegetation of these areas should proceed as quickly as possible. To ensure maximum vegetation cover establishes on the rehabilitated areas, the soil might need to be treated to alleviate compaction and increase fertility. Refer to the guidelines as per the specialist soils study for the site.

7.5.5.2 Increase in Alien Vegetation

Disturbances remaining following mining activities on site will provide opportunity for alien vegetation to establish and spread into remaining wetland areas. Disturbed footprints such as the rehabilitated opencast pits will be especially susceptible given that alien vegetation such as *Acacia mearnsii* is already established on site.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. If alien vegetation is left to spread uncontrolled, alien species could over time dominate wetland systems on site to the exclusion of indigenous species. Wetland systems dominated by alien species are typically also more susceptible to erosion, while discharge to downstream reaches is also likely to decrease.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-5.00	-8.33
Maximum Mine Production	-17.50	-6.00	-10.00
No-Go Alternative	N/A	N/A	N/A

An alien vegetation management plan should be initiated during the construction phase of the mine and remain in place until a minimum of 5 years after completion of rehabilitation measures. All populations of alien species that are potential invasive should be identified on site and controlled, and ideally removed. Saplings of alien trees establishing on rehabilitated areas should be removed before they reach 1m in height, implying that regular surveys and clearing activities are required (at least once a year).

7.5.5.3 Water Quality Deterioration Due to Acid Mine Drainage

Post mining the backfilled opencast pit is likely to fill with water and start decanting. Decant is expected to be acidic, as well as sulphate and metal rich.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. A large number of mines exist within the Steelpoort River catchment, with many further mines proposed. The overall impact on water quality to the Steelpoort River, a tributary of the already water quality stressed Olifants River systems, is thus likely to be significant. If left unmanaged, decant of acidic mine drainage from the rehabilitated pits will enter the downstream water resources and lead to significant deterioration in water quality and a resultant loss of sensitive species. Increased salinities are also likely to make the water less fit for use by downstream water users.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-21.25	-21.25	-42.50
Maximum Mine Production	-23.75	-23.75	-47.50
No-Go Alternative	N/A	N/A	N/A

No contaminated seepage should be allowed to enter any remaining wetland or water courses on site. A management plan should be put in place to ensure that either no decant occurs, or that decant is of an acceptable quality and meets the ecological requirements of the Steelpoort River as set in the Reserve. The possibility of implementing a water treatment strategy should be investigated. Such a treatment strategy should ideally be developed at a regional scale.

7.5.6 SURFACE WATER

7.5.6.1 Chemical pollution of surface water

Decommissioning activities related to the removal of infrastructure and the use of machinery and equipment have the potential to result in pollution of surface water due to spillages, seepages or leaks and improper waste handling, storage and disposal.

Alternative	Pre-Mitigation	Post-Mitigation	Final

	Score	Score	Significance
Sensitivity Planning Approach	-12.50	-6.00	-9.00
Maximum Mine Production	-15.00	-10.00	-15.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and locations with regard to GN 704 of the NWA;
- All hazardous substances must be stored and handled on impervious substrates and bunded areas in order to handle potential spillages;
- All hazardous substances will only be stored in designated areas constructed to ensure their safe storage;
- Waste handling and storage facilities to be constructed away from surface water resources and drainage lines;
- All vehicles and equipment must be kept in good working order and regularly services;
- Should a spill occur then the spill response procedure and provided in this EMP should be followed.

7.5.7 GROUND WATER

7.5.7.1 Alteration of groundwater levels

Flooding of the pit and resultant groundwater recovery for alternative 2 is expected to occur within 10.5 years due to the location of the mine on a watershed divide with decant expected to begin within 5 years of mine closure. Flooding of the pit and resultant groundwater recovery for alternative 3 is expected to occur within 12 years with decant expected to begin within 3 years of mine closure. As groundwater levels have been altered, so too has the aquifer. As such it is anticipated that more water will now be made available for re-entry into the wetlands and other surface water resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance

Sensitivity Planning Approach	-20.00	-20.00	-36.67
Maximum Mine Production	-20.00	-20.00	-40.00
No-Go Alternative	N/A	N/A	N/A

It is possible to do pre-emptive dewatering before water is contaminated and store for later use. Careful management is required.

Depending on wetland development may be mitigated by nature of wetlands alone.

7.5.7.2 Contamination of groundwater

Contaminated water from the pit will be dominated by the oxidation of sulphide minerals and solutions of salts in the area backfilled. This will result in high concentrations of up to 2200mg/l of SO_4. Contaminated groundwater plumes will now start to migrate from the open cast pit and toward surface water resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-20.00	-20.00	-40.00
Maximum Mine Production	-20.00	-20.00	-40.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Ensure that concurrent rehabilitation and correct backfilling is undertaken which will lower groundwater recharge and minimise the infiltration of oxygen rich water which in turn will minimise contaminating geochemical reactions

7.5.8 AIR QUALITY IMPACTS

7.5.8.1 Dust Fall Out

Nuisance dust fall occurs when dust-fall rates exceeding the residential guideline of 600 mg/m²/day, beyond the mine boundary.

Power generation, farming activities, and nearby mining add to the cumulative nature of this impact. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-9.00	-16.50
Maximum Mine Production	-12.00	-11.00	-20.17
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.5.8.2 Elevated PM10 Levels

Elevated PM_{10} levels outside of the mining boundary will affect the surrounding sensitive receptors. Public response for this impact has been significant. The cumulative impact of mining operations as well as other contributing sources will result in non-compliance with NAAQS even under the mitigated scenario. This non-compliance will be applicable during mining operations only. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.00	-11.00	-18.33
Maximum Mine Production	-14.00	-13.00	-21.67
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.5.8.3 Elevated PM2.5 Levels

Elevated $PM_{2.5}$ levels outside of the mining boundary will affect the surrounding sensitive receptors. Public response for this impact has been significant. Impact assessment included the cumulative impacts as a result of particulate emissions from the Glisa processing plant. It was not within the scope of this assessment to quantify other sources of airborne particulates, although sources are likely to include power generation, farming activities, and nearby mining. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-10.00	-9.00	-13.50
Maximum Mine Production	-12.00	-11.00	-16.50
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.5.8.4 Impact of Dust Fall Out on Agriculture

Dust-fall rates exceeding 400 mg/m²/day, beyond the mine boundary, could impact the photosynthetic activity of crops and reduce the aesthetic appeal of flowers produced by Hadeco. This impact has received a significant public response. During mining operations dust fall-out may exceed 400 mg/m2/day at locations beyond the mine boundary. Reduced photosynthetic rates in crop plants (sunflower and cotton) have been recorded at this deposition rate. A reduction in aesthetic appeal of flowers, produced by Hadeco, is also likely at 400 mg/m2/day or higher. This is applicable to 39ha of Hadeco cultivated areas near the Portion 30 boundary. After the cessation of mining activities and providing that appropriate rehabilitation has been completed, dust-fall rates are likely to reduce. Dust-fall is of importance as a nuisance factor and is not yet a regulated pollutant.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-13.00	-11.00	-16.50
Maximum Mine Production	N/A	N/A	-N/A
No-Go Alternative	N/A	N/A	N/A

It is recommended that the use of water sprayers or chemical stabilisers be implemented to control dust emissions from roads and crushers.

7.5.9 NOISE IMPACTS

7.5.9.1 Noise Nuisance

Activities that will take place during this phase are the demolition and removal of infrastructure used during the operational phase and the infilling of the open cast pit (areas not handled by the roll-over procedure during operations) from discard dumps.

There is a potential for several noise sensitive receptors to be impacted by noise generated by activities during the closure and rehabilitation phase from this pit alternative, and specifically during the night-time period. The noise impact is relatively smaller for the Sensitivity Planning approach than for the Maximum Mine Production Alternative, and there are fewer NSRs that could potentially be affected in the southern sector of the study area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-6.75	-6.75	-9.00
Maximum Mine Production	-6.75	-6.75	-9.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to reduce the impact of noise nuisance on sensitive receptors:

- Maintenance facilities and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites;
- Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds;
- Demolition activities, and particularly the noisy ones, are to be confined to reasonable hours during the day and early evening;
- With regard to unavoidable very noisy demolition activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;

- In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993); and
- Staff working in areas where the 8-hour ambient noise levels exceed 75dBA should wear ear protection equipment.

7.5.10 VISUAL IMPACTS

7.5.10.1 Visual Impact of Dust

Dust created due to the removal of vegetation, movement of heavy vehicles and mining activities affects the sensitive receptors in the area. This public response for this impact has been significant. The dust created by the Paardeplaats Coal Mine will have a cumulative impact as there is already dust that is being created by the Exxaro Glisa Coal Mine. During the construction phase site establishment will take place and vegetation will be removed. This phase can still be rehabilitated to a degree that is similar to the surrounding area. The visual resource value of the area is moderate as the area is similar to the surroundings.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-12.50	-11.25	-18.75
Maximum Mine Production	-12.50	-11.25	-18.75
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- Dust suppression techniques should be in place at all times during the construction and operational phases; and
- Rehabilitate/restore exposed areas as soon as possible after construction activities are complete.

7.5.10.2 Day Time Visual Impact

Mining activities have an effect on the visual landscape and character of the area. The proposed activity will contribute to the cumulative impact of existing mining activities in the area as well the dust that is being created. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-11.25	-10.00	-13.33
Maximum Mine Production	-12.50	-11.25	-16.88
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented in order to reduce the significance of this impact:

- Paint buildings and structures with colours that reflect and complement the natural browns of the surrounding landscape. Avoid pure light colours and pure blacks;
- To reduce the potential of glare external surfaces of buildings and structures should be articulated or textured to create interplay of light and shade; and
- Rehabilitate / restore exposed areas as soon as possible after construction activities are complete.

7.5.10.3 Night Time Visual Impact

Lights used at night for mining activities will affect the visual landscape and character. The proposed activity will contribute to the cumulative impact of existing mining activities in the area as well the dust that is being created. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-7.50	-6.25	-8.33
Maximum Mine Production	-7.50	-6.25	-8.33
No-Go Alternative	N/A	N/A	N/A

It is recommended that the following mitigation measures are implemented in order to reduce the significance of this impact:

- Avoid high pole top security lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area; and

- Light public movement areas (pathways and roads) with low level 'bollard' type lights and avoid post top lighting.

7.5.11 TRAFFIC IMPACTS

7.5.11.1 Impact on Adjacent Road Network

There will be an increase in traffic on the adjacent road networks. From a traffic engineering perspective the impact is low. The traffic will be added to the existing road network. The environmental damage has already been done with the construction of the road within an existing road reserve, which may also include services and stormwater drainage. The mitigation measure may include road upgrades at the intersections on the road network. However these upgrades will be within the existing road reserve, where the environmental damage has already been done. To conclude the environmental impact can be described as neutral as the traffic is been added to the existing roads.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-5.00	5.50	8.25
Maximum Mine Production	-5.00	5.50	8.25
No-Go Alternative	N/A	N/A	N/A

The following are suggestions for upgrading the road network:

- Minimum width of 4m for all lanes on approach to intersection;
- Increasing the corner radii to 20m to ensure abnormal roads do not run over the pavement; and
- Right turn refuges at all intersections that are able to accommodate two heavy vehicles without restricting the flow of traffic.

7.5.11.2 Impact on Bridges and Culverts

Additional heavy traffic over bridges and culverts is expected. The cumulative impact on the bridges and culverts on the adjacent road network will be low. All these are existing structures and should have been design to the correct standards to accommodate heavy vehicles. The report recommended that all culverts and bridges on possible heavy vehicle routes be assessed by a structural engineer and where necessary any remedial works to be undertaken. The impact on resources will be negligible as the culverts and bridges are on existing roads. Therefore any environmental damage has occurred during the construction of the bridges and culverts. There may be some additional impact should remedial works be required to repair or upgrade any bridges and culverts.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-2.00	2.50	2.92
Maximum Mine Production	-2.00	2.50	2.92
No-Go Alternative	N/A	N/A	N/A

The most appropriate mitigation strategy would be to avoid these environmentally sensitive areas, where possible, by designing the mine layout in such a way that the routes between the pit and the processing plant and other areas are the shortest possible, but avoid these sensitive areas as much as possible.

If it is not possible to avoid these areas, then the culverts should be designed to have the minimum impact on the environment as possible and should be temporary structures that can be removed as soon as that section of the road is not required.

For the external road network the impact will be determined following a structural assessment of the culverts themselves. This is required in order to determine the structural condition of these culverts. Once this has been carried out it will be possible to determine if these culverts have the structural integrity to cope with the expected loadings during the operational lifespan of the mine.

If mitigation measures are required then it is recommended that they are designed to have as little impact as possible and should be designed in such a way that they can be removed at a later stage, if required.

7.5.11.3 Impact on Communities

Additional heavy vehicles travelling through communities or urban areas will affect the normal usage of these roads. The addition of heavy vehicles on the road network that pass through local communities and urban areas will have some impact. Many of these routes already experience heavy vehicles operating on them. However this impact can be mitigated by the implementation of travel management plan. This will identify appropriate routes that heavy vehicles can use to avoid communities and urban areas. There will be no loss of resources as the additional heavy vehicles will be operating on existing roads.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-6.00	-6.00	-7.00
Maximum Mine Production	-6.00	-6.00	-7.00
No-Go Alternative	N/A	N/A	N/A

To minimise the impact on the adjacent communities a traffic management plan be should be prepared, which would identify appropriate routes for heavy vehicles to avoid communities and limit time of operation.

7.6 REHABILITATION AND CLOSURE PHASE IMPACTS

The list below is of the impacts likely to occur during the rehabilitation and closure phase. Each listed impact has been assessed and assigned a significance score. The impacts for each of the three project development alternatives are included for comparative purposes.

7.6.1 SOILS, LAND USE, AND LAND CAPABILITY IMPACTS

7.6.1.1 Reduction in Agricultural Potential

The proposed mining activities have the potential to result in the loss of arable agricultural potential due to removal and storage of soil profile. The impact may become cumulative if area than one area is affected and it may result in the loss of irreplaceable resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-13.00	-19.50
Maximum Mine Production	-18.75	-14.00	-21.00
No-Go Alternative	N/A	N/A	N/A

The following should be implemented:

- Stockpiled soil is to be replaced to optimum depth and then loosened to create a suitable environment.

7.6.1.2 Soil Compaction

There is the potential for soil to be compacted during mining operations. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-16.25	-24.38
Maximum Mine Production	-18.75	-17.50	-26.25
No-Go Alternative	N/A	N/A	N/A

The following should be implemented:

- Ensure that soil is replaced evenly;
- Soil should be loosened prior to seeding; and
- Monitoring is essential.

7.6.1.3 Change in Landscape

Mining activities have the potential to result in alteration of the prevailing terrain. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-14.00	-14.00	-18.67
Maximum Mine Production	-18.75	-14.00	-18.67
No-Go Alternative	N/A	N/A	N/A

Refer to original contour plan, as well as pre-mining soil map, to ensure that terrain features are re-created with suitable soils. Wetlands should be avoided wherever possible.

7.6.1.4 Reduction of Soil Fertility

Loss of fertile topsoil due to mining activities during the operational phase is a potential impact. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-14.00	-14.00	-18.67
Maximum Mine Production	-18.75	-13.00	-17.33
No-Go Alternative	N/A	N/A	N/A

Once soil is replaced and loosened, re-vegetate as soon as possible, along with fertilizer and lime according to requirements (determined by specialist). Vegetation growth should be monitored.

7.6.1.5 Soil Erosion Hazard

Increased susceptibility to erosion due to removal of vegetation cover is a potential impact resulting from mining activities. There has been public concern regarding this impact, and there is the potential for this impact to be cumulative but on condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-17.50	-13.00	-15.17
Maximum Mine Production	-18.75	-13.00	-15.17
No-Go Alternative	N/A	N/A	N/A

Re-vegetate soil surface as soon as possible, and monitor constantly to ensure even coverage so that bare soil surface is minimized.

7.6.2 IMPACTS ON AQUATIC ECOLOGY

7.6.2.1 Decline in Water Quality: Acid Mine Drainage and Decant

After closure, the pits are likely to fill with water (from groundwater ingress/surface runoff). Water within the pit will become acidic and contaminated, notably by salts (especially sulphates and chlorides) and metals (especially iron and aluminium). Contaminated water could potentially contaminate surrounding groundwater and surface water either through seepage (Acid Mine Drainage) or decant. This could continue to contaminate downstream reaches indefinitely. There is also a risk of residual AMD occurring below former product stockpiles/waste rock dumps.

This impact will exacerbate impacts due to mining further downstream within the Steelpoort catchment. The existing good quality water within the upper Steelpoort catchment will be compromised, thus setting the stage for future mining within the catchment. Existing good water quality is likely to be permanently affected within the Steelpoort tributary (downstream of Site 7)

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-23.75	-17.00	-34.00
Maximum Mine Production	-23.75	-18.00	-36.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures should be implemented:

- Ensure adequate rehabilitation and removal of all pollution sources (stockpiles, waste dumps);
- At this stage no mitigation for AMD and decant are available. Therefore, ingress of water into the pit should be prevented as far as possible;
- Ensure continued water quality and biomonitoring programmes post-closure. Should any monitoring (biomonitoring, groundwater or surface water monitoring or environmental audits) detect any signs of deterioration or pollution, rectifying actions should be taken; and
- Rehabilitated surfaces should be free draining to ensure no pooling of water that could lead to infiltration or AMD.

7.6.2.2 Biodiversity Loss

Decant and AMD could lead to water of poor quality (mainly due to acidity, salts and metals) to enter the surface water (either directly through overflowing, decanting or seepage into groundwater that reaches surface water ecosystems), resulting in continued loss of sensitive aquatic biota and overall biodiversity as predators higher up in the food chain (e.g. frogs, birds, otter) may also be affected. Furthermore, the decline in habitats due to ongoing deposition of sediments, may result in continued declines in abundance and species composition. These impacts may be carried downstream, affecting ecosystem downstream of the study site.

Existing impacts to habitats and sensitive species may exceed threshold levels for survival. In addition, increasing habitat loss is affecting animals associated with aquatic ecosystems, such as otter. Populations of threatened fish species may be lost from downstream reaches, particularly within the Steelpoort Catchment.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-20.00	-13.50	-24.75
Maximum Mine Production	-20.00	-14.25	-26.13
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended:

- Implement all mitigation measures given for erosion, sedimentation and water quality;
- Implement all mitigation measures regarding effective rehabilitation; and
- Ensure continued water quality and biomonitoring programmes post-closure. Should any monitoring (biomonitoring, groundwater or surface water monitoring or environmental audits) detect any signs of deterioration or pollution, rectifying actions should be taken.

7.6.2.3 Decline in Water Quality: Sedimentation and Turbidity

Deconstruction of infrastructure and rehabilitation will cause mobilisation of sediments and erosion. This will result in increased sediment loads being carried downstream. The consequences of this include:

- Increased turbidity;
- Increased settling out of sediments in downstream reaches, causing changes in benthic habitat suitability and colonisation by monospecific reed beds

This impact may exacerbate impacts due to mining and agriculture further downstream within the Steelpoort catchment. Habitats may be permanently affected within the upper reaches of the Steelpoort tributary. This may result in species loss.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-12.00	-14.00
Maximum Mine Production	-16.25	-13.00	-19.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures should be implemented:

- Deconstruction activities should be confined to a minimum area, which should be clearly demarcated. Delineated wetlands should be considered no-go areas as far as possible;
- Sediment trapping mechanisms should prevent soils from being washed into wetlands;
- Movement of machinery and vehicles during the infrastructure removal process must be strictly controlled to prevent disturbance to wetland areas. Rehabilitated areas should be re-vegetated as soon as possible to minimise erosion; and
- The affected landscape should be rehabilitated in such a way that overland flow is diffuse and free-draining, with no constrictions or risk of preferential flow paths being created. Within rehabilitated areas, steep slopes and concentrated run-off should also be avoided to prevent erosion. The rehabilitated areas should be revegetated as soon as possible following completion of the earthworks to minimise erosion. Regular long-term follow up of rehabilitated areas will be required to ensure the successful establishment of vegetation and to survey for any erosion damage on site. Erosion damage should be repaired immediately.

7.6.2.4 Decline in Water Quality: Spills and Leaks

Deterioration in water quality due to spills, leaks and dust: It is likely that residual seepage of pollutants will take place from contaminated soils left on site. Dust and sediments may contain contaminants that can pollute surface water. Storm water flushing old stockpile areas, as well as dust, can also carry pollutants into receiving water bodies. Spills or leaks from vehicles and storage areas during decommissioning also pose a risk to water quality.

This impact will exacerbate impacts due to mining further downstream within the Steelpoort catchment. Sensitive species may be lost.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-9.75	-11.38
Maximum Mine Production	-20.00	-11.25	-15.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures should be implemented:

- Ensure separation of clean and dirty water and allow clean water to enter natural water bodies;
- To prevent spillages, vehicles should be well maintained;
- Diesel and oil/grease should be stored in bunded areas that will allow any spillages to be easily and quickly isolated and prevent contamination of any soils or water;
- Spills should be cleaned up with approved absorbent material such as "Drizit" or "Spillsorb". These should be kept in sufficient quantities on site to deal with small spills. Absorbent material and contaminated soil should be disposed of at a registered hazardous waste site;
- An emergency preparedness plan should be compiled and all construction staff aware of procedures in event of a spill;
- Hazardous waste should be stored in bunded/impermeable areas and disposed of appropriately at a registered landfill site. Potential spills or seepage of hazardous waste must be anticipated and prevented; and
- Implement an ongoing aquatic biomonitoring and water quality programme. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.

7.6.3 IMPACTS ON WETLANDS

7.6.3.1 Increased Surface Run-Off

Rehabilitated opencast areas are likely to be shaped to be free-draining and characterised by shallow, compacted soils with sparse vegetation cover. These conditions will be conducive to the generation of significantly increased surface runoff compared to the ore-mining environment. Downslope wetlands are thus likely to receive increased flow volumes and velocities. Surface runoff is also likely to be sediment rich.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. On condition that the mitigation measures are implemented, it is unlikely that there will be irreplaceable loss of resources

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-18.75	-16.25	-24.38
Maximum Mine Production	-18.75	-16.25	-24.38
No-Go Alternative	N/A	N/A	N/A

This impact is difficult to mitigate. Soil depth on the rehabilitated areas should be maximised. Replaced spoils should be shaped to approximate the natural landscape profile and be free-draining, but avoid steep slopes that will erode. Once soils have been replaced, revegetation of these areas should proceed as quickly as possible. To ensure maximum vegetation cover establishes on the rehabilitated areas, the soil might need to be treated to alleviate compaction and increase fertility. Refer to the guidelines as per the specialist soils study for the site.

7.6.3.2 Increase in Alien Vegetation

Disturbances remaining following mining activities on site will provide opportunity for alien vegetation to establish and spread into remaining wetland areas. Disturbed footprints such as the rehabilitated opencast pits will be especially susceptible given that alien vegetation such as *Acacia mearnsii* is already established on site.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. If alien vegetation is left to spread uncontrolled, alien species could over time dominate wetland systems on site to the exclusion of indigenous species. Wetland systems dominated by alien species are typically also more susceptible to erosion, while discharge to downstream reaches is also likely to decrease.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-16.25	-5.00	-8.33
Maximum Mine Production	-17.50	-6.00	-10.00
No-Go Alternative	N/A	N/A	N/A

An alien vegetation management plan should be initiated during the construction phase of the mine and remain in place until a minimum of 5 years after completion of rehabilitation measures. All populations of alien species that are potential invasive should be identified on site and controlled, and ideally removed. Saplings of alien trees establishing on rehabilitated areas should be removed before they reach 1m in height, implying that regular surveys and clearing activities are required (at least once a year).

7.6.3.3 Water Quality Deterioration Due to Acid Mine Drainage

Post mining the backfilled opencast pit is likely to fill with water and start decanting. Decant is expected to be acidic, as well as sulphate and metal rich.

According to the National Biodiversity Assessment, wetlands are already the most threatened ecosystem type in South Africa. The specific wetland types and wetland vegetation types of the study area have been classified mostly as critically endangered, indicating that less than 20% of the original area remains in good condition. The proposed opencast mining activities will contribute to the cumulative wetland degradation within the Mpumalanga Highveld. A large number of mines exist within the Steelpoort River catchment, with many further mines proposed. The overall impact on water quality to the Steelpoort River, a tributary of the already water quality stressed Olifants River systems, is thus likely to be significant. If left unmanaged, decant of acidic mine drainage from the rehabilitated pits will enter the downstream water resources and lead to significant deterioration in water quality and a resultant loss of sensitive species. Increased salinities are also likely to make the water less fit for use by downstream water users.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-21.25	-21.25	-42.50
Maximum Mine Production	-23.75	-23.75	-47.50

No-Go Alternative	N/A	N/A	N/A

No contaminated seepage should be allowed to enter any remaining wetland or water courses on site. A management plan should be put in place to ensure that either no decant occurs, or that decant is of an acceptable quality and meets the ecological requirements of the Steelpoort River as set in the Reserve. The possibility of implementing a water treatment strategy should be investigated. Such a treatment strategy should ideally be developed at a regional scale.

7.6.4 SURFACE WATER

7.6.4.1 Decanting of contaminated groundwater into surface water

Groundwater decanting from the open pit will be contaminated and will flow down gradient. Contaminated groundwater is likely to enter and contaminate surface water resources.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-21.25	-18.75	-37.50
Maximum Mine Production	-21.25	-21.25	-42.50
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Decant must be collected into dedicated lined PCD;
- Continued maintenance of all dams to ensure to spills, seepages or leakage;
- Continued maintenance of clean and dirty water system infrastructure;
- Pipelines and sumps to be kept clean and in good working order;
- Implementation of water treatment plant at NBC Glisa;
- Continue to investigate various water treatment options including pH adjustment, controlled release and further containment options; and
- Ensure that proper backfilling is undertaken throughout the operation to ensure less recharge of oxygen rich water and reduction in AMD produced.

7.6.5 GROUND WATER

7.6.5.1 Decanting of contaminated groundwater into surface water

Recovery of groundwater levels post mining has the potential to result in movement if contaminated water away from the backfilled pit and AMD contamination will now decant into surface water resources. Groundwater level recovery is anticipated within 5 years as the mine is located on a watershed divide and the decanting rate is expected to be in the order of 4000 m^3/day for Alternative 2 and 730 m^3/day for Alternative 3.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-20.00	-17.50	-32.08
Maximum Mine Production	-20.00	-17.50	-35.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to manage this impact:

- Decant water must be contained at the decant point anticipated;
- Passive treatments at decant point
- Decant water must be treated and tested to comply with relevant water standards before discharge; and
- Decant water must be treated at the water treatment plant located on NBC Glisa.
- Confirm decant point with high density surface elevation survey.

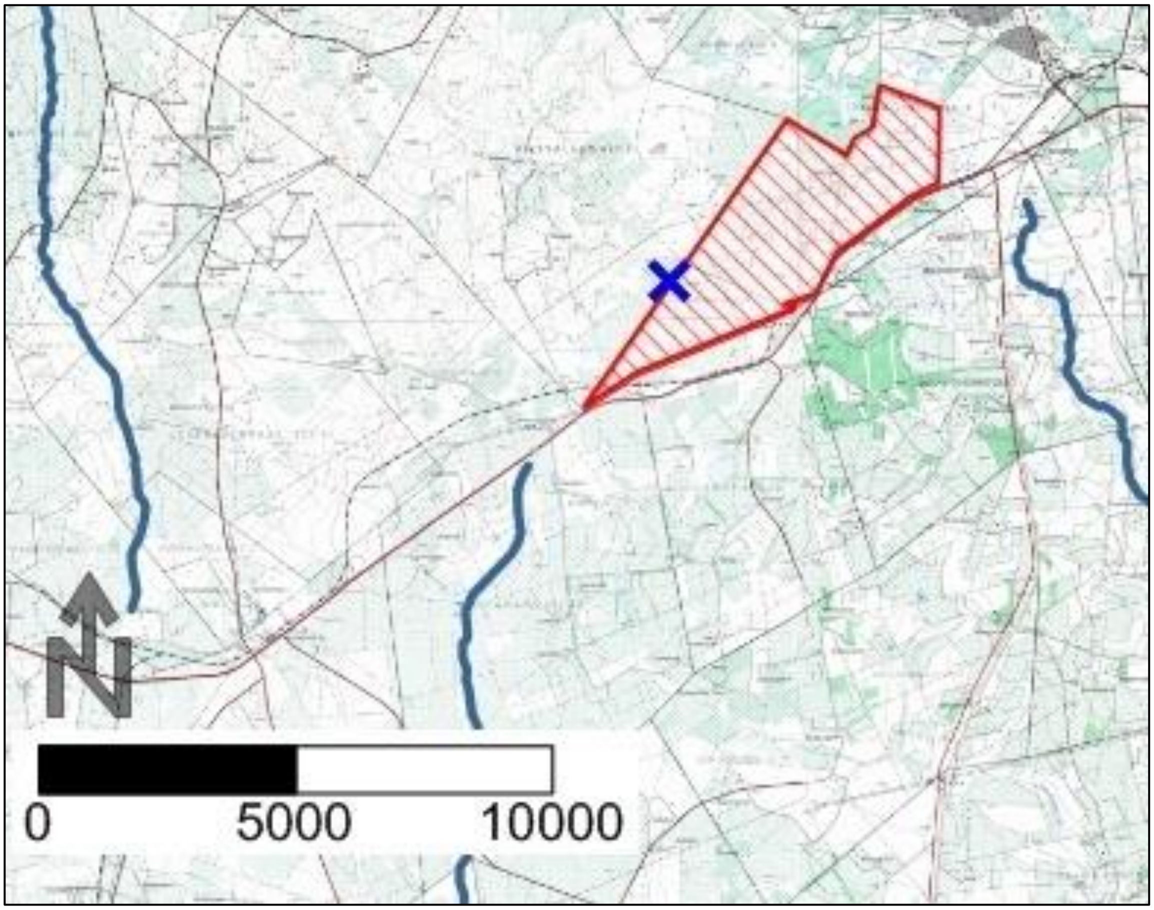

Figure 75: Decant location for Alternative 2

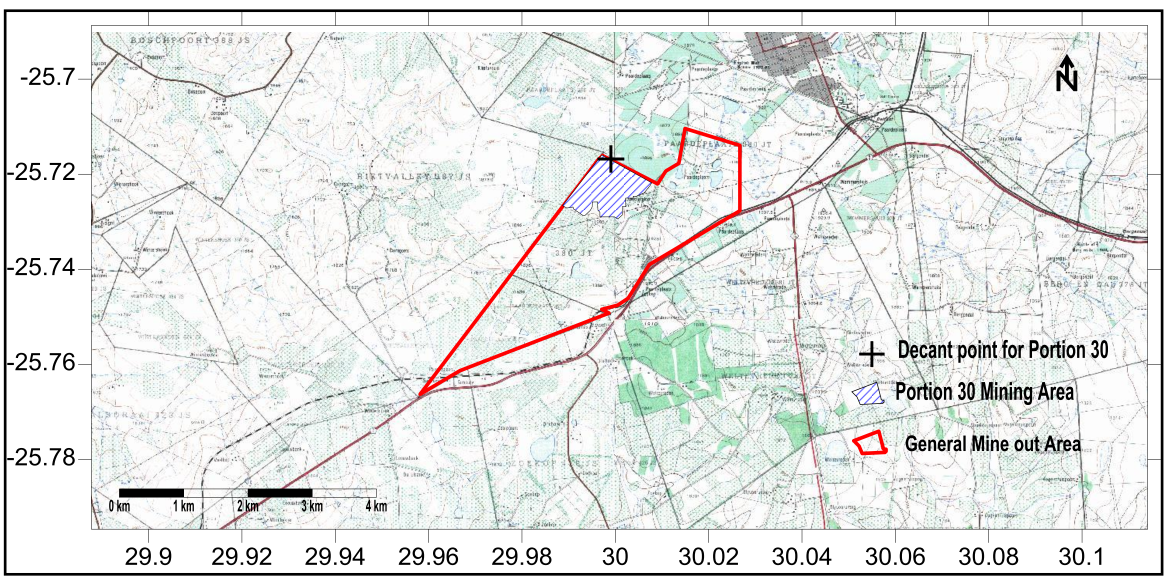

Figure 76: Decant location for Alternative 3

7.6.6 NOISE IMPACTS

7.6.6.1 Noise Nuisance

Activities that will take place during this phase are the rehabilitation of the surface area of the pit (relay of the topsoil from the storage areas and revegetation of the area) and monitoring of rehabilitation efforts.

There is a potential for several noise sensitive receptors to be impacted by noise generated by activities during the closure and rehabilitation phase from this pit alternative, and specifically during the night-time period. The noise impact is relatively smaller for the Sensitivity Planning approach than for the Maximum Mine Production Alternative, and there are fewer NSRs that could potentially be affected in the southern sector of the study area.

Alternative	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Sensitivity Planning Approach	-6.75	-6.75	-9.00
Maximum Mine Production	-6.75	-6.75	-9.00
No-Go Alternative	N/A	N/A	N/A

The following mitigation measures are recommended to reduce the impact of noise nuisance on sensitive receptors:

- Maintenance facilities and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites;
- Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds;
- Demolition activities, and particularly the noisy ones, are to be confined to reasonable hours during the day and early evening;
- With regard to unavoidable very noisy demolition activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact;
- Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;
- In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993); and

- Staff working in areas where the 8-hour ambient noise levels exceed 75dBA should wear ear protection equipment.

8 LIST OF SIGNIFICANT IMPACTS IDENTIFIED

As a result of the impact assessment undertaken in Section 7 a detailed list of significant impacts is provided below and for each project phase. The selection criteria for impacts deemed "significant" is simply the final score calculated post mitigation and with the addition of the prioritisation factors described in the assessment methodology. The list includes significant positive and negative impacts applicable to both alternatives.

8.1 SIGNIFICANT PRE-CONSTRUCTION IMPACTS

- Skills development
- Co-operative governance
- Resettlement of Hadeco Village

8.2 SIGNIFICANT CONSTRUCTION PHASE IMPACTS

- Increase in HIV/Aids and other infectious diseases
- Skills development
- Co-operative governance
- Chemical pollution of soil
- Transformation of vegetation
- Loss of biodiversity
- Spread of alien invasive species
- Loss of aquatic ecosystems
- Decline in water quality
- Biodiversity loss in aquatic ecosystems
- Loss of wetland habitat
- Elevated PM_{10} levels
- Alteration of natural drainage patterns
- Alteration of ground water levels

- Wetland dewatering

8.3 SIGNIFICANT OPERATION PHASE IMPACTS

- Damage/destruction of palaeontological resources
- Increase in HIV/Aids and other infectious diseases
- Skill development
- Co-operative governance
- Net employment
- Income generation
- Reduction in agricultural potential
- Loss of soil fertility
- Soil erosion hazard
- Soil compaction
- Chemical pollution of soil
- Change in natural landscape
- Transformation of vegetation
- Damage to habitat
- Habitat destruction
- Loss of biodiversity
- Direct and indirect mortality
- Red Data and protected species
- Spread of alien invasive species
- Decline in water quality: seepage
- Biodiversity loss in aquatic ecosystems
- Elevated PM_{10} levels
- Noise nuisance
- Visual impact of dust
- Day time visual impact

- Surface water contamination
- Alteration of ground water levels
- Contamination of ground water
- Wetland dewatering

8.4 SIGNIFICANT DECOMMISSIONING PHASE IMPACTS

- Reduction in agricultural potential
- Soil compaction
- Soil erosion hazard
- Transformation of vegetation
- Spread of alien invasive species
- Decline in water quality: Acid Mine Drainage and decant
- Biodiversity loss in aquatic ecosystems
- Increased surface runoff
- Water quality deterioration due to Acid Mine Drainage
- Elevated PM_{10} levels
- Visual impact of dust
- Alteration of ground water levels
- Contamination of ground water

8.5 SIGNIFICANT REHABILITATION AND CLOSURE PHASE IMPACTS

- Reduction in agricultural potential
- Soil compaction
- Reduction in soil fertility
- Decline in water quality: Acid Mine Drainage and decant
- Biodiversity loss in aquatic ecosystems
- Increased surface runoff

- Water quality deterioration due to Acid Mine Drainage
- Decanting of contaminated ground water into surface water

It is important to note that the above lists are summaries of the significant impacts likely to be experienced by the project during each of the key project phases. The identification and assessment of each impact was undertaken by a relevant specialist and in conjunction with EIMS. Although extensive, this list is not conclusive. Mining and the environment are both dynamic and prone to change and as such the identification of impacts should be undertaken through the project lifecycle.

9 STAKEHOLDER ENGAGEMENT

9.1 PUBLIC PARTICIPATION METHODOLOGY

The Public Participation Process (PPP) is a requirement of several pieces of South African Legislation. The aim of PPP is to ensure that all relevant Interested and Affected Parties (I&AP’s) are meaningfully notified, consulted and their opinions considered during the course of the project.

The proposed Paardeplaats Coal Mine is located in a complex stakeholder environment in which historical grievances regarding impacts originating from NBC Glisa are widespread and common. The most common I&AP complaint regarding NBC Glisa’s operations are in the form of those related to blasting, noise, vibration, dust and the provision of information by the mine to I&AP’s.

As such the methodology applied to PPP was one of openness, transparency and collaboration between the EIAP and I&AP’s.

9.2 IDENTIFICATION OF I&AP’S

The initial identification of I&AP’s was undertaken using the existing NBC Glisa I&AP database as well as Windeed searches to determine registered landowners on properties under application and registered landowners in the surrounding area. From the initial list of I&AP’s a database was compiled that separated I&AP’s into the following four broad categories:

- Registered landowners and lawful occupiers of properties under application;
- Registered landowners of surrounding properties and key individuals;
- Authorities and government departments; and
- Organisations, agencies, groups, unions and companies.

Throughout the project, any and all I&AP's who have expressed interest in the project or have been identified through the dissemination of notification documents have been captured and added to the database for the proposed Paardeplaats Coal Mine.

9.2.1 LIST OF AUTHORITIES IDENTIFIED AND NOTIFIED

The following authorities have been identified and notified of the proposed Paardeplaats Coal Mine:

- Department of Mineral Resources (DMR);
- Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET);
- Department of Environmental Affairs (DEA);
- Department of Water Affairs (DWA);
- The Mpumalanga Department of Agriculture, Rural Development and Land administration (DARDLA);
- eMakhazeni Local Municipality;
- Mpumalanga Department of Roads and Transport;
- Mpumalanga Tourism and Parks Board;
- The South African Heritage Resources Agency (SAHRA); and
- The South African National Roads Agency Limited (SANRAL)

9.2.2 LIST OF KEY STAKEHOLDERS IDENTIFIED AND NOTIFIED

The following Key Stakeholders have been identified and notified of the proposed Paardeplaats Coal Mine:

- Spoornet;
- Sasol Mining;
- Eskom;
- Afgri;
- Birdlife South Africa;
- Federation for Sustainable Environment;
- Nkomati Catchment Management Authority;
- Ekangala Grassland Trust;

- Endangered Wildlife Trust;
- South African Crane Working Group;
- Working for Wetlands;
- Highlands Crane Group;
- Highlands Organics;
- Belfast Business Chamber;
- Empiver CC;
- The South African National Biodiversity Institute (SANBI);
- South African Wetlands Conservation Programme;
- Wildlife and Environment Society of South Africa (WESSA);
- World Wildlife Federation;
- Northern Coal (Pty) Ltd;
- Water Research Commission;
- Agri SA;
- Agri Sa Mpumalanga;
- Zoekop Farmers Trust;
- National African Farmers Union (NAFU);
- Masina Farming CC;
- Thandani Communal Property Association;
- Awie De Wit Eiendomme CC;
- Menco;
- Belfast Ratepayers Association;
- Umcembo Mining;
- Mpumalanga Wetland Forum;
- Belfast Fly Fishing Association; and
- Wonderfontein Community Association.

9.2.3 LIST OF SURFACE RIGHTS/LANDOWNERS IDENTIFIED AND NOTIFIED

The following surface rights/landowners of the area under application have been identified and notified of the proposed Paardeplaats Coal Mine:

- Neville Wilkie;
- Maria Wilkie;
- Con Sabbagha;
- Susan Sabbagha;
- Marguerite Eiselen;
- Victor Dick;
- Stephanie Dick;
- Hadeco; and
- Exxaro Coal Mpumalanga (Pty) Ltd

In addition to the surface rights/landowners of properties within the application area, surface rights holders/landowners within the surrounding area were also identified and notified of the proposed Paardeplaats Coal Mine. For a full list of the surrounding landowners identified and notified please refer to Appendix R.

9.3 NOTIFICATION OF I&AP'S

I&AP's identified were notified of the proposed Paardeplaats Coal Mine on 1 August 2012 and in the following manner. For proof of notification please refer to Appendix R.

9.3.1 REGISTERED LETTERS, FAXES AND EMAILS

The information provided to I&AP's in registered letters, facsimiles and emails included the purpose of the project, the mining method to employed, the mineral to be mined, the details of the area under application, the three environmental processes and approvals required and date by which registration and comment must be provided. The notification also included information on where to review the draft scoping report and the date, place and time on which the initial public open day was scheduled.

9.3.2 SITE NOTICES

Ten (5 English and 5 Afrikaans) A2 laminated site notices were placed in around the proposed Paardeplaats application area. The site notices contained the following information:

- Project name;
- Applicant Name;
- Project location;
- Map of proposed project area;
- Closest town;
- Mine description;
- Legislative requirements and processes;
- Details of the initial public open day; and
- The relevant EIMS contact person for the project

9.3.3 POSTERS

Eight (4 English and 4 Afrikaans) A2 Posters were also placed at the following locations:

- Belfast Highland Spar notice board;
- Belfast Spar notice board;
- Belfast Public Library and Clinic; and
- Hadeco Head Quarters

The site posters contained the same set of information as the site notices.

9.3.4 BACKGROUND INFORMATION DOCUMENTS

Included in I&AP registered letters, emails and facsimiles was a Back Ground Information Document (BID). Information in the BID included the following:

- Project introduction;
- Aim of the BID;
- Project description;
- Location and extent of the project;
- Legislative requirements and processes;
- A summary of the Public Participation Process to be followed;
- Information on available document review;
- I&AP registration form and questionnaire;

- Details on the initial public open day to be held; and
- The relevant EIMS contact person for the project.

9.3.5 NEWSPAPER ADVERTISEMENTS

Two advertisements notifying I&AP's of the proposed project were placed in newspapers. The first was placed in the legal section of the Beeld national newspaper and the second in the Middleburg Herald. The information contained in the newspaper adverts included:

- Project name;
- Applicant name;
- Closest town;
- Mine description;
- Project description;
- Legislative requirements and processes;
- Details on the initial public open day to be held; and
- The relevant EIMS contact person for the project.

The advertisement in the Beeld was placed on 1 August 2012 and the follow up advertisement, reminding I&AP's of the proposed project was placed on 28 September in the Middle Herald.

9.4 PUBLIC PARTICIPATION OPEN DAYS

In addition to the notification document, two Public Participation Open Days were scheduled at the Belfast Gold Club.

9.4.1 INTRODUCTORY OPEN DAY

After initial I&AP notification period an introductory open day was held at the Belfast Gold Club on 31 August 2012. The open day ran from 09:00 to 18:00 and was held in an informal manner in which I&AP's were provided individual time with the EAP.

The purpose of the introductory open day was to introduce I&AP's to the proposed project, explain the process going forward, inform them that the Draft Scoping Report was available for review and to solicit any further comment, concerns, suggestions and objections to the proposed project. I&AP's were afforded 45 days to review the Draft Scoping Report and provide comment by 15 September 2012 for inclusion into the final document that was submitted to MDEDET and re-submitted to DMR. From the initial open day it was gathered that most I&AP's expressed historical grievances with NBC Glisa over concerns regarding blasting, vibration, noise and dust.

9.4.2 EIA FEED BACK OPEN DAY

The second I&AP open day was held on 18 January 2013 at the Belfast Golf Club. It ran fron 19:0 to 16:00 and was held in an informal manner in which I&AP's were provided individual time with the EAP to discuss the project.

The purpose of the second open day was to present the results of the EIA and specialist studies to I&AP's, discuss the suggested mitigation measures and project alternatives as well as a review of the Draft Environmental Management Programme.

I&AP's were provided 42 days from 19 December 2012 to 15 February 2013 (excluding the period from 19 December 2012 – 03 January 2013) to review the Draft Integrated Environmental Management Programme and provide comment for inclusion into the final EMPR to be submitted to MDEDET and re-submitted to DMR.

9.5 ISSUES AND RESPONSES

The issues and responses below include all those provided and addressed up until 14 February 2013. Any urther comment received will be forwarded on to the DMR.

9.5.1 HOW ISSUES RAISED WERE ADDRESSED

Issues raised were addressed in a transparent manner and included in the compilation of the EIA and EMP for the proposed Paardeplaats Coal mine in the following manner:

- Issues raised were used quantitatively to calculate the significance of impacts both real and perceived;
- Issues raised were used to provide further suggestions and recommendations with regard to technical management options for impacts;
- Issues raised were used to develop suitable project alternatives; and
- Issues raised were used to direct specialist studies

I&AP's issues, comments, concerns and other information were used not only to develop the EIA and EMP, but to describe the baseline receiving environment including current land uses as well. All information requests by I&AP's were also honoured by the EAP.

9.5.2 SUMMARY OF THE ISSUES AND RESPONSES

The table below is a summary of the issues raised by I&AP's and the corresponding response by the EAP.

Table 79: Summary of I&AP comments and responses

Name	Environmental Aspect	Nature of Interest	Comment	Response
Chris Foster	1. Wetlands 2. Aquatic ecology 3. Water quality 4. NBC Glisa cumulative impacts	Belfast resident	1. Mr Foster wants studies to include SASS5 and Diatoms. 2. Mr Foster is concerned about inclusion of Belfast residents in the review and comment process.	1. EIMS thanked Mr Foster for his comments and assured him that SASS5 and Diatoms studies are included in the specialist studies, in particular the wetland and aquatic ecology studies. The associated reports which will be submitted to the authorities and made available to the public for review during the EIA phase. 2. Mr Foster was also informed that any comment from the Belfast residents would be included in all reports. The approach to the public notification process specifically considered the inclusion of the general Belfast residents. This approach is presented in the Draft Scoping Report and is anticipated to be adequate. The IAP is encouraged to advise EIMS if there are any reasonable additional mechanisms which EIMS could and should utilise to improve the

Name	Environmental Aspect	Nature of Interest	Comment	Response
				participation of the Belfast residents.
			3. Mr Foster would like the cumulative impacts from NBC Glisa to be studied.	3. The cumulative impacts of NBC Glisa are outside the scope of this project. However, the information will be passed on to NBC Glisa
David Hepworth	1. Rehabilitation	Belfast resident	1. Mr Hepworth asked to be included as a registered I&AP in the database.	1. EIMS added Mr Hepworth to the I&AP database.
			2. Mr Hepworth wanted to know how rehabilitation will be addressed.	2. EIMS explained that a closure and rehabilitation plan is being developed for the EIA
			3. Mr Hepworth wants a copy of specialist studies to provide informed comment	3. EIMS explained that all specialist studies scoping component was included in the scoping report. The specialist EIA level studies, when complete will also be made available for review and public comment
			4. Mr Hepworth asked that a hard copy be made available if the electronic copy proved problematic to procure.	4. EIMS informed Mr Hepworth that the Draft Scoping Report was available at the Belfast Public Library and on line at the EIMS website.

Name	Environmental Aspect	Nature of Interest	Comment	Response
Koos Pretorius	1. I&AP representation	Surrounding landowner Member of Wonderfontein Community Association (WCA) Member of Federation for Sustainable Environment (FSE)	1. Dr Pretorius asked for WCA and FSE to be included in the IAP database. 2. Requested copy of the scoping report, the SLP, the MWP, and the DMR acceptance letter. 3. Dr Pretorius explained that Blasting Specialists typically use the USBN standard developed in the USA. Koos believes that it is not appropriate for South Africa and this must be considered in the study undertaken. 4. Dr Pretorius stated that 125dB for blasting must be the cut-off limit. 5. Dr Pretorius commented that mining is not allowed in the	1. EIMS thanked Dr Pretorius for his interest in the project and informed him that the WCA and FSE have been added to the I&AP register. 2. EIMS provided him copies of the requested documents. EIMS also sent a copy of the Draft Scoping Report via Speedpost to Dr Pretorius. 3. The Blasting Specialist explained that South Africa does not currently have a blasting standard and as such the USBN standard has been adopted. The adoption of this standard has been confirmed with the DMR. 4. The current recommend limit for air blast in South Africa is 134dB. However the Blasting Specialist suggested that the limit should be 120 dB and this will be stipulated in the EIA/EMP and EMPR 5. Your comment is noted. Mining is not a preferred land use option as per the

Name	Environmental Aspect	Nature of Interest	Comment	Response
			EMakhazeni/MPTB EMF and that mining would constitute and entire land use change.	EMakhazeni/MPTB EMF.
			6. Dr Pretorius would like a comparative land use study in to determine if the proposed Paardeplaats mining right area is more suited for land uses such as agriculture, conservation and wilderness.	6. A detailed comparative land use study is beyond the scope of the studies undertaken for the EIA/EMP and EMPR. However, land use study has been undertaken and identified alternate land uses within the proposed application area most notably grazing and the bulb farming operations of Hadeco
			7. A big issue is the post mining land use option. Dr Pretorius would ideally like agriculture and grazing land uses to occur concurrently with mining. In other words, these land uses should be allowed to exist for as long as possible prior to be disturbed by mining and then be allowed to occur “ahead” of actual mining operations and “behind” mining operations that have concluded	7. Where possible Exxaro will lease back land to the lawful occupiers up until mining (including site preparation) impacts on the area. However, the mining operation (including site preparation and rehabilitation) can pose potential safety issues and as such it is not often possible to accommodate concurrent land use while mining and throughout the mining phases. Health and safety are the primary concerns that prevent the

Name	Environmental Aspect	Nature of Interest	Comment	Response
			all within the mining right application area. As such, land within the application area and not currently be utilised must be used for other land uses.	land uses from occurring concurrently.
			8. This allows for multiple land uses, further employment opportunities and prevents the area from being sterilized from further land uses. This allows for a sustainable land use that can occur concurrently with mining operations	8. Your comment regarding sustainable and optimal use of land is noted, and as explained above is ideal but in practise not very feasible due to the health and safety concerns presented by mining to other land users noted and supported
			9. Dr Pretorius commented that it is essential that agricultural soil potential must be reinstated post mining.	9. Your comment is noted and soil conservation and utilisation will be detailed in the EIA/EMP and EMPR
			10. Soils, particularly high agricultural potential soils cannot be sterilised and this represents a long-term food security risk.	10. Your comment is noted
			11. The grazing capacity per animal must be correctly assessed. Dr Pretorius states that the current capacity is around 2-3 hectares	11. According to the Soils, land use and land capability Specialist the prevailing grazing capacity within the area is

Name	Environmental Aspect	Nature of Interest	Comment	Response
			per animal.	approximately 7-8 ha
			12. A further concern regarding grazing as a post mining land use option is water. Dr Pretorius states that the water is likely to be unsuitable for watering livestock post mining and that Exxaro should provide suitable water instead.	12. Water for grazing purposes is usually rain fed and seldom requires abstraction of groundwater. Exxaro will continue to manage and the commissioning of the new water treatment plant will allow for the treatment of water. Water will be pumped from Paardeplaats to Glisa. The WTP is in process of being commissioned as part of the Glisa operation. And makes provision for the treatment of Paardeplaats for long term period. There is adequate provision for post closure treatment costs.
			13. Dr Pretorius states that around 150 -160 head of cattle are currently present within the proposed Paardeplaats application area.	13. Your comment regarding the number of cattle in the area is noted and will be included in the land use description of the EIA/EMP and EMPR
			14. Dr Pretorius states that he would be happy if post mining grazing capacity could be re-instated to 8-	14. As discussed above the prevailing grazing capacity within the area is approximately 7-8 ha. If reasonable

Name	Environmental Aspect	Nature of Interest	Comment	Response
			9 hectares per animal.	mitigation measures as suggested in the study are put in place it should be possible to obtain post-mining grazing capacity levels equivalent to prevailing levels of 7-8 ha and is a realistic aim for rehabilitation purposes. The current grazing capacity is not 8-9 ha per animal
			15. Dr Pretorius commented that IF the rehabilitation plan is to return the area to agricultural land use post mining then certain conditions must be met. These include commitments to land capability and commitments on behalf of the applicant that any shortfall such as reduced yields or grazing capacity, as a result of post mining land capability must be paid for by the applicant.	15. A detailed rehabilitation plan is being undertaken. The rehabilitation plan will consider the anticipated post mining land use of grazing and post mining grazing capacity. As part of the rehabilitation plan, monitoring of the success of the plan will be to determine and re-instate said grazing capacity
			16. The mine must be held financially accountable for the preferred land use option post mining and its productivity in terms of	16. Until an application for Closure is submitted to the DMR, the mine is held financially accountable and cannot close until the rehabilitation

Name	Environmental Aspect	Nature of Interest	Comment	Response
			agriculture, grazing or any other preferred land use.	objectives, including grazing capacity is met
			17. Dr Pretorius commented that the area, according to the Mpumalanga C-Plan is considered highly significant and irreplaceable.	17. Your comment is noted and will be included in the EIA/EMP and EMPR
			18. Dr Pretorius asked how Exxaro intend to maintain wetlands post mining.	18. The maintenance and rehabilitation of wetlands will be discussed in the specialist reports to be used in compilation of the EIA/EMP and EMPR
			19. Dr Pretorius asked that a cumulative assessment be undertaken to determine the impact of the destruction of wetlands as required by the mining operation.	19. The cumulative impact of impacts identified is included in the methodology used to determine final impact significance. As wetland destruction is an anticipated impact, the cumulative impact as well as irreplaceable loss of resources will be included in the final impact significance value of the impact
			20. Dr Pretorius commented that the area is of high water quality that is released throughout the year,	20. Your comment is noted and will be provided to the specialists responsible

Name	Environmental Aspect	Nature of Interest	Comment	Response
			He stated that the impact of the mine will not necessarily be felt in Belfast except in terms of soils and Belfast Dam, but it will be felt in the Steelpoort River and Dehoop Dam.	for ground and surface water studies.
			21. Dr Pretorius commented that the existing Glisa Mine discharges water from the open pits into upper tributaries of the Steelpoort River	21. Your comment is noted
			22. Dr Pretorius stated that the only proven water treatment technology with regard to coal mining is reverse osmosis	22. Your comment is noted
			23. Dr Pretorius stated that the water treatment plant being commissioned by Exxaro must be a 5.8 – 6 mega litre per day plant and based on his calculations will cost R1.5 Billion. Dr Pretorius would like the specifications and details of the plant that is being planned and it must be included	23. The water treatment plant at Glisa is at an advanced stage but is yet to be finalised. Your request for details and specifications will be forwarded through to Exxaro and Glisa management for comment. It is anticipated that the plant will cater for both Glisa and the proposed Paardeplaats mine

Name	Environmental Aspect	Nature of Interest	Comment	Response
			in the rehabilitation plan and the costs to commission and operate it, as well as the financial model used to determine this.	
			24. Dr Pretorius states that at least 39 families live within the proposed mining application area and will be uprooted.	24. Your comment is noted and this information has been forwarded through to the social specialists for inclusion in their study.
			25. Dr Pretorius asked if anyone has been consulted regarding relocations	25. Relocation is a personal issue and as such needs to be dealt directly with the affected parties. Exxaro adheres to the World Guidelines regarding relocation and relocation consultations usually involve a third party to mediate and drive the process. Relocation will be discussed with affected parties when necessary.
			26. Dr Pretorius states that relocation consultation must be done in conjunction with the EMPR and not after the report has been submitted to the DMR for decision making	26. Relocation prior to the completion and submission of the EMPR has never been a requirement of the DMR or MPRDA. As such, relocation of affected parties will be undertaken on a personal basis and as the need arises. Exxaro usually purchases land

Name	Environmental Aspect	Nature of Interest	Comment	Response
				from affected parties at a premium, giving the owner an opportunity to relocate to another area and continue with similar activities. Should there be tenants or other lawful occupiers they are also relocated. In the past Exxaro has included relocation of tenants or other lawful occupiers as part of the agreement of sale.
			27. Dr Pretorius stated that he is unhappy with the SLP and that the project was not identified and chosen in consultation with local people.	27. Your comment is noted. The SLP reflects what was asked for by the community. The SLP was compiled in conjunction with the community forum and other I&AP's in Belfast who indicated that they need a training centre to provide them with skills to enter the job market.
			28. On 14 December 2012 Dr Pretorius requested a copy of the Draft EMPR burnt to a CD to be delivered to him. He also enquired about the date of submission of the report to the DMR	28. EIMS agreed to send a CD to Dr Pretorius. EIMS confirmed that the draft EMPR would be submitted to the DMR on or before 19 December 2012.

Name	Environmental Aspect	Nature of Interest	Comment	Response
			29. On 20 January 2013 Dr Pretorius asked when the final EMPR would be available. 30. On 21 January 2013 Dr Pretorius asked whether the EMPR had been submitted to the DMR. 31. Dr Pretorius queried the motivation of alternatives in the wetland specialist study.	29. EIMS explained that depending on the volume off public comment received the report would be finalised by the end of February 2013. 30. EIMS explained the process of handing in a draft EMPR in order to meet the DMR deadlines 31. EIMS explained the different alternatives to Dr Pretorius via email. The confusion was then clarified telephonically.
Maria Wilkie	1. Land use 2. Visual feature 3. Specialist site visits	Land owner Portion 13	1. Mrs Wilkie informed EIMS of the land uses on the property namely grazing and trout dams 2. Mrs Wilkie expressed concern about the impact of the proposed mine the on the gravel road and the oak trees lining the road.	1. EIMS thanked Mrs Wilkie for her comments and informed her that the grazing and trout dams as land uses will be included in the description of land use in reports. 2. The potential of traffic and the impact on existing road infrastructure has been identified and will be assessed in detail in the EIA. Depending on the requirements of the road for mining purposes there is a possibility that the oak trees will likely be removed

Name	Environmental Aspect	Nature of Interest	Comment	Response
			3. One of the landowners from portion 13 asked why there are more specialists coming onto their property.	3. EIMS let the landowners know that previously the specialists came on the properties included in the mining right application to conduct scoping phase baseline investigations. Currently the specialists are coming to conduct the detailed studies required for the EIA phase. Some specialists have done this but others are still to come.
Marguerite Eiselen	1. Visual feature 2. Blasting impact 3. Heritage feature	Land owner Portion 13	1. Mrs Eiselen also expressed concern about the oak trees near the road within portion 13. 2. Mrs Eiselen and Mrs Sabbagha indicated that there has been a notable impact of blasting on some of the tombstone slabs within the two cemeteries about 2 km from Glisa.	1. EIMS stated that any oak trees that fall within the final mining area would most likely be removed for the mine however the oak trees on portion 13 would remain, unless the final mining area includes Portion 13. 2. EIMS let the landowners know that EIMS will let the blasting specialist know about this potential impact and ask him to examine this in his study as well as include mitigation measures.

Name	Environmental Aspect	Nature of Interest	Comment	Response
Con Sabbagha	1. Historical grievances with Glisa 2. Blasting 3. Vibration 4. Noise 5. Dust 6. Provision of information	Land owner Portion 13	1. Let the project team know that due to the negative track record of his correspondence/ liaison with Glisa, he would like to be assured that any comments he makes will be included in the minutes of the Open Day and documentation that will be submitted to the Department of Mineral Resources (DMR) 2. Asked whether portion 13 will be mined as it is included in the mining right application but seems to be excluded in the mining schedule presented on the poster? If not mined initially are there plans to mine it in the future? Mr Sabbagha Indicated that not knowing whether portion 13 will be mined or not creates uncertainty which affects their livelihood. 3. Mr Sabbagha again stated that his lack of trust is based on	1. EIMS assured Mr Sabbagha. that as part of the process, all I&APs comments will be recorded in the Issues and Responses Report which will be submitted along with the Final Reports to the DMR and MDEDET. 2. EIMS let Mr Sabbagha know that as per Exxaro's prospecting assessments portion 13 was found not to be a viable area to mine and this is indicated by its exclusion from the mining schedule presented. Furthermore, the mining schedule as it stands indicates that there are no plans to mine portion 13 in the future. Exxaro also confirmed that portion 13 will not be mined. 3. EIMS let the owners of portion 13 know that portion 13 will be included

Name	Environmental Aspect	Nature of Interest	Comment	Response
			previous experience with Glisa therefore he would like to suggest that if Exxaro does not plan to mine on portion 13, that this be left out of the mining right application. Further, Mr Sabbagha suggested that should a small portion of portion 13 be desirable for mining then only that small area should be delineated for mining and not the entire portion 13.	in the mining right application but as per the mining schedule will not be mined, however should any area within portion 13 be desirable for mining, only that area will be delineated for mining not the entire portion 13 and this to be indicated in the mining right should it be awarded.
			4. The attendees from portion 13 let Pieter du Toit of Exxaro know that the four of them are the owners of all of portion13, and that Errol Woodhouse is aware of this.	4. Exxaro let Mr Sabbagha and the rest of the representatives of portion 13 in attendance know that there seemed to be uncertainty about the ownership of the area where the oak trees are within portion 13, as per information from Errol Woodhouse.
			5. Mr Sabbagha was concerned that this issue of uncertainty about ownership of the area on the boundary of portion 13 to the west seems to always come up	5. Pieter du Toit indicated that he would prefer that Errol Woodhouse facilitate such a meeting and arrangements will be made with him to discuss this matter.

Name	Environmental Aspect	Nature of Interest	Comment	Response
			and would like it to be sorted out.	
			6. Mr Sabbagha mentioned that there are 2 dams within portion 13 that are very important for their fly fishing business, if the proposed mining schedule is followed there is a concern that the dams will run dry due to the flow direction in the area.	6. EIMS initially stated that the hydrological study showed that the some of the drainage is north as indicated by Mr Sabaggha.
			7. Mr Sabbagha is concerned that if the dams do run dry it will completely affect their business and they will no longer be able to do their work.	7. Exxaro stated that the plan at present based on the proposed mining schedule is to buy the entire fishing business or not at all (based on information he was given by Errol Woodhouse involving the 12 people syndicate).
			8. The landowners of portion 13 present suggested that Exxaro liaise directly with them. Mr. Sabbagha was concerned that Errol Woodhouse didn’t interpret their comments correctly to Exxaro regarding the purchase of option of purchasing the fishing	8. Exxaro let the landowners of portion know that should the dams run dry due to the activities of the proposed mine (specialist studies will be undertaken to investigate this impact), then Exxaro will compensate the landowners.

Name	Environmental Aspect	Nature of Interest	Comment	Response
			business. He stated that the landowners agreed that Exxaro should compensate for the small portion of portion 13, and not that Exxaro should either buy entire potion 13 or not at all.	
			9. A concern was raised by the landowners of portion 13 that blasting by Glisa is affecting them and they believe it is above the stipulated limits; however they have not been given access to the blasting records as per their request to Glisa. This is why they are concerned about the potential impact of the proposed Exxaro mine's blasting (noise, dust and vibrations) on portion 13, and would like that there be more stringent reporting especially of limit exceedances as well as that they have access to the reported records.	9. EIMS agreed to forward on the concerns and comments of the landowners to Exxaro to be sent to the mine manager at Glisa.
			10. The landowners' inability to get	10. Pieter du Toit let the landowners know that he is not responsible for

Name	Environmental Aspect	Nature of Interest	Comment	Response
			previously requested information from Glisa (e.g. blasting records, EMP) have made the landowners to not trust any process such as the one for this project. 11. The portion 13 landowners were concerned about Glisa's lack of rehabilitation on portion 24 despite numerous meetings that have been held and the issue mentioned. They would like to suggest that Exxaro have a detailed rehabilitation plan. Furthermore, Mr Sabbagha requested that a detailed plan on how the run-off will be managed (including contaminated water) as previous experience with Glisa had resulted with a number of non- conformances.	Glisa and thus cannot respond on their behalf. However, for this Paardeplaats project the team will follow the process as per the regulations. 11. EIMS stated that a detailed rehabilitation plan will be submitted with the final documents to DMR which will be binding to Exxaro. Moreover, detailed plan on the water use within the proposed mine will be included and submitted to the DMR (includes details on how contaminated water from Glisa will be utilised in the Paardeplaats mine and treated). A recommendation will be included in the Environmental Management Plan (EMP) that an independent Environmental Control Officer (ECO) be appointed to monitor adherence to these plans. Also a recommendation that a community forum be established will be made, and through this forum some of the results (those not making

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				available confidential Exxaro information to the public) made available to the committee.
			12. Mr Sabbagha asked when the next report will be made available.	12. EIMS let him know that the specialists are currently conducting the detailed assessment studies (EIA phase) and their reports as well as the Draft EIA report will be available in October, and this will be followed by a public meeting to discuss the findings of the EIA phase, then a final EIA report will be submitted to DMR.
			13. The impact of mining activities on the air quality were further discussed, whereby Mr Sabbagha asked whether it is just accepted that the air quality is compromised but nothing done about it or no accountability from the mines.	13. EIMS stated that an air quality study was commissioned and findings of the study as well as mitigation and management measures will be submitted to the DMR. EIMS will make the specialist aware of the concerns and that issues such as measurements of instantaneous peaks in dust production (in order to prevent exceedances) are considered. EIMS will discuss with specialists and Exxaro regarding

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				avenues and recommendations towards making such information available to the affected landowners during operation.
			14. It was further mentioned by one of the portion 13 landowners that noise from the activities on Glisa will affect them, and that previously they have been told that noise is not directly from the mining activities. Since Paardeplaats will be much closer to portion 13 than Glisa, this farm will be more affected by the noise pollution and they do not want the reasoning that as a baseline there is already a lot of noise.	14. EIMS let the landowners know that the Glisa noise pollution will be included as part of the potential cumulative effects for the Paardeplaats project and the noise specialist will be made aware of this.
			15. The project team was asked how they would make the Draft EIA Report available to the I&APs, it was recommended that this be made available in electronic format (CDs) via post.	15. EIMS will make copies of the Draft EIA Report available and will send sms's to notify I&APs that these have been sent via post.
			16. There was a further concern by	16. EIMS let Mr Sabbagha Know that

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			Mr Sabbagha that previous behaviour by mines was such that they would apply for a mining right and later sell off mining right without having mined at all.	there is a period of 120 days after a mining right has been granted that the applicant must commence some part of the proposed mining activity otherwise the mining right can be revoked.
			17. Mr Sabbagha asked that enough time be allocated for the Draft EIA report findings presentation meeting.	17. EIMS assured Mr Sabbagha that a period of 45 days will be provided for all I&AP's to review and comment on the Draft EIA Report.
			18. Mrs. Sue Sabbagha was concerned about the dispute between the landowners (syndicate) of portion 13 and Exarro (Glisa mine) regarding the outspan area between Glisa and portion 13, she would like this outspan area (which is part of portion 13) to be excluded from the proposed Paardeplaats mine's mining schedule. Mr. Con Sabbagha presented EIMS with a letter of correspondence with Mr. Errol Woodhouse from Exxaro	18. KP and EC stated that EIMS was under the impression that the ownership of the outspan had since been resolved but told Mr. Sabbagha that EIMS would follow-up on the correspondence to date regarding this matter (Mr. Sabbagha to send copy of letter and any other documents of correspondence from Exxaro to KP), and KP would get back to Mr. Sabbagha within a week. Exxaro agree that the outspan is part of portion 13 as confirmed in an email from Errol Woodhouse dated 8

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			regarding the dispute on to whom the outspan area belongs (including drawing showing which servitudes had since been cancelled at which point the said property/outspan is supposed to revert back to previous owners) but stated that to date there has been no resolution on the exclusion of the outspan from the mining right application (which had created uncertainty to the landowners, associated businesses and workers) as its legal ownership had not as yet been resolved (a meeting was held with Mr. Woodhouse in this regard on the 18th October 2012).	November 2012 containing correspondence from Karen Mare of Exxaro dated 2 November 2012. KP further let Mr & Mrs. Sabbagha know that with regards to removal of the outspan from the mining schedule, excluding a property from a mining right application that has not yet been approved would create confusion. Should the mining right be awarded then an amendment to the mining schedule where properties such as portion 13 may be excluded should that be the agreement, is then possible. KP suggested to Mr & Mrs Sabbagha that the recommendation that should the mining right be granted, that portion 13 be excluded and the mining right amended to reflect only the property (ies) to be mined (this is in line with the preferred alternative of mining only portion 30). The owners of portion 13 stated that the outspan area has not been included in any of the EIA

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				studies undertaken for the Paardeplaats project and therefore it cannot be included in the mining right.
			19. Mr. Con Sabbagha stated that the owners of portion 13 are opposed to the proposed mining activity because of detrimental impacts to the environment and surrounding landowners but that if mining is to proceed the alternative of mining only portion 30 is preferred.	19. Your comment is noted
			20. Mr. Con Sabbagha was concerned that should portion 29 (Hadeco property) be mined (if the existing mining schedule is approved and not the preferred alternative), the water channels of portion 13 may permanently dry out or the polluted groundwater runoff onto portion 13.	20. KP asked EC to include this concern in the report.
			21. Mr. Con Sabbagha stated that it looks like overburden from the	21. KP answered that EIMS will make sure the section on rehabilitation in

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			proposed mining activities is going to be dozed off but that there is no mention of compacting as part of rehabilitation. He further mentioned that it looks like the only compaction will be from transportation however he is concerned that if proper rehabilitation measures are not adopted and implemented from the start, in the winter everything dries up and gradually invasive plants establish instead of natural indigenous vegetation as a result. 22. Mr. Sabbagha stated that there is mention in the available draft EIA report about decanting and wanted to know if this is included in the water treatment plant design plans. Mr Sabbagha further stated that the owners of portion 13 feel that decant water from the mine must be treated to avoid downstream pollution and that the treatment plant must be	the report is made clearer with regards to compaction of overburden. Moreover, KP stated that in the report EIMS would add that all rehabilitation efforts be monitored and results of the monitoring reported regularly by an independent consultant, and submitted to the DMR as per the suggestion by Mr. Sabbagha. 22. KP let Mr. Sabbagha know that the design for the water treatment plant by Glisa is still underway and thus not made public as yet. However, the finalised design of how the water treatment would be carried out would be included in the final EMPR report which will be made available to I&APs for review prior to any implementation.

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			commissioned and ready to treat all the decant water when mining starts. 23. Mr. Sabbagha mentioned that in the report showing information regarding the blasting, there is no indication of mitigation measures. This is a concern as many of the dwellings on portion 13 are within areas where the blasting noise exceeds 134 decibels. Mr. Sabbagha voiced concern that the blasting diagram for the preferred alternative presented a minimum blasting noise at 130 decibels but that if entire study area was blasted then the noise level would be even higher than 130 decibels. Mr Sabbagha stated that Glisa has informed him that the recommended 125 decibel level cannot be achieved and that this matter has been discussed with the mine on several occasions. However, it	23. EC answered that for the entire mining schedule area there are 3 blasting diagrams included in the report (low, medium and high blast charges) and only one diagram for the preferred alternative of only mining portion 30 (low). KP showed Mr. Sabbagha the diagrams. KP mentioned to Mr. Sabbagha that the blasting specialist has recommended a blasting maximum level of no more than 125 decibels

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			appears from the Paardeplaats EIA that the recommended levels are attainable, and therefore Mr Sabbagha wants the approved EMP to stipulate that this is the maximum air blast noise level allowable.	
			24. Mr. Sabbagha presented a recommendation of continuous communication with the I&APs with regards to the project and asked whether such provisions were included in the report (e.g. forum meetings for the discussion & presentation of monitoring results etc.) as was done for Glisa mine as a recommendation by Exxaro.	24. KP will add this suggestion/recommendation in the report.
			25. Mr. Sabbagha mentioned that he is very happy and impressed with the report, and mentioned that it is one of the best that he has seen.	25. EIMS thanked Mr Sabbagha.
			26. Mr. Con Sabbagha wanted to	26. Your comment has been noted.

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			know how the direction of dust can be determined as this would allow the landowners of portion 13 to be able to determine when the dust is from the mine. KP let Mr. Sabbagha know that the dust fallout model shows the direction the dust will fall and the information on this model is available in the previous Glisa mine EIA which is available. Mr. Sabbagha mentioned that he had requested to see this document from ID but has to date not received it. Mr Sabbagha also stated that there is technology available to determine whether dust fallout on a 24 hour basis is acceptable. The owners of portion 13 want the mine to use these methods to determine what the short period dust fallout is.	
Minette Eiselen	Same as Mr Sabbagha	Landowner Portion	Same comments as Mr Sabbagha	Same EIMS response as to Mr Sabbagha

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		13		
Petro Wilkie	Same as Mr Sabbagha	Landowner Portion 13	1. Same comments as Mr Sabbagha 2. Mrs. Petro Wilkie was concerned about the resolution for Figure 55 in the report and asked if a better map may be provided. 3. Mrs Wilkie asked how she can unzip some of the appendices in order to view them. Further Mr William Wilkie confirmed that he knows how to do this and would be able to assist Mrs Wilkie.	1. Same EIMS response as to Mr Sabbagha 2. EIMS stated that due to the large size of some of the original maps, they had been reduced for inclusion in the report which affected the resolution. EIMS will send an electronic copy of the said map in its original form to Mrs Wilkie by courier (Ms Corné Wilkie provided an address to which the document can be sent). 3. EIMS explained to Mr Wilkie how the files can be unzipped and viewed and demonstrated how to do this.
Sue Sabbagha	Same as Mr Sabbagha	Landowner Portion 13	1. Same comments as Mr Sabbagha	1. Same EIMS response as to Mr Sabbagha

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			2. Mrs Sabbagha stated that the technicality of some of the reports making up the draft EIA report are not easy to follow for I&APS. 3. Mrs Sabbagha and Mrs Wilkie stated that they had received the minutes of the Scoping Open Day but that not everyone who had attended had received them or the notification about the EIA Open Day.	2. EIMS answered that the concepts of some fields of study are difficult to simplify but an effort would be made to try make the reports as clear as possible. 3. EIMS apologised for the omissions and would make sure all previous open day attendees were included in the database and received further notifications.
Corne Wilkie	Same as Mr Sabbagha	Landowner Portion 13	Same comments as Mr Sabbagha	Same EIMS response as to Mr Sabbagha
Neville Wilkie	Same as Mr Sabbagha	Landowner Portion 13	Same comments as Mr Sabbagha	Same EIMS response as to Mr Sabbagha
Erich Eiselen	Same as Mr Sabbagha	Landowner Portion 13	Same comments as Mr Sabbagha	Same EIMS response as to Mr Sabbagha

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Tshilidzi Masalesa	1. Impact on railway servitude 2. Impact on infrastructure	Transnet	1. Response on behalf of Transnet freight rail. No objections but concerned about impact of mine on the railway servitude. Stated that Transnet will not be held responsible for any injury caused from illegal crossing of the railway line.	1. EIMS thanked Ms Masalesa for her response and informed her that her concerns would be addressed in the final scoping report.
Stuart Barnhoorn of Hadeco	1. Objection	Land owner Portions 29 and 40	1. Mr Barnhoorn requested a copy of the mining schedule. 2. Mr. Barnhoorn stated that Hadeco does not see the Paardeplaats project as viable due to the potential detrimental impacts of the mining activities on their crops (main concerns being dust pollution, groundwater contamination and blasting). 3. Mr Barnhoorn requested a private meeting with Exxaro to discuss Hadeco's views on the project.	1. EIMS sent the schedule to Mr Barnhoorn. 2. The concern is noted. 3. Exxaro asked Mr Barnhoorn if such a meeting could not be conducted at the open day with the rest of the team

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				there but Mr Barnhoorn preferred a private meeting. EIMS expressed concern about the meeting between Exxaro and Mr Barnhoorn taking place outside the open day proceedings and suggested that a summary of the discussion be presented to EIMS (so that it can be documented
			4. Mr Barnhoorn asked what the timeframe of the remaining phases of the project was,	4. EIMS let him know that EIMS has forecast submission of the Final EIA Report at the end of February 2013 (the closing date for submission of public comment is the 14th of February 2013).
			5. Mr Barnhoorn asked that they get an extension for the submission of their comments regarding the draft EIA Report as they had received some of the documents late.	5. Exxaro expressed concern about the request for extension from Hadeco stating that the project had already been considerably delayed (when Exxaro was awaiting the project application acceptance and reference number from DMR). EIMS informed Mr Barnhoorn what the legislative timeframe for the public comment period in this EIA phase of the project

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				is 30 days (excluding the period between the 20th of December and the 3rd of January), and that more than that time has been included in the 14th of February 2013 comment period deadline allocated. EIMS also let Mr Barnhoorn know that Hadeco could submit comments directly to the DMR after the 14th of February 2013 or EIMS could forward the comments to the DMR on their behalf but those comments would not be included in the Final EIA Report. EIMS also mentioned that should the project be approved, Exxaro would be required to liaise with Hadeco and any other affected landowners before commencing any mining related activities
			6. Mr. Barnhoorn stated that he had had a brief look at the specialist reports and has concerned that some of the information, particularly the ones pertaining to wind and dust pollution, was	6. EIMS let Mr Barnhoorn know the specialists had taken a conservative approach to their assessment. However, EIMS will appreciate Hadeco's input and comments regarding their review of the

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			vague. Mr Barnhoorn would like Hadeco specialists to review the assessments and compare their results to those of the available reports.	specialists' reports and particularly on the impacts of dust on crops as they have the expertise on it. Exxaro stated that they would like to see any proposed additional mitigation recommendations from the Hadeco specialists prior to their incorporation to the Final Report, should that be necessary.
			7. Mr Barnhoorn asked how much blasting is envisaged for the proposed mine.	7. Exxaro and EIMS answered that the blasting will be the same as the current blasting taking place at the adjacent Glisa mine.
JDM Law	1. Objection	Attorneys for Hadeco	1. JDM Law on behalf of Hadeco objects to the proposed development. JDM Law requested copies of the Mining Right Application, the Letter of Acceptance from the DMR, details of the land area applied for, the Mining Works Programme, the Scoping Report, and any and all directives issued	1. EIMS requested permission from Exxaro to provide the requested documents to Hadeco.

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			by the DMR to Exxaro. 2. JDM Law sent a second urgent request for the above mentioned information. 3. JDM Law submitted a letter at the Public Open Day expressing concern about the following environmental aspects: • Effect on the environment, water quality • Removal of topsoil • Impact on air quality • Impact on farming infrastructure and production • Socio-economic impact – loss of jobs, housing, school. 4. JDM Law submitted an objection	2. EIMS provided electronic copies of the requested documents to Hadeco and JMD Law. EIMS informed Hadeco that a copy of the Draft Scoping Report was available on the website. 3. EIMS signed a copy of the letter as proof of receipt. 4. EIMS received a copy of the objection

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			on behalf of Hadeco against the proposed project to the DMR. The objection submitted to the DMR is on the grounds of unacceptable pollution, ecological degradation and damage to the environment and unacceptable impact on the socio-economic environment.	on 28 September 2012. EIMS thanked Hadeco for the correspondence and affirmed that the comments and concerns would be addressed, as far as is practically possibly in the EIA.
			5. JDM Law asked to know if the submission of the EMPR would still take place on 19 December and if I&AP's would be provided an opportunity to review the document and provide comment.	5. EIMS explained that a DRAFT EMPR will be submitted on or before 19 December 2012 in order to comply with DMR timelines. The report however remains a draft and I&AP's will be provided until 12 February 2013 to review and comment on the report before re-submission of the final EMPR to DMR and submission to MDEDET
			6. On 17 January 2013 JDM Law sent a letter to EIMS requesting more time in which to peruse the EMPR.	6. EIMS responded that unfortunately we are unable to grant an extension due to the legislated timeframes that need to be adhered to.
			7. An objection was submitted to the	7. The objection has been noted. EIMS

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			DMR from JDM Law on behalf of Hadeco regarding the proposed Paardeplaats project.	responded to this objection on 22 February 2013.
			8. JDM Law detailed the communication entered into between themselves and EIMS.	8. EIMS records indicate that the record of communication provided by JDM Law is incomplete. The full detail of communications entered into was provided by EIMS.
			9. JDM Law asserts that Hadeco was not provided enough time to review the EMPR documentation	9. The legally required period for public comment is 30 days. Even if all of the documents were only accessed by JDM Law on 9th January 2013 as asserted the I&AP had 38 days in which to peruse them.
			10. It is asserted by JDM Law that the impact of air quality on Hadeco was not adequately addressed in the EMPR.	10. Sections 7.3.9, 7.4.10, 7.5.8, 7.3.9.4, 7.4.10.4, 7.5.8.4, 7.4.10, 7.5.8, 7.3.2.7, 7.4.2.2, 7.4.2.8, 21.8, 22.2.46 and 23.2 of the EMPR deal with air quality and the impact of dust on Hadeco's operations.
			11. JDM Law asserts that the EMPR does not adequately address the issues of water contamination	11. Sections 7.6.4.1 and 7.6.5.1, 21.7, 22.2.28, 22.2.29, 22.2.30, 22.2.31, 22.2.32, 22.2.33, 22.4.94, 22.4.96, 22.6.113, 23.5, 23.5 and 25.2 of the

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			and lowered ground water levels.	EMPR deal with water quality and quantity and the impact of mining operations on Hadeco's operations.
			12. JDM Law stated that Hadeco is concerned with the effects of blasting on the dams, irrigation pipes, infrastructure, and people on their property. Hadeco is also concerned that the mitigation measures for blasting lack clarity.	12. This concern is noted. Sections 7.4.13, 21.11, 22.1.3, 23.3, and 22.2.45 of the EMPR address this issue and how to manage it. EIMS also clarified that due to the extremely unique nature of each blast required, the mitigation measures for blasting have to be designed specifically for each activity once the conditions and requirements for the blast have been ascertained. The broad management framework within which this will take place is described in the report.
			13. The socio-economic impact of the proposed mining operations on Hadeco was raised as an issue by JDM Law.	13. EIMS noted this concern. Sections 4.10, 21.2, 22.1.4, 22.1.7, 22.2.14, 22.2.17, 22.1.5.H, 7.4.3.1, 3.7.3.4, 6.3.6, and 6.1.3 of the EMPR address the socio-economic impacts of the proposed mine.

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Catharina M. Visagie	1. Vibration 2. Dust 3. Noise 4. Water pollution	Belfast resident Member of the Belfast Fly Fishing Association (BFFA)	1. Mrs Visagie expressed concerns regarding the impacts of vibration, dust, noise and water pollution 2. Mrs Visagie (BFFA) asked if the transportation of coal will follow the existing road used by Glisa.	1. EIMS thanked Mrs Visage and explained that these impacts will be identified and assessed in the EIA. 2. EIMS confirmed that coal transport will follow the existing road used by Glisa.
Janet Hendriks	1. Noise 2. Traffic 3. Pollution 4. Tourism 5. Surface water	Belfast resident	1. Informed EIMS of the proposed High-Altitude Training Centre. And expressed concerns about the effect of noise, traffic, lack of accommodation, and pollution on Belfast fly-fishing and tourism industry. 2. Mrs Hendriks asked if the run-off will be managed, whereby concern is mainly regarding water from mining activities going back into the land.	1. EIMS thanked Mrs Hendriks for her comments. 2. EIMS let her know about the findings of the hydrological report whereby most of the runoff heads into the Steelpoort area. Cut-off berms will be established and pollution control dams used to manage water. Existing contaminated water from Glisa will be utilised by Paardeplaats. Any run-off

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				from rain water will be re-used at Paardeplaats.
			3. Mrs Hendriks asked when the blasting will be carried out as currently there have been incidences by Glisa when blasting was carried out in the evening and over the weekend.	3. EIMS and Exxaro stated that blasting should be during the week at day time as per standard and the timing will be based on the mining schedule.
			4. Mrs Hendriks asked that should there be any changes to the blasting times, the public should be notified.	4. This was noted and EIMS added that blasting impacts will be addressed by the blasting specialist and mitigation and management measures recommended.
			5. Mrs Hendriks asked if the proposed mine will be open-cast.	5. EIMS let Mrs Hendriks know that that was the case and that it would be carried out as a hybrid of bench and roll-over methods. Whereby the pits will be backfilled (rehabilitated) as the mining progressed so that at no point the entire area will be one open pit.
			6. Mrs Hendriks asked if there is still a possibility of halting the project.	6. EIMS let her know that the decision on the proposed mining right application lies solely on the DMR. EIMS is the independent facilitator and all I&AP comments will be

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				included in the documentation to be submitted to DMR for their decision making. 7. EIMS shared with the fly fishing representatives at the open day about the main areas of concern of the landowners that attended the open day. 8. EIMS let Mrs Hendriks know that he will advise the socio-economic specialist to consult with her regarding the impacts on local business.
Francois Krige	1. Biodiversity 2. Wetlands 3. Land Use 4. Rehabilitation 5. Prospecting 6. Compensation	Mpumalanga Parks and Tourism Board	1. Commented on high significance of the terrestrial and aquatic biodiversity. 2. Mr Frans Krige (Mpumalanga Parks Board) asked how Exxaro plans to deal with local existing business such as Hadeco.	1. EIMS thanked Mr Krige for completing the IAP Registration Form and for his comments. EIMS assured Mr Krige that his concerns would be included in the Final Report. 2. EIMS indicated to Mr Krige that as per mining schedule, the Hadeco properties will be completely affected as the activity will be open cast mining.

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			3. Mr Krige asked how many hectares the mining activity will involve.	3. EIMS showed Mr Krige the mining schedule and indicated the areas identified for the mining.
			4. Mr Krige asked if there is a comprehensive rehabilitation plan.	4. EIMS stated that there is a rehabilitation specialist that is part of the project team; they are to present a detailed rehabilitation plan as part of their study.
			5. Mr Krige asked if any wetlands had been identified within the proposed mining area.	5. EIMS indicated that wetland studies (including delineation) are currently being undertaken. Furthermore, different options will be considered including the no-go option and sensitivity based (e.g. consideration of infrastructure placement, open pits and roads in relation to features such as wetlands).
			6. Mr Krige asked how Exxaro plans to deal with the externalities.	6. Gerrie Muller (socioeconomic study specialist) responded to Mr Krige stating that mitigation costs, land-use externalities, cultivation (yield per hectare) will be considered. When Mr Krige asked about the water related externalities, Khalid Patel mentioned

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				that surface water and geo-hydrological studies (including borehole drilling) are being undertaken and the results will be utilised in assessing the externalities.
			7. Mr Krige asked how the specialists were able to access the properties prior to the mining right being granted.	7. EIMS let Mr Krige know that access to property agreements have been made with the affected landowners and all specialists are aware and must adhere to these.
			8. Mr Krige asked how Exxaro will reward/ compensate the downstream landusers for externalities.	8. EIMS answered that activities envisaged for Paardeplaats are not as extensive as those for other mining activities as some of Glisa infrastructure will be utilised. Numerous specialist studies are also being undertaken and their results will be utilised to formulate recommendations.
			9. Mr Krige asked how the prospecting process had been carried out (including maps etc.); it is his understanding that there had been some objections. He	9. EIMS let Mr Krige know that the prospecting has already been undertaken and that is why the mining right application was subsequently submitted. EIMS does

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			would also like to be sent documentation that shows that the prospecting right was legally awarded.	not have access to the prospecting right application information. Pieter du Toit will provide EIMS with proof that prospecting right was awarded legally and this will be forwarded to Mr Krige
			10. Mr Krige asked if the Paardeplaats mining project would not be viable if Hadeco does not sell.	10. EIMS let him know that portion 30 which is owned by Exxaro is the priority area for mining as per the mining schedule. Exxaro is currently under negotiations with Hadeco regarding the purchase of their properties, pending the outcome Exxaro will either mine or not mine in that area.
			11. Mr Krige asked why Exxaro is planning to do open-cast and not underground mining, and what are the cost differences?	11. EIMS stated that the seams in the proposed mining area are too shallow (10-40m) for underground mining and open pit is preferred and feasible.
			12. Mr Krige asked who will be undertaking the wetland studies.	12. EIMS let him know that Mr Alan Batchelor from wetland Consulting will be doing the wetland studies. (Mr Batchelor passed away on Monday 3

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				September 2012).
			13. Mr Krige mentioned that it looks like there are large risks to this project, and it is his understanding that there can never be mining rehabilitation (e.g. soil, water).	13. EIMS indicated that there are risks regarding the cost of rehab in the long run, sensitivities such as wetlands etc., and all these are considered in the process through specialist studies. Information from the specialist studies will be part of the reports submitted to the DMR for decision-making, and will include information from the rehabilitation specialist.
			14. Mr Krige asked what cost-benefit parameters were used.	14. Gerrie Muller answered that the economic value added by the mine (e.g. employment), economic income etc. forms part of the assessment. The parameters include long term decant costs (financial provision important here to describe values and long term potential liabilities to be allocated for).
			15. Mr Krige asked if cumulative effects will be considered.	15. EIMS answered that cumulative effects are part of the aspects that will be considered and evaluated as part

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				of the impact assessment methodology to be followed in this project.
			16. Mr Krige mentioned that Mpumalanga Parks Board has identified an area for conservation in the vicinity of the proposed mining area. He suggested that EIMS consult with the Steenkampsberg Environmental Initiative (SEI): to get information on submitted application for conservation area within Belfast; look into zoning issues within proposed mining area. 17. Mr Krige stated that he appreciates the amount of time allocated by the project team for the public consultation at the open day.	16. EIMS thanked Mr Krige for his suggestions and informed him that they would be included in the Final Report.
Philip de Klerk	1. General	Transnet	1. Mr de Klerk stated that the faxed notification documents were	1. EIMS emailed the notification

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			unclear and requested that they instead be mailed to him	documents to Mr de Klerk
Ursula Franke	1. Bio-diversity 2. Land use	EWT	1. Ms Franke stated that she wished to be registered as an IAP on behalf of the Endangered Wildlife Trust 2. She stated that the project falls within the Steenkampsburg Wet Grasslands area, an area of high biodiversity. 3. Ms Franke expressed concern about the impact of mining on the natural environment and sustainable land uses.	1. EIMS thanked Ms Franke for her comment and informed her that she would be included as a registered I&AP in the database 2. EIMS explained that her comments will be included into reports to be submitted to authorities. 3. Comment noted
Leigh Combrink	1. General	EWT	1. Ms Franke wishes to register Ms Combrink as an IAP on behalf of the Endangered Wildlife Trust	1. EIMS informed Ms Franke that Ms Combrink had been registered and added to the database
Carolyn Ah	1. Avi fauna	Birdlife SA	1. Mrs Ah Shene-Verdoorn	1. EIMS thanked Ms Ah Shene-

Name	Environmental Aspect	Nature of Interest	Comment	Response
Shene-Verdoorn	2. Land Use 3. Wetlands		requested that Birdlife SA be registered as an I&AP and included in the database. 2. Mrs Ah-Shene expressed concern about the location of the application – within an IBA, which is prioritised as a conservation area and the presence of threatened bird species and wetlands in the area. 3. Mrs Ah-Shene stated that BirdLife South Africa does not condone mining in, or adjacent to IBAs especially when there is confirmed presence of threatened bird species on the property. In addition there are wetlands and Threatened Ecosystems (Eastern Highveld Grassland is listed as Vulnerable) and under these circumstances mitigation	Verdoorn for her comments and assured her that BirdLife SA was registered as an I&AP and included in the database. 2. EIMS informed her that an ecological assessment has been undertaken including an avifaunal study detailing the presence of threatened bird species in the area. EIMS requested mitigation measures from the BirdLife SA and the shapefile of the IBA. 3. EIMS thanked Ms Ah-Shene for her comments and informed her that her objection had been noted.

Name	Environmental Aspect	Nature of Interest	Comment	Response
			measures will not suffice nor would BirdLife SA entertain offsets.	
Doug McFarlane	1. Wetlands 2. Aquatic ecology	Specialist	1. Mr Mcfarlane asked to be kept in mind if the study required any further wetland and aquatic studies done.	1. EIMS attempted to contact Mr McFarlane through the email provided but the email was returned.
Amanda Botha Ernst van der Berg Verne Lello John Stevens	1. Blasting	ELM ward councillors	1. Representatives from the ELM were not aware of the open day but attended and filled in registration forms or took some away with them to distribute to colleagues. 2. Their concern was on blasting.	1. EIMS let them know that the blasting specialist will be made aware of the areas of concern attained at the open day, so as to include and consider these in his study.
Philix Mnisi	1. Railway 2. Conservation offset 3. Transport	Transnet	1. Mr Mnisi wanted to know when Glisa mine first went into operation. 2. Mr Mnisi wanted to know how big	1. Exxaro and EIMS informed Mr Mnisi that Glisa was first mined in the 1890s. 2. EIMS informed Mr Mnisi that the

Name	Environmental Aspect	Nature of Interest	Comment	Response
			the study area included in the mining schedule is. 3. Mr Mnisi enquired about the potential for conservation offsets. 4. Mr Mnisi queried the length of time before portion 30 is mined to capacity. 5. Mr Mnisi asked where the coal mined at the proposed Paardeplaats mine would be sent.	entire application area is 1 415 hectares. 3. EIMS explained that sensitive areas such as wetlands were identified within the study area including within the preferred alternative of portion 30. The wetlands within portion 30 would be damaged should this option be approved, therefore it has been recommended in the EIA report that Exxaro offset the damaged wetlands by creating a conservancy on a number of their other properties in the vicinity of portion 30 (the area would be more than the area lost within portion 30). 4. EIMS explained that it would take about 10 years to mine portion 30 to capacity 5. EIMS informed Mr Mnisi that the coal would be for Eskom (power stations) and a small portion exported. KP further mentioned that the proposed Paardeplaats mine will not need a

Name	Environmental Aspect	Nature of Interest	Comment	Response
				processing plant as the plant at Glisa would be utilised.
			6. Mr Mnisi asked what the distance was that would be required to transport the extracted coal from the proposed Paardeplaats to Glisa.	6. EIMS stated that the distance would be very short if the preferred alternative of portion 30 only being mined is approved (portion 30 is adjacent to existing Glisa mine.
			7. Mr Mnisi asked if there would be any impact on the railway line running parallel to the N4 and what the distance between the railway line and the boundary of the study area is.	7. EIMS let Mr Mnisi know that no impact on the railway is expected as the railway line is away from the preferred alternative of portion 30. EIMS confirmed that portion 30 is approximately 800 m from the boundary of the study area where the railway line is located
			8. Mr Mnisi asked in terms of environmental sustainability, what will be impact of the coal supplied to Eskom regarding carbon emissions.	8. EIMS answered that the coal used by Eskom would contribute to the carbon emissions however, nationally there is a great demand and need for electricity (for the economy and people that previously didn't have electricity, etc.) and as much as alternative energy sources exist, coal still the best energy source to provide

Name	Environmental Aspect	Nature of Interest	Comment	Response
				this electricity while no other viable option is available
			9. Mr Mnisi after further perusal of the posters asked about the identified dust pollution impact regarding the new regulations standards.	9. EIMS let Mr Mnisi know that the new regulations have not yet been gazetted but the specialist in question (dust pollution studies) was aware of the new standards and considered this in his assessment and these have been included in the EMP (preconstruction to rehabilitation).
			10. Mr Mnisi then asked if that means there will be monitoring.	10. EIMS confirmed that there is provision for the monitoring of various aspects, as specialists included recommendations for both mitigation and management of impacts as well as their monitoring.
			11. Mr Mnisi asked which dust is being referred to in the impacts poster.	11. EIMS answered that the most of the dust referred to will be dust from construction vehicles (trucks etc.) as the processing will occur at the Glisa mine.
			12. Mr. Mnisi asked if the trucks transporting the coal will cross	12. EIMS told Mr. Mnisi that the existing route utilised by Glisa would be used and that a road and traffic

Name	Environmental Aspect	Nature of Interest	Comment	Response
			the railway line. 13. Mr. Mnisi asked which Eskom power stations will be supplied with the coal from the proposed Paardeplaats mine.	assessment showed that the existing road will handle the added capacity. EIMS further explained that the existing transportation route goes under the railway line and thus won't impact on the line or the town traffic (approximately 6 km of the road near the town at most: about 4 km from portion 30 and another 2 km to Belfast). 13. EIMS answered that the following power station would get the coal: Arnot, Camden, Majuba and Tutuka.

9.5.3 SIGNIFICANT COMMENTS, CONCERNS AND OBJECTIONS RAISED

To date, the majority of I&AP's, including those present at the initial open day, have voiced concerns regarding historical grievances with Glisa over issues such as blasting, noise, dust, vibration and the provision of information by Glisa to I&AP's. These same issues were also raised with regard to the proposed Paardeplaats Coal Mine.

In addition, further comment raised was with regard to land use, land capability surface water run-off management, rehabilitation, wetlands, biodiversity, water quality and socio-economic conditions.

Two formal objections to the proposed project have been recorded. Birdlife SA objects to the proposed development of the Paardeplaats Coal Mine as it falls within the Steenkampsberg Important Bird Area (IBA) and is considered significant in terms of avifauna conservation.

The second objection is from Hadeco. Hadeco's objection to the proposed Paardeplaats Coal Mine is due to the impact that the proposed mining development will have on their cold climate bulb operation, a unique and highly specialised operation. Hadeco's objections have been considered and was critical in the development of the feasible project development alternative namely, Alternative 3 Sensitivity Planning Approach.

Hadeco has also objected to the proposed Alternative 3 on grounds that even such reduced mining activities will negatively affect their operations.

This alternative aims to restrict mining to Portion 30 of the farm Paardeplaats 380 JT so as to not impede and unnecessarily disrupt Hadeco's operations and the community of workers living in its properties.

10 ADEQUACY OF PREDICTIVE METHODS, UNDERLYING ASSUMPTIONS AND UNCERTAINTIES

The assumptions, uncertainties and limitations for the specialist studies have been drawn from the relevant reports as provided by the specialists.

10.1 ENVIRONMENTAL ASSESSMENT LIMITS

The specialist reports did not assess the health and safety of workers as this is assumed to be regulated separately by the Occupational Health and Safety legislation.

10.2 PREDICTIVE MODELS

Predictive models are only as accurate as the data provided, therefore, if the input data becomes inaccurate or inapplicable due to project design changes or alterations to other variables, the predictive models will decrease in accuracy.

10.3 HERITAGE AND CULTURAL RESOURCES

Despite the comprehensive fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover (tree plantations) over some portions of the study area. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must be contacted immediately.

10.4 SOCIO-ECONOMIC ENVIRONMENT

The following assumptions and limitations are relevant:

- Not every individual in the community could be interviewed, therefore only key people in the community were approached for discussion. Additional information was obtained using existing data, records of public meetings and via telephonic and personal interviews.
- The social environment constantly changes and adapts to change, and external factors outside the scope of the project can offset social changes, for example changes in local political leadership. It is therefore difficult to predict all impacts to a high level of accuracy, although care has been taken to identify and address the most likely impacts in the most appropriate way for the current local context within the limitations.
- Social impacts can be felt on an actual or perceptual level, and therefore it is not always straightforward to measure the impacts in a quantitative manner.
- Social impacts commence when the project enters the public domain. Some of these impacts are thus already taking place, irrespective of whether the project continues or not. These impacts are difficult to mitigate and some would require immediate action to minimise the risk.
- There are different groups with different interests in the community, and what one group may experience as a positive social impact, might be experienced as a negative impact

by another group. This duality will be pointed out in the impact assessment phase of the report.

- The mining project being evaluated is economic viable.
- All the economic information provided by a trusted source, Quantec, is as correct as regional economic projections could possibly be.
- This study works mainly with “inferred economic data”, augmented by a local thorough site visit.
- Some macro-economic modelling was undertaken. Economic calculations were done in spread sheets tables and precaution was taken that the best and most recently available information was used.

10.5 ECOLOGY

The following assumptions and limitations are applicable to the floral assessment:

- The Braun-Blanquet approach was developed to collect 95% of the species present within a plot, therefore the more plots surveyed the more comprehensive the species lists will be and the more detailed the vegetation description and mapping will be.
- The following confidence levels are attributed to the species recorded: Families – 95%, Genera – 85% and Species – 75%.
- Available regional land cover information was limited to the latest national dataset from 2000, it is expected that land cover changes occurred since 2000, mainly associated with urbanisation, mining and agriculture.
- For many of the threatened plant species in South Africa no images are available to assist with field identification. Surveys done outside the optimal flowering period (November – March) further limit the probability of identifying these species.
- The survey was completed in March, at the end of the optimal growing season and the effects of the colder environment at the high altitude was visible, with some of the forbs already past their flowering period.
- Due to the unavailability of 1 m contours for the whole study area, the 5 m contours available from the Surveyor – General was used, resulting in the loss of smaller rocky or steep areas. Therefore not all of the rocky or steep sloped areas were surveyed or mapped.

- In the absence of a detailed soil map (1: 10 000 scale), it is basically impossible to map with a high confidence the distribution and extent of the remaining natural grassland communities, because the vegetation reflects the soil conditions.

The following assumptions and limitations are applicable to the faunal assessments:

- In order to obtain a comprehensive understanding of the dynamics of terrestrial communities, as well as the status of endemic, rare or threatened species in any area, faunal assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints such long-term studies are not feasible and more often based on instantaneous sampling bouts.
- It is worth noting that the Belfast area is confined to a high-altitude zone (c. 1 900 m.a.s.l.) that experiences frequent mist-belt and overcast conditions with wind speeds of up to 36.8km/h; www.wunderground.com) and frequent thunderstorms that were not always optimal for invertebrate sampling, especially for butterflies. In general, invertebrate surveys, in particular butterfly surveys, should preferably conform to temperatures of 13-17ºC during sunny conditions (with a minimum of 60% sunshine) or at least 17ºC during both sunny and cloudy conditions (New, 1997).
- The information as presented in this document only has reference to the investigated study area and cannot be applied to any other area. This company, the consultants and/or specialist investigators do not accept any responsibility for conclusions, suggestions, limitations and recommendations made in good faith, based on the information presented to them, obtained from the surveys or requests made to them at the time of this report.
- SARCA and SAFAP provide distribution data at the quarter degree square (QDS) resolution. Expected species lists may therefore represent an overestimation of the diversity expected as very specific habitat types may be required by a species which may be present in a QDS but not necessarily on the study site within the QDS. Conversely, many large areas in South Africa are poorly sampled for herpetofauna and expected species lists may therefore underestimate the species diversity. All possible attempts were made to refine the expected species list based on species-specific habitat requirements and a deeper understanding of the habitat types and quality of the study site which was obtained during the summer survey.
- Damage to equipment by agricultural mammal species, especially cattle, caused losses of a number of Sherman traps.

- Unseasonal dry weather preceded the winter survey, which may affect the overall results. The data gathered from the i-Buttons show that cool rain conditions did set in during the study period which may have a double effect of negatively influencing trap results. As a rule, warm and wet conditions result in a basal layer optimal for foraging and cover from predators. A compromised basal layer can result in reduced animal activity. Furthermore, many mammals generally avoid exposure to low temperatures, as a lot of energy is required to maintain their body temperature (Schmidt-Nielsen, 1995). Due to the fact that small mammals mostly forage at night and the temperatures at night dropped down to as low as 7°C, it is not surprising that nocturnal activity was, for certain more sensitive species, reduced. The strong dependence on moisture of some species (Skinner and Chimimba, 2007) will also result in reduced activity patterns. Therefore many mammal species minimize their activity during colder and drier periods to optimize energy expenditure and avoid exposure and dehydration and these ecological patterns must be noted in the overall results.

10.6 WETLANDS AND AQUATIC ECOLOGY

Despite a comprehensive field assessment it is important to note that reference conditions are unknown and this limits the confidence with which the present ecological category has been assigned. In terms of aquatic ecosystems, these systems can vary both temporally and spatially and once-off surveys such as this are therefore likely to miss substantial ecological information, thus limiting accuracy, detail and confidence of the assessment.

10.7 SURFACE WATER

The key constraints at this point include:

- Insufficient DEM data to accurately calculate flood lines;
- ABA accounting results to conduct hydrochemical modelling;
- Detailed mining plans and site infrastructure; and
- Limited flow gauge information.

10.8 GROUND WATER

The following conditions typically need to be described in a model:

- Geological and hydrogeological features;
- Boundary conditions of the study area (based on the geology and hydrogeology);

- Initial water levels of the study area;
- The processes governing groundwater flow; and
- Assumptions for the selection of the most appropriate numerical code.

Field data is essential in solving the conditions listed above and developing the numerical model into a site-specific groundwater model. Specific assumptions related to the available field data include:

- The top of the aquifer is represented by the generated groundwater heads.
- The available geological/ hydrogeological information was used to describe the different aquifers. The available information on the geology and field tests are considered as correct.
- Many aquifer parameters have not been determined in the field and therefore have to be estimated.

In order to develop a model of an aquifer system, certain assumptions have to be made. The following assumptions were made:

- The system is initially in equilibrium and therefore in steady state, even though natural conditions have been disturbed.
- No abstraction boreholes were included in the initial model; however they may be included in some of the scenarios.
- The boundary conditions assigned to the model are considered correct.
- The impacts of other activities (adjacent mines and agriculture) have not been taken into account.
- No information was available concerning the hydraulic parameters/characteristics of the wetlands. Only wetland delineations were available. The hydraulic characteristics / parameters were therefore assumed. It is therefore assumed that there is a clay layer underlying the wetlands with a hydraulic conductivity of 1 x 10-5m/d.

It is important to note that a numerical groundwater model is a representation of the real system. It is therefore at most an approximation, and the level of accuracy depends on the quality of the data that is available. This implies that there are always errors associated with groundwater models due to uncertainty in the data and the capability of numerical methods to describe natural physical processes.

10.9 AIR QUALITY

The following assumptions and limitations are applicable to this assessment:

- MM5 modelled meteorological data was used in the dispersion modelling.
- No measured dust fall-out levels were made available at the time of the study.
- The dispersion model cannot compute real-time mining and production processes, and average through-puts were therefore used.
- Accurate dust-fall predictions rely on accurate site specific particle size distributions. Particle size distributions used in calculations were based on analyses of South African collieries. A particle size distribution was selected from these that would result in the highest fallout rates and was assumed to represent the most conservative estimate.
- The locations of proposed activities were assumed and could influence the dispersion model outcomes, especially when these activities are located near the mine boundary.

10.10 NOISE

As the detailed sound power levels of the plant and equipment were not available, the anticipated noise profile was calculated from data at similar type equipment. Although not all of the details of the planned surface workings and related infrastructure layouts have been finalised, where this is the case, general concepts have been used in the noise impact evaluation and these are adequate to provide a sound basis for the analysis of typical noise conditions and impacts that are likely to prevail on the project. Data related to construction have been sourced from various consultants and contractors, British Standard BS 5228 and the experience that JKA has had working on similar sites.

10.11 BLASTING AND VIBRATION

Considering the stage of the project, the data observed was sufficient to conduct an initial study. Surface surroundings change continuously and this should be taken into account prior to any final design and review of this report. This report is based on data provided and international accepted methods and methodology used for calculations and predictions.

10.12 VISUAL

At this stage of the project it is still unsure whether people that are located on site or bordering the site will be relocated or whether they will stay on the proposed properties. It will therefore be assumed that these residents will stay on site and will therefore be sensitive receptors.

Concurrent rehabilitation will take place during the mining process and it is assumed that the overburden dumps will be used during the rehabilitation process.

11 DESCRIPTION & ARRANGEMENT FOR MONITORING AND MANAGEMENT OF ENVIRONMENTAL IMPACTS

This section describes the arrangements for monitoring and management of the environmental impacts identified in Section 7. Furthermore, this section serves to outline the functional requirements, roles and responsibilities and monitoring timeframes. Additional considerations for planned monitoring, as identified by specialists, are included in Section 22.

11.1 LIST OF IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Impacts to the receiving environment that require on-going environmental monitoring include the following:

- Air quality ;
- Blasting and vibration;
- Biodiversity;
- Groundwater;
- Surface water;
- Noise;
- Rehabilitation; and
- Wetlands and aquatic ecology

As mines and the environment are both dynamic it is likely that future scenarios may require the monitoring of additional or unforeseen impacts. As such, the list provided is by no means conclusive and must instead be used as a guideline for the impacts that require monitoring

11.2 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES

The purpose of monitoring is not merely to collect data, but to provide information necessary to make informed decisions on managing and mitigating potential impacts. Monitoring therefore serves the following functions;

- Serve as early warning system to detect any potential negative impacts;

- To provide information to feedback into management controls to avoid, prevent or minimise potential negative impacts;
- Provide quantitative data that can serve as evidence for the presence of negative impacts or the lack thereof; and
- Allows for trending, modelling and prediction of future conditions or potential impacts

Based on the above, the applicant must ensure that monitoring programmes comprise of the following (at a minimum) in order to obtain valuable environmental data:

- Environmental aspect monitoring must be a formalised procedure;
- All equipment used in monitoring must be correctly calibrated and serviced regularly;
- Samples required for analysis will be sent to an independent and accredited laboratory;
- Monitoring data must be stored;
- Data must be checked and interpreted and tending undertaken on a quarterly basis;
- Both the date and reports on environmental monitoring must be kept on record for the life of mine and where relevant provided to I&AP's; and
- The general and site specific parameters to be monitored must be identified by an independent specialist, the authorities and where relevant I&AP's.

As a result of the studies undertaken, each contributing project specialist has (where relevant) provided considerations and further guidelines for the establishment of monitoring programmes. These considerations and guidelines are detailed in Section 22.

11.3 MONITORING ROLES AND RESPONSIBILITIES

The role and responsibility of implementing and executing environmental monitoring is allocated to the Mine Environmental Manager. The Mine Environmental Manager must ensure the following:

- Identify and appoint appropriately qualified individuals to develop, design and establish monitoring programmes;
- Ensure that monitoring programmes are scoped correctly and implemented prior to construction (unless advised differently by a specialist) ;
- Make provision for any changes or new monitoring requirements in both existing and new environmental monitoring programmes; and
- Ensure that adequate budget is set aside for environmental monitoring.

It is important to note that in addition to the roles and responsibilities of the Environmental Manager, the details of environmental monitoring must routine be communicated to the mine manager and operations staff.

11.4 TIMEFRAMES FOR MONITORING AND REPORTING

The timeframe for monitoring and reporting on the result of environmental monitoring are provided below. It is important to note that these are broad timeframes and require refinement by specialist responsible for design of the monitoring programmes.

Table 80: Timeframes for monitoring and reporting

Impact	Timeframe & Frequency	Reporting Frequency
Air quality	All project phases As per specialist advice	Monthly
Blasting and vibration	Each blast As required by sensitive I&AP's	Monthly
Biodiversity	All project phases As per specialist advice	Monthly
Groundwater	All project phases As per specialist advice	Monthly
Surface water	All project phases As per specialist advice	Monthly
Noise	All project phases As per specialist advice As required by sensitive I&AP's	As required
Rehabilitation	Operational phase Decommissioning phase Closure and rehabilitation phase	Monthly
Wetlands and ecology	All project phases	Monthly

12 TECHNICAL SUPPORTING INFORMATION

The following specialist studies were undertaken as part of the EIA and have been considered/incorporated in the compilation of this EMPR:

- Impact Tables (Appendix A);
- Air Quality (Appendix B);

- Aquatic Ecology (Appendix C);
- Blasting and Vibration (Appendix D);
- Ecology (Appendix E);
- Economic (Appendix F);
- Heritage (Appendix G);
- Hydrology (Appendix H);
- Noise (Appendix I);
- Closure, Rehabilitation and Final Land Use (Appendix J);
- Sensitive Receptors (Appendix K);
- Social (Appendix L);
- Soils, Land Use and Land Capability (Appendix M);
- Traffic (Appendix N);
- Visual (Appendix O);
- Wetlands (Appendix P);
- Closure Costing (Appendix Q); and
- Public Participation (Appendix R).

SECTION 2: ENVIRONMENTAL MANAGEMENT PROGRAMME

13 ENVIRONMENTAL MANAGEMENT PRINCIPLES

NEMA establishes a general framework for environmental law, in part by prescribing national environmental management principles that must be applied when making decisions that may have a significant impact on the environment. These principles are briefly summarised below:

13.1 HOLISTIC PRINCIPLE

The Holistic principle, as defined by NEMA (Section 2(4)(b) requires that environmental management must be integrated, acknowledging that all elements of the environment are linked and inter-related and it must take into account the effect of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option (defined below). Holistic evaluation does not mean that a project must be looked at as a whole. It rather means that it must be accepted that there is a whole into which a project introduced. If the indications are that the project could have major adverse effects, the project must be reconsidered and where appropriate re-planned or relocated to avoid an adverse impact or to ensure a beneficial impact.

13.2 BEST PRACTICABLE ENVIRONMENTAL OPTION

When it is necessary to undertake any action with environmental impacts, the different options that could be considered for the purpose must be identified and defined. The Best Practicable Environmental Option (BPEO) is defined in NEMA as “the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.” Other guidelines typically used for environmental management in terms of other legislation include: BPM which is the Best Practicable Means and BAT which is the Best Available Technology.

13.3 SUSTAINABLE DEVELOPMENT

The concept of sustainable development was introduced in the 1980’s with the aim to ensure that the use of natural resources is such that our present needs are provided without compromising the ability of future generations to meet their own needs. The constitution of South Africa is built around the fact that everyone has the right to have the environment protected through reasonable legislative and other measures that secure ecologically sustainable development. The National

Environmental Principles included in the NEMA require development to be socially, environmentally and economically sustainable

13.4 PREVENTATIVE PRINCIPLES

The preventative principle is fundamental to sustainable development and requires that the disturbance to ecosystems and the pollution, degradation of the environment and negative impacts on the environment be avoided, or, where they cannot be altogether avoided, are minimised and remedied

13.5 THE PRECAUTIONARY PRINCIPLES

The precautionary principle requires that where there is uncertainty, based on available information, that an impact will be harmful to the environment, it is assumed, as a matter of precaution, that said impact will be harmful to the environment until such time that it can be proven otherwise. The precautionary principle requires that decisions by the private sector, governments, institutions and individuals need to allow for and recognise conditions of uncertainty, particularly with respect to the possible environmental consequences of those decisions. In South Africa, the DWA (then DWAF) adopted a BPEO guideline in 1991 for water quality management and in 1994 in the Minimum Requirements document for waste management.

In terms of DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, the precautionary principle is defined as, “Where a risk is unknown; the assumption of the worst case situation and the making of provision for such a situation.” Here the precautionary principle assumes that a waste or an identified contaminant of a waste is “both highly hazardous and toxic until proven otherwise.”

In the context of the EIA process in South Africa, the precautionary principle also translates to a requirement to provide sound, scientifically based, information that is sufficient to provide the decision making authority with reasonable grounds to understand the potential impacts on the environment, the extent thereof and how impacts could be mitigated. If such information is not adequate for this purpose, the relevant authority cannot be satisfied as is required and then the authority should require that further information be collected and provided.

13.6 DUTY OF CARE AND CRADLE TO GRAVE PRINCIPLE

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

By way of example, the principle of "duty of care" in terms of waste management emphasises the responsibility to make sure that waste is correctly stored and correctly transported, as it passes through the chain of custody to final point of disposal. This means that waste must always be stored safely and securely. The company removing and disposing of waste also holds the responsibility to hold the relevant licenses, and that waste is transported alongside the necessary paperwork.

"Cradle to Grave" refers to the responsibility a company takes for the entire life cycle of a product, service or program, from design to disposal or termination. In terms of the DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, "any person who generates, transports, treats or disposes of waste must ensure that there is no unauthorised transfer or escape of waste from his control. Such a person must retain documentation describing both the waste and any related transactions. In this way, he retains responsibility for the waste generated or handled." This places responsibility for a waste on the Generator, and is supported by the "Cradle to Grave" principle, according to which a "manifest" accompanies each load of Hazardous Waste until it is responsibly and legally disposed. This manifest is transferred from one transporter to the next along with the load, should more than one transporter be involved. Once the waste is properly disposed of at a suitable, permitted facility, a copy of the manifest must be returned to the point of origin." Duty of Care offers one strategy to implement sustainable development.

13.7 POLLUTER PAYS PRINCIPLE

The "polluter pays principle" holds that the person or organisation causing pollution is liable for any costs involved in cleaning it up or rehabilitating its effects. It is noted that the polluter will not always necessarily be the generator, as it is possible for responsibility for the safe handling, treatment or disposal of waste to pass from one competent contracting party to another. The polluter may therefore not be the generator, but could be a disposal site operator or a transporter. Through the 'duty of care' principle, however, the generator will always be one of the parties held accountable for the pollution caused by the waste. Accordingly, the generator must be able to prove that the transferral of management of the waste was a responsible action. The polluter pays principle acceding to NEMA dictates that "the cost of remedying pollution, environmental degradation and consequent adverse effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment."

14 DUTY OF CARE RESPONSIBILITIES

Training and awareness should be fostered in all staff working to ensure that they can perform their duties. Failure to comply with the provisions in the EMPR and NEMA would be a contravention of the Act. The relevant sections of NEMA are provided below, to outline the duty of care and responsibility that the applicant and all employees have to towards the environment. The National Environmental Management Act (Act 107 of 1998) (NEMA) Section 28: makes provision for Duty of care and remediation of environmental damage. The binding principals are described below:

1. Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.
2. Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-
   a) any activity or process is or was performed or undertaken; or
   b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.
3. The measures required in terms of subsection (1) may include measures to-
   a) investigate, assess and evaluate the impact on the environment;
   b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
   c) cease, modify or control any act, activity or process causing the pollution or degradation;
   d) contain or prevent the movement of pollutants or the cause of degradation;
   e) eliminate any source of the pollution or degradation; or
   f) remedy the effects of the pollution or degradation.
4. No person may-
   a) unlawfully and intentionally or negligently commit any act or omission which causes significant or is likely to cause significant pollution or degradation of the environment;
   b) unlawfully and intentionally or negligently commit any act or omission which detrimentally affects or is likely to affect the environment in such manner; or
   c) refuse to comply with a directive issued under this section.

Any person who contravenes or fails to comply with subsection (14) is guilty of an offence and liable on conviction to a fine not exceeding R1million or to imprisonment for a period not exceeding 1 year or to both such a fine and such imprisonment.

15 FAILURE TO COMPLY WITH ENVIRONMENTAL CONSIDERATIONS

Within the provisions of the relevant environmental legislation, there are a number of penalties for non-compliance or offences. Below a few extracts are presented for information purposes, however these must not be read in isolation and the reader is reminded that there are other acts that may be applicable to the relevant project:

- NEMA Section 24F(2): It is an offence for any person to fail to comply with or to contravene the conditions applicable to any environmental authorization granted for that listed activity. 24F(4) A person convicted for an offence under subsection 2 is liable to a fine not exceeding 5 million rand or to imprisonment not exceeding 10 years or to both such a fine and imprisonment;
- NEMA Section 34(6): Whenever any manager, agent or employee does or omits to do an act which it had been his or her task to do, or to refrain from doing on behalf of the employer and which would be an offence under any provision listed in Schedule 3 (relates to all environmental related acts) for the employer to do or omit to do, he or she shall be liable to be convicted and sentenced in respect thereof as if he or she were the employer;
- NWA Section 151 (1): “No person may fail to comply with any condition attached to a permitted water use (Water Use License)”;
- NWA Section 151 (2): “Any person who contravenes any provision of subsection 1 is guilty of an offence and liable, on the first conviction, to a fine or imprisonment for a period not exceeding 5 years or to both a fine and such imprisonment (10 years for second conviction)”;
- In addition, if anyone is convicted of an offence under the act which has resulted in harm, loss or damage to any other person, the court may award damages to be paid by the accused or convicted;
- NWA Section 154: Makes provision that it’s not only the applicant that may be liable but also an employee or agent acting on their behalf;
- In terms of the MPRDA, Section 98, any person is guilty of an offence if he or she fails to comply with the requirements of the issued mining permit; and

- MPRDA Section 99 (1a): any person convicted of an offence in terms of the MPRDA is liable to a fine not exceeding R100, 000 or to imprisonment to a period not exceeding 2 years or to both such fine and imprisonment.

It is recommended that a procedure for non-compliances (i.e. incentives or disincentives for conformance and non-conformance with the EMP requirements) must be employed to ensure that the EMP is adequately implemented. The system to be used must be determined before mining commences, included in the tender documents and contracts, and made clear to all project workers. The system may include that the independent ECO can be authorized to impose spot fines on the Contractor and/or his subcontractors for any of the transgressions detailed below:

- Littering on site;
- Lighting of illegal fires on site;
- Persistent or un-repaired oil leaks;
- Any persons, vehicles or equipment related to the Contractor's operations found within the designated "no – go" areas;
- Any vehicles being driven in excess of designated speed limits;
- Removal and/or damage to fauna, flora or heritage objects on site; and
- Legal contraventions.

Such fines should be issued in addition to any remedial costs incurred as a result of non-compliance with the Environmental Specifications and or legal obligations.

16 ROLES AND RESPONSIBILITIES

The applicant will be responsible for ensuring overall compliance with the provisions of the EMPR. Implementation is the key to the success of the EMPR and arguably one of the most difficult components to achieve. In order to ensure that the EMPR and its mitigation measures are implemented, roles and responsibilities need to be clearly defined and documented prior to commencement. This section serves as a guide on which party is normally responsible for certain tasks. Specific roles are designated in the specific environmental management and mitigation requirements in this EMPR. The table below serves as a guide on which party is normally responsible for certain tasks.

16.1 THE PROJECT PROPONENT

The contractor is usually a third party appointed by the applicant to undertake the actual construction of the project. The principal contractor, any other contractors and sub-contractors will be required to comply with the provisions contained herein, and accordingly, the EMPR and its provisions must form part of any contractual arrangements between the applicant and contractors. The contractor must comply with EMPR during construction and ensure that all his employees and sub-contractors appointed by him are familiar with the EMPR. The legal accountability for correct implementation of the relevant requirements of the EA and EMPR must be contractually bound to the appointed contractor. The contractor's role includes:

- Provide all necessary supervision during the execution of the project. He/ She should be available on site all the time;
- Appoint a suitably qualified, competent Mine EO that will be responsible for among others, ensuring daily compliance with the EMPR and EA throughout the construction and operation of the facility;
- Appoint a suitably qualified, competent Environmental Control Officer (ECO);
- Notify DMR of changes in the Mine resulting in significant environmental impacts;
- Assess the Contractors environmental performance during mining in consultation with the Environmental Control Officer (ECO);
- Ensure compliance with regulations;
- To implement the projects as per the approved project plan;
- To ensure that implementation is conducted in an environmentally acceptable manner;
- To fulfill all obligations as per the agreed contract;
- To comply with special conditions as stipulated by surrounding Landowners during the negotiation process (if any); and
- To inform and educate all employees about the environmental risks associated with the different activities that should be avoided during the construction process and lessen significant impacts to the environment.

Therefore, ultimately, the Applicant is responsible for the development and implementation of the EMP and, where relevant, ensuring that the conditions in the authorisation are satisfied. Where mining activities are contracted out (e.g. to Contractors and Subcontractors), the liability associated with non-compliance still rests with the Applicant (unless otherwise agreed upon between the authorities, the Applicant and the contracting parties). The Applicant (and not the

Contractor) is therefore responsible for liaising directly with the relevant authorities with respect to the preparation and implementation of the EMPR and meeting authorisation conditions.

The Applicant together with the ECO shall identify and comply with all relevant national, provincial and local legislation, including associated regulations and bylaws and shall establish and maintain procedures to keep track of, document and ensure compliance with environmental legislative changes. All project activities must adhere to and comply with all South African legislation and regulations and this requirement must also be included in the Contractors'/Applicant conditions. Should there be changes in legislation and/or regulations then action will be taken to incorporate such changes and to pass these requirements on to the Contractors.

16.2 THE MINE MANAGER

The Mine Manager is the individual responsible for the overall implementation of the project in respect of time, cost and legal provisions. This role is usually fulfilled by the applicant but may be designated to another third party (e.g. contractor, project engineer, etc.). The roles of the Mine Manager typically include the following:

- The Mine Manager acts on behalf of the Applicant regarding the administration of contracts;
- In consultation with the system Planning Engineer, determines the scope of work;
- Provides scheduling, aspects of co-ordination and estimating;
- Ensures implementation of the project plan within cost, time and quality constraints;
- Ensures that implementation of EMPR is executed as planned;
- Keeps the asset owner informed of progress made during the life cycle of the project; and
- Ensure that all pre-commencement conditions in the EMPR/EA are fulfilled before the Contractor occupies the site.

16.3 THE MINE ENVIRONMENTAL CONTROL OFFICER

The ECO is appointed by the Applicant and should preferably be independent from the Applicant and the Contractor. The ECO should have appropriate training and experience in the implementation of environmental management specifications. The ECO must preferably have a tertiary qualification in an Environmental Management or appropriate field. The ECO provides feedback to the Project Manager regarding all environmental matters. The ECO is responsible for communicating environmental issues associated with the site to the Mine Manager. Contractors are answerable to the ECO (or Mine Manager, depending on contractual arrangements) for non-compliance with the requirements stated in the EMP. For the purposes of implementing the conditions contained herein, the Applicant should appoint the ECO well before (at least 2 weeks) the start of any work. The ECO is responsible for compliance monitoring, and auditing function as well as the explanation of environmental issues contained in this EMP to anyone working on the site.

The ECO roles include:

- Maintenance, update and review of the EMP;
- Liaison between the Applicant, Contractors, authorities and other lead stakeholders on all environmental concerns;
- Conveying the contents of the EMP, the conditions of the EA conditions to the Contractor site staff and discuss the contents in detail with Mine Manager and Contractor at a pre-construction meeting. This formal induction training shall be done with all main and sub-contractors. Record of the training date, meeting attendees and discussion points shall be kept by the ECO;
- Conducting a pre-construction survey of the site prior to construction (see section 21.1 (No 4));
- Review the site induction training to ensure environmental issues receive adequate attention and important site specific issues are included;
- The Applicant shall ensure that contact numbers of the ECO and Mine EO are made available to Landowners prior to commencement of construction, and landowners shall be notified of any changes in these contact details;
- Conduct environmental audits of the site and relevant documentation. The Audit frequency shall be every two weeks during construction and Monthly during operational phase;
- Validating the regular site inspection reports, which are to be prepared by the Mine EO;
- Maintain a record all Non Conformances and action plans to ensure that measures are put in place to remedy possible effect;
- Compilation and administration of an environmental monitoring plan to ensure that the environmental management measures are implemented and are effective; and

Ensure that all environmental monitoring programmes (sampling, measuring, recording etc. when specified) are carried out according to protocols and schedules

16.4 THE MINE ENVIRONMENTAL OFFICER

The Applicant shall appoint an Environmental Officer (EO) who is a suitably qualified individual (and preferably be a senior member of staff) that will be responsible to oversee day to day compliance with the EMPR and ensure its correct implementation throughout the construction and operation of the facility. The Mine EO will also be responsible for correct implementation of other environmental commitments such as compliance with the EA, Permits, licenses and other relevant environmental procedures and documentation (e.g. method statements and monitoring programs). The Mine EO is responsible for adequate environmental training of staff and employees throughout the operation of the facility.

The Mine EO roles will include:

- Preparing activity based Environmental Method Statements where required (Operational Phase);
- Regular inspections of the work area(s);
- Monitoring compliance with the EMP and approved Environmental Method Statements/Management Plans on an ongoing basis throughout the project;
- Auditing of the Contractors environmental performance and documentation during the construction phase;
- Complete Site Inspection Forms on a regular basis (weekly) throughout the project;
- Issuing of site instructions to the Contractor for corrective actions required;
- Ongoing environmental awareness training of the site personnel throughout the Operational phase;
- Maintain a record of environmental incidents (spills, impacts, injuries, complaints, legal transgressions etc.) as well as corrective and preventive actions taken, for submission to the Mine Manager and ECO;
- Maintain a public complaints register in which all complaints are recorded, as well as action taken, for submission to the Mine Manager and ECO. The complaints register should also be submitted to DMR on an annual basis;
- Ensure required corrective actions are taken within specified time frame in respect of non-conformances and environmental incidents;
- Attendance at all SHE meetings, toolbox talks and awareness training programmes;
- Waste Management; and

- Ensuring that environmental signage and barriers are correctly placed and maintained.

16.5 THE CONTRACTOR

The contractor is usually a third party appointed by the applicant to undertake the actual construction of the project. The Contractor is answerable to the Mine Manager and ECO for all environmental issues associated with the project. Contractor performance will, amongst others, be assessed on health, safety and environmental management criteria. The principal contractor, any other contractors and sub-contractors will be required to comply with the provisions contained herein, and accordingly, the EMP and its provisions must form part of any contractual arrangements between the applicant and contractors. The contractor must comply with EMP during construction and ensure that all his employees and sub-contractors appointed by him are familiar with the EMP. The legal accountability for correct implementation of the relevant requirements of the EA and EMPR must be contractually bound to the appointed contractor.

The Contractors role includes:

- Provide all necessary supervision during the execution of the project. He/ She should be available on site all the time;
- Appoint a suitably qualified, competent Environmental Officer (EO) that will be responsible for among others, ensuring daily compliance with the EMPR, EA during the construction phase;
- To implement the projects as per the approved project plan;
- To ensure that implementation is conducted in an environmentally acceptable manner;
- To fulfill all obligations as per the agreed contract;
- To comply with special conditions as stipulated by surrounding Landowners during the negotiation process (if any); and

Ensure that the Contractors staff and employees have received the appropriate environmental awareness training prior to commencing construction

16.6 THE CONTRACTORS ENVIRONMENTAL OFFICER

Each contractor affected by the EMP shall appoint an Environmental Officer (EO), who is responsible for the on-site implementation of the EMPR. The Contractor must ensure that the Contractor's EO is suitably qualified and competent to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, labourers, the ECO and the public. The Contractor's EO ensures that all Sub contractors working under the Contractor abide by the requirements of the EMPR. The costs related to the implementation of the EMPR will be the responsibility of the Contractor.

The Contractor's EO roles will include:

- Preparing activity based Environmental Method Statements where required (Construction Phase);
- Review the contractors safe work procedures/risk assessments/DSTI's (daily safe task instruction) during the construction phase and include information relating to the relevant environmental risks and appropriate mitigation measures;
- Support the Mine EO and ECO in monitoring by maintaining a permanent presence on site;
- Taking required corrective action within specified time frame in respect of non-conformances and environmental incidents;
- Assist in finding environmentally acceptable solutions to construction problems;
- Attendance at all SHE meetings, toolbox talks and induction programmes;
- Inspect the site as required to ensure adherence to the management actions of the EMP on a daily basis;
- Complete a Site Inspection Checklist on a daily basis;
- Report any complaints to the Mine EO to be captured in the complaints register;
- Provide inputs to the regular environment reports to be prepared by the Mine EO and ECO;
- Liaise with the construction team on issues related to implementation of, and compliance with the EMP;
- Waste Management; and
- Ensuring that environmental signage and barriers are correctly placed and maintained.

16.7 THE AUTHORITIES

The authorities that should be involved are the Gauteng Department of Mineral Resources, the Gauteng Department of Agriculture, Conservation and Environment (GDACE), and the Department of Water Affairs (DWA). The authorities may be required to perform the following roles:

- Participate in a meeting(s) with the Applicant at the start of the EMP process in order to reach agreement on the approach to the EMP;
- Review the EMP submission;
- Review Monitoring and Audit reports, if required;
- Review whether there is compliance by the Applicant and Contractor with the terms of the EMPR and permit/license conditions. Whenever necessary, the authorities should assist the Applicant in understanding and meeting the specified requirements; and
- The authorities may perform random controls to check compliance. In case of persistent non-compliance, the Applicant will be required to provide an action plan with corrective measures and have it approved by the authorities.

17 AUDITING AND REPORTING PROCEDURES

Reporting procedures must be developed at the start of the project, for conveying information from the compliance monitoring activities and to ensure that management is able to take rapid corrective action should certain thresholds be exceeded. Different reporting procedures may include:

- Inspections;
- Accidents and emergencies;
- Measuring performance indicators and interpreting and acting on the indicators;
- Records of monitoring activities to test the effectiveness of mitigation measures and impact controls, as well as for compliance auditing purposes; and
- Training programmes and evidence of appropriate levels/amount of skills/capacities created.

All monitoring and auditing must be accompanied by applicable records and evidence (e.g. delivery slips, photographic records, etc.). All reports must be retained and made available for inspection by the ECO, the Applicant and /or the Relevant Competent Authorities. All reports shall be signed by the relevant parties to ensure accountability. The applicant must use the audit report findings to continually ensure that environmental protection measures are working effectively on site through a system of self-checking. The EMP should be viewed as a dynamic document aimed at continual environmental performance improvement.

17.1 CONSTRUCTION PHASE

The following auditing and reporting shall be required throughout the construction phase:

- Weekly Compliance Reports: These reports must be prepared by the designated Mine EO and must aim to monitor and report of on compliance with the EA and EMPR as well as general environmental performance;
- Daily Environmental Checklists: These reports must be prepared by the contractors EO and must aim to monitor and report on day to day activities so as to ensure compliance with environmental method statements, the EMP, EA and general environmental performance;
- The Contractor's EO must review all safe work procedures/risk assessments/DSTI's (daily safe task instruction) from the safety department and include the relevant environmental risks and appropriate mitigation measures. Since the above procedures are specific to the applicable activity being undertaken, the inclusion of environmental measures aims to ensure each activity is undertaken in an environmentally responsible manner;
- Bi-Monthly Compliance Audits: These audits must be undertaken by the ECO and must aim to monitor and report on compliance with the requirements of the EA and EMP, and general environmental performance; and
- Monthly Audit Reports: The ECO must compile Monthly EMP compliance reports (audits) which are to be submitted to the applicant for his review and correction of non-compliance issues. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified.

17.2 OPERATIONAL PHASE

The following auditing and reporting shall be required throughout the construction phase;

- Monthly Compliance Audits: These audits must be undertaken by the ECO and must aim to monitor and report on compliance with the requirements of the EA and EMP, and general environmental performance; and
- Monthly Audit Reports: The ECO must compile Monthly EMP compliance reports (audits) which are to be submitted to the applicant for his review and correction of non-compliance issues. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified.

17.3 RESPONDING TO NON COMPLIANCES

Non-compliance will be identified and managed through the following four key activities including;

- **Inspections** of the site and activities across the site;
- **Monitoring** of selected environmental quality variables;
- **Audits** of the site and relevant documentation as well as specific activities;
- **Reporting** on a monthly basis.

An environmental non-conformance and incident register must be prepared and maintained by the ECO throughout construction and operation in order to monitor environmental concerns, incidents, and non-conformances. The register must include details of date, location, NC or Incident EMP aspect, corrective action taken, adequacy of corrective action, date rectified, etc. (refer to Table 81 below).

Table 81: Non-conformance Register template

NON-CONFORMANCE REGISTER	
DETAILS OF NON-CONFORMANCE / INCIDENT	**CORRECTIVE ACTION**
Reference Number	Suggested Corrective Action
NC / Incident	Actual Corrective Action Taken
Date of Occurrence	Suggested Due Date
Environmental Aspect type:	Corrective Action Status (Pending / Complete / Overdue)
Time	Actual Date Corrected
Responsible Contractor	Date Closed
Location Reference number	Transgression Status (Open / Closed)
GPS Coordinate (Lat/Long)	Response Time of Corrective Action (On Time / Late)
Description of NC/Incident	
Photographic Reference	
EMP Reference	

Cause of the NC/Incident	

Non-compliance with the EMP or any other environmental legislation, specifications or standards shall be recorded by the ECO in the non-conformance register. This register shall be maintained by the ECO and will be sent to the Applicant and Contractor on a regular basis (Monthly), and the Applicant shall ensure that the responsible party takes the necessary corrective actions. Non-conformances may only be closed out in the register by the ECO upon confirmation that adequate corrective action has been taken. The register should be utilised to measure overall environmental performance.

17.4 ENVIRONMENTAL INCIDENCES

For the purposes of this project, an environmental incident can be divided into three levels, i.e. major, medium and minor. All Major and Medium environmental incidents shall be recorded in the ECO's non-conformance and incident register. Minor incidents shall be recorded by the contractor (construction phase), and by the Applicant (operational phase) in their own incident register. Definitions and examples of environmental incidents are provided in Table 82 below;

Table 82: Description of incidents and non-conformances for the purpose of the project

Non-Conformance	Any deviation from work standards, practices, procedures, regulations, management system performance etc. that could either directly or indirectly lead to injury or illness, property damage, damage to the workplace environment, or a combination of these.
Major Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread, long-term, irreversible significant negative impact on the environment and/or has a high risk of legal liability. A major environmental incident usually results in a significant pollution and may entail risk of public danger. Major environmental incidents usually remain an irreversible impact even with the involvement of long-term external intervention i.e. expertise, best available technology, remedial actions, excessive financial cost etc. Major environmental incidents may be required to be reported to the authorities. The ECO shall make the final decision as to whether a particular incident should be classified as a Major incident. An example of a Major environmental incident would be a significant spillage (e.g. 500 litres) of fuel into a watercourse.
Medium Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread or localised, short term, reversible significant negative impact on the environment and/or has a risk of legal liability. A medium environmental incident may be reported to the authorities,

	can result in significant pollution or may entail risk of public danger. The impact of medium environmental incidents should be reversible within a short to medium term with or without intervention. The ECO shall make the final decision as to whether a particular incident should be classified as a Medium incident. An example of a Medium environmental incident would be a large spill of fuel (e.g. 20 – 50 litres) onto land.
Minor Environmental Incident	An incident or sequel of incidents, whether immediate or delayed, where the environmental impact is negligible immediately after occurrence and/or once-off intervention on the day of occurrence. An incident where there is unnecessary wastage of a natural resource is also classified as a minor environmental incident. An example would be leaking water pipes that result in the wastage of water. A minor environmental incident is not reportable to authorities. An example of a minor incident is day to day spills of fuel or oil onto the ground where the spill is less than one or two litres.

The following incident reporting procedures shall apply to this project:

- **All** environmental incidents shall be reported to Contractor's EO and Mine EO and shall be recorded in their respective incident registers;
- All medium and Major environmental incidents shall also be reported to the ECO by the Mine EO. The ECO shall record the incident in the ECO's non-conformance and incident register and advise on the appropriate measures and timeframes for corrective action;
- An incident report shall be completed by party responsible for the incident for all medium and major incidents and the report shall be submitted to the Mine Manager and ECO within 5 calendar days of the incident;
- The ECO shall investigate all medium and minor incidents and identify any required actions to prevent a recurrence of such incidents;
- In the event of an emergency incident (unexpected sudden occurrence), including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the Applicant shall notify the relevant authorities in accordance with Section 30(3) of the National Environmental Management Act (Act 107 of 1998). The ECO shall assess all medium and major incidents and shall advise the Applicant when any such incident must be reported to the authorities as per the above requirement.

18 REVIEW AND REVISION OF THE EMPR

It is important to note that this EMPR is made legally binding as a result of the requirement to comply with the EMPR, as specified in the MPRDA. In accordance with Section 102 of the MPRDA, no EMPR may be amended or varied without the written consent of the minister. It is however also important to consider that the EMPR is a dynamic document which may require such alteration and /or amendment as the project evolves. Conditions under which the EMP would require revision include:

- changes in legislation;
- occurrence of unanticipated impacts or impacts of greater intensity, extent and significance than predicted;
- inadequate mitigation measures (i.e. where environmental performance does not meet the required level despite the implementation of the mitigation measure); and
- Secondary impacts occur as a result of the mitigation measures.

The ECO should be responsible for ensuring that the registration and updating of all relevant EMP documentation is carried out. It shall be the responsibility of the Applicant/Mine Manager to ensure that all personnel are performing according to the requirements of this procedure and to initiate the revision of controlled documents, when required by changes in process or operations and shall notify the ECO of such changes. Clear procedures must be specified at the beginning of the project for making changes to EMP documents, circulating updated documents, and destroying obsolete versions. Documents must be revised as required by changing circumstances. Distribution lists and document change control sheets must be kept for all documents.

It is recommended that a risk assessment protocol must be developed and implemented by the ECO which shall be utilised to evaluate the environmental risk associated with the potential proposed alterations and/or amendments. The results of the risk assessment must then be included in the submission to the DMR for the section 102 process. **Only on written approval from the competent authority may such changes be effected.**

Further to the above, the applicant shall conduct performance assessments of the EMPR (in accordance with the general conditions of the mining right/permit – MPRDA Regulation 55) in order to ensure compliance and assess the continued appropriateness and adequacy of the EMPR. Again it is important to note that if alterations and/or amendments are required, these may only be effected with written approval from the competent authority.

19 ENVIRONMENTAL AWARENESS PLAN AND TRAINING

Training and environmental awareness is an integral part of a complete EMPR. The overall aim of the training will be to ensure that all site staff are informed of their relevant requirements and obligations pertaining to the protection of the environment and the EMPR and EA.

The applicant and contractor must ensure that all relevant employees are trained and capable of carrying out their duties in an environmentally responsible and compliant manner, and are capable of complying with the relevant environmental requirements. To obtain buy-in from staff, individual employees need to be involved in:

- Identifying the relevant risk;
- Understanding the nature of risks;
- Devising risk controls; and
- Given incentive to implement the controls in terms of legal obligations.

The applicant shall ensure that adequate environmental training takes place. All employees shall have been given an induction presentation on environmental awareness. Where possible, the presentation needs to be conducted in the language of the employees. All training must be formally recorded and attendance registers retained.

The environmental training should, as a minimum, include the following:

- General background and definition to the environment;
- The importance of compliance with all environmental policies;
- The environmental impacts, actual or potential, of their work activities;
- Compliance with mitigation measures proposed for sensitive areas;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving compliance with the environmental policy and procedures and with the requirement of the applicant’s environmental management systems, including emergency preparedness and response requirements;
- The potential consequences (legal and/or other) of departure from specified operating procedures;
- The mitigation measures required to be implemented when carrying out their work activities; and

- All operational risks must be identified and processes established to mitigate such risk, proactively. Thus the applicant needs to inform the employees of any environmental risks that may result from their work, and how these risks must be dealt with in order to avoid pollution and/or degradation of the environment.

In the case of permanent staff required during the operational phase of the project, the applicant / contractor shall provide evidence that such induction courses have been presented. In the case of new staff (including contract labour) the contractor / applicant shall keep a record of adequate environmental induction training.

19.1 CONSTRUCTION PHASE

The specific requirements for environmental training include:

- Environmental Induction Training: All general workers will receive induction training which will be presented by the Contractors Health and Safety Manager Representatives. The induction training must include an environmental management component which will be will be prepared by the Contractor’s Representative and presented where possible by the Contractor’s Representative. The training material must include general environmental awareness and an overview of the EMPR and EA requirements. The Induction Training Material must be reviewed and approved by the ECO;
- Weekly Environmental Toolbox Talks: Environmental toolbox talks will be prepared by the Contractor’s Representative to cover a range of environmental topics and must be presented to relevant staff during applicable times during construction process. The aim of these toolbox talks will be to inform site employees of general environmental requirements pertaining to specific activities, as well as specific EMPR and EA requirements and obligations. The ECO shall review environmental toolbox talks on a periodic basis to ensure the material is relevant and appropriate;
- Informal training of all staff on site is also required on an on-going basis through informal discussions, on-site supervision and through facilitation of day to day activities. Such training must be given or otherwise facilitated by the Contractor’s EO; and
- The Contractor’s EO must review all safe work procedures/risk assessments/DSTI’s (daily safe task instruction) from the safety department and include the relevant environmental risks and appropriate mitigation measures. Since the above procedures are specific to the applicable activity being undertaken, the inclusion of environmental measures aims to ensure each activity is undertaken in an environmentally responsible manner.

19.2 OPERATIONAL PHASE, DECOMMISSIONING PHASE, AND REHABILITATION

The specific requirements for environmental training include;

- Site Environmental Induction Training (Operational Phase): All site staff and employees will receive induction training which will be presented by the Health and Safety Manager Representatives. The induction training must include an environmental management component which will be will be prepared by the Mine EO and presented where possible by the Mine EO. The training material must include general environmental awareness and an overview of the EMPR and EA requirements. The Induction Training Material must be reviewed and approved by the ECO;
- Regular Environmental Toolbox Talks: Environmental toolbox talks will be prepared by the Mine EO to cover a range of environmental topics and must be presented to relevant staff during applicable times during all relevant phases. The aim of these toolbox talks will be to inform site employees of environmental requirements pertaining to specific activities, as well as specific EMPR and EA requirements and obligations; and
- Informal training of all staff on site is also required on an on-going basis through informal discussions, on-site supervision and through facilitation of day to day activities. Such training must be given or otherwise facilitated by the Mine EO.

19.3 ENVIRONMENTAL ASPECTS THAT DESCRIBE THE PRE-MINING ENVIRONMENT

The environmental aspects that describe the pre-mining environment are summarised below. It is important to note that these aspects must be read in conjunction with the detailed description of the baseline receiving environment in.

- The terrain is comprised of undulating plains with slopes of between 3% and 8%.
- Pre-mining soils are of moderate to high agricultural potential and support arable, grazing and wilderness land capabilities;
- Mixed land uses of mostly grazing, the specialised Hadeco bulb farming operation, mining and trout farming;
- A relatively healthy and functioning ecosystem with a strong carnivore assemblage;
- Wetlands, the majority of which are largely unmodified hill slope seepage wetlands;
- Perennial and non-perennial drainage patterns;

- Moderate to good ground and surface water quality; and
- Eastern valley grassland

The purpose of the list above is to guide the environmental objectives of rehabilitation and closure described in Section 26 of this report.

19.4 MEASURES TO CONTROL OR REMEDY ANY CAUSES OF POLLUTION OR DEGRADATION

The broad measures to control or remedy any causes of pollution or environmental degradation as a result of the proposed activities taking place on the Paardeplaats Coal Mine are provided below:

- Limit the size of the area to be disturbed as far as is practically possible;
- Design and construct infrastructure such as the PCD and Pit dewatering dams with both decant and drainage systems inclusive of storm water runoff measures;
- Conduct regular dam inspections in line with the regulatory requirements;
- Design and construct waste rock dumps and overburden dumps with adequate storm water runoff measures;
- Establish and maintain dirty and clean water systems in line with the regulatory requirements;
- Treat all contaminated water prior to discharge;
- Contain potential pollutants and contaminants (where possible) at source;
- Handling of potential pollutants and contaminants (where possible) must be conducted in bunded areas and on impermeable substrates;
- Ensure the timeous clean-up of any spills;
- Implement a waste management system for all waste stream present on site';
- Investigate any I&AP claims of pollution or contamination as a result of mining activities;
- Continue with concurrent rehabilitation;
- Operate the mine in line with the proposed closure goals and objectives;
- Rehabilitate the proposed mining site in line with the requirements of the detailed rehabilitation and closure plan; and

- Implement the action plans and technical management options described in Section 21 and Section 22 respectively

It is of critical importance that the broad measures to control or remedy any causes of pollution or environmental degradation are applied during all phases of the proposed mining operation. This is essential and allows for the operation to be conducted in a manner that will allow for the post mining closure goals and objectives to be met.

20 PROCEDURE FOR ENVIRONMENTAL EMERGENCIES & REMEDIATION

The Applicant together with the ECO must identify potential emergencies and develop procedures for preventing and responding to them. There are several options for dealing with high priority impacts and risks, as the paradigm has two components, probability and consequence. The design of control measures rest on the understanding the cause and effect. Best practise is to intervene with the ultimate factors were feasible, rather than treat the outcomes. Emergency response therefore has the option of reducing probability, or reducing the consequence, reducing the probability is the preferred option. Below are some common emergency preparedness approaches:

- Threat consequence if and when the risk eventuates, when the risk becomes an issue;
- Combine reducing the probability and treating the consequence;
- Offset environmental losses by investing in other assets;
- Not manage some of the risks because there are too many; and
- Make provision to manage residual impacts or issues that arise because of shortcomings in risk identification and rating, avoidance and mitigation or because a rare event has occurred.

Residual impacts are those impacts that despite reducing the probability and consequence might still occur. In these cases parties will have to be compensated, pollution cleaned up and damage to the environment remediated. The Applicant must ensure that all emergency procedures are in place prior to commencing work. Emergency procedures must include, but are not limited to;

- Fire Prevention;
- Fire Emergency Response;
- Spill prevention;
- Spill Response;

- Contamination of a water resource;
- Accidents to employees; and
- Use of hazardous substances and materials, etc.

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

20.1 FIRE

Sparks generated during welding, cutting of metal or gas cutting can result in fires. Every possible precaution shall therefore be taken when working with this equipment near potential sources of combustion. The contractor/Applicant must take all reasonable measures to ensure that fires are not started as a result of activities on site. No smoking is allowed near containers with flammable contents or at areas that are highly flammable. Smoking is only permitted at areas designated for smoking. No open fires are permitted on site and no burning of waste is to be allowed on site. The contractor/Applicant shall ensure that there is sufficient fire fighting equipment available on site at all times. Such precautions include having an approved fire extinguisher immediately available at the site of any such activities. The contractor/Applicant is to ensure that he/she has the contact details of the nearest fire station in case of an emergency. Appropriate and correctly serviced equipment must be available for all activities that are likely to generate fire.

It is further anticipated that firebreaks will be required around the site perimeter. It is recommended that such fire prevention measures are implemented in consultation with adjacent landowners and where necessary that the Applicant coordinate fire prevention efforts with local FPA.

20.2 HEALTH AND SAFETY

The Applicant and Contractor shall make allowance for the supply, erection, maintenance and removal of the information boards. Information boards shall also provide the name of the process managers, relevant contact person and contact number. This will ensure that the public access to request information and/or to lodge any complaints. The boards will essentially be to advise the public of the construction activities to be undertaken, or being undertaken and to advise of the prohibition of entering demarcated “no-go” areas.

The Applicant and Contractor must ensure that compliance with the Occupational Health and Safety Act (Act No. 85 of 1993) is strictly adhered to. All reasonable measures must be taken to ensure the safety of all site staff and the surrounding community is not compromised. No weapons may be brought onto the property by any person. Where fencing is temporarily affected, temporary security must be provided at all times until the fence is reinstated.

The Applicant and Contractor must ensure that all vehicles using public roads are in a roadworthy condition, that drivers adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to. The contractor shall make provision for flagmen to regulate traffic and construction vehicles when necessary.

The Applicant and Contractor must ensure that all accidents and incidents are recorded and reported to the ECO. The Applicant/ contractor must have easy access to all relevant emergency numbers for example, spill response teams, fire authorities, fire protection associations, medical emergency, nearest emergency rooms (hospitals) to the site, of both private and public hospitals. The Applicant and Contractor must take all reasonable measures to ensure the health and safety of all employees, visitors and the public.

20.3 SPILL RESPONSE PROCEDURE

Spill response procedures shall be developed for the construction and operational phases by the Contractor and Applicant respectively, and they shall instruct all employees, staff and labourers shall be instructed regarding implementation of spill prevention measures and spill response procedures. In the event of a spill, the following procedure applies:

- Immediately report the spill to the relevant supervisor and EO;
- Take immediate action to contain or stop the spill;
- Contain the spill and prevent its further spread (e.g. earth berm or oil absorbent materials for spill to land or by deploying booms and/or absorbent material for a spill to water);
- Dispose of any contaminated soil or materials according to appropriate waste disposal procedure. Note: Waste from spills of hazardous materials shall be disposed of as hazardous waste at a suitably licensed waste disposal facility;
- The Contractor’s EO and Mine EO shall record details of the spill in their respective incident registers;
- Photographic evidence shall be obtained of the spill cleanup.

In the case of large spills, the services of a specialist spill response agency shall be required, who shall advise on appropriate cleanup procedures and follow-up monitoring (if required).

In the event of any spills which are classified as medium or major incidents, the Mine EO shall immediately inform the ECO. The ECO shall record the incident in the ECO’s non-conformance and incident register and advise on the appropriate measures and timeframes for corrective action. Environmental incident reports shall be completed and submitted to the Mine Manger and ECO within 5 working days for all medium and major incidents. If there is a requirement to report the incident to the authorities, this shall be done by the Applicant in consultation with the ECO

The Applicant must also, (as per Section 30 of the NEMA) notify the Director-General (DWA, DEA and DMR), South African Police Services, MDEDET and Local Municipality and any persons whose health may be affected of the nature of an incident including:

- Any risks posed to public health, safety and property,
- Toxicity of the substance or by products released by the incident and
- Any step taken to avoid or minimise the effects of the incident on public health and the environment

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

21 ACTION PLAN TO ACHIEVE OBJECTIVES AND GOALS

The final environmental significance scores presented in the Action Plan are for the preferred Alternative 3 – Sensitivity Planning Approach.

21.1 CULTURAL & HERITAGE RESOURCES

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of external haul roads Establishing stormwater management measures	Impact on graves and cemeteries (Sensitivity Approach Alternative).	-16.00	-10.00	-13.33
		Impact on buildings and structures (Sensitivity Approach Alternative).	-3.00	-3.00	-3.50
		Damage/Destruction of undiscovered Heritage structures/resources (Sensitivity Approach Alternative).	-7.00	-7.00	-9.33
		Impact on graves and cemeteries outside mining footprint but within mining right boundary.	-16.00	-10.00	-16.67
		Impact on buildings and structures outside mining footprint but within mining right boundary.	-15.00	-11.00	-14.67
		Damage/Destruction of undiscovered Heritage structures/resources outside mining footprint but within mining right boundary.	-7.00	-7.00	-9.33
		Impact on graves and cemeteries outside mining right boundary.	-9.00	-7.50	-8.75
		Impact on buildings and structures outside mining right boundary.	-13.00	-8.25	-8.25
Operation	Vegetation clearance Removal of infrastructure Planned placement of infrastructure Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of infrastructure and services Drilling Blasting Excavations Establishment of internal haul roads	Impact on graves and cemeteries (Sensitivity Approach Alternative).	-7.50	-7.50	-7.50
		Impact on buildings and structures (Sensitivity Approach Alternative).	-3.00	-3.00	-3.50
		Damage/Destruction of undiscovered Heritage structures/resources (Sensitivity Approach Alternative).	-7.00	-7.00	-9.33
		Impact on graves and cemeteries outside mining footprint but within mining right boundary.	-7.50	-7.50	-7.50
		Impact on buildings and structures outside	-15.00	-11.00	-14.67

	Establishment of RoM stockpiles Waste rock dumps for backfilling Soil management Concurrent rehabilitation	mining footprint but within mining right boundary.			
		Damage/Destruction of undiscovered Heritage structures/resources outside mining footprint but within mining right boundary.	-7.00	-7.00	-9.33
		Impact on graves and cemeteries outside mining right boundary.	-9.00	-7.50	-8.75
		Impact on buildings and structures outside mining right boundary.	-13.00	-8.25	-8.25
		Impact on Palaeontological Resources.	-16.00	-16.00	-29.33
Decommissioning, Rehabilitation & Closure	Dismantling and demolition of infrastructure Blasting Backfilling of pits and voids Slope stabilisation Erosion control Landscaping	Impact on graves and cemeteries (Sensitivity Approach Alternative).	-7.50	-7.50	-7.50
		Impact on buildings and structures (Sensitivity Approach Alternative).	-3.00	-3.00	-3.50
		Impact on graves and cemeteries outside mining footprint but within mining right boundary.	-7.50	-7.50	-7.50
		Impact on buildings and structures outside mining footprint but within mining right boundary.	-15.00	-11.00	-14.67

ACTION PLAN

The action plan for managing heritage impacts will be incorporated into a **Heritage Management Plan** to be developed by a suitably qualified expert and will adhere to the following principles:

- First and foremost, to prevent any disturbance, damage or impact to any heritage features;
- Where disturbance or damage to heritage features is unavoidable, the required action will be to obtain the necessary permits and have the sites fully documented by a relevant specialist prior to removal/destruction.
- Where graves must be relocated, the exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring party & frequency and targets & indicators in Section 34, Section 65, and Section 97 of the EMP.

21.2 SOCIO-ECONOMIC IMPACTS

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	Skills development programmes Integration with Municipalities' strategic long term planning	Skills development.	17.00	23.75	39.58
		Co-operative governance. The government is an important role player in the project. If the mine and the government work together they have the potential to make a positive contribution to the	12.00	17.50	20.42

		local community.			
Construction & Operation	General construction activities that may lead to social impacts be it physical or perceived. Employment of local labour Stakeholder engagement Community liaison CSI initiatives Skills development programmes Environmental awareness training HIV/AIDS Awareness programmes General Mining activities that may lead to social impacts be it physical or perceived Integration with Municipalities' strategic long term planning.	Increase in HIV/AIDS and other infectious diseases.	-19.00	-13.50	-22.50
		Health impacts such as asthma, sinusitis, allergies and other respiratory diseases attributed to dust generated by the operation of the mine.	-13.00	-8.25	-11.00
		Conflict between local residents and newcomers.	-15.00	-10.00	-13.30
		Resettlement of Hadeco Village. Affected people will be resettled if the area is mined and this will impact on their livelihoods and social and community structures.	-17.00	-10.50	-21.00
		Expectations regarding the benefits of the project.	-16.25	-9.00	-13.50
		Skills development.	17.00	23.75	39.58
		Impact on infrastructure such as roads and housing.	-13,00	-7.50	-10.00
		Social impact of blasting. Farms in close proximity of the mine and residents of Belfast and Siyuthuthuka complain about cracks in their houses due to the blasting operations of the mine.	-13.00	-6.75	-9.00
		Dust. Coal dust has a negative impact on the livelihoods of the agricultural community since it affects the quality of their products.	-13.00	-8.25	-13.75
		Water pollution. There are fear and perception around water pollution in the community, especially since areas in close proximity has been affected by incidents related to acid mine water.	-14.00	-7.50	-13.75
		Co-operative governance. The government is an important role player in the project. If the mine and the government work together they have the potential to make a positive contribution to the local community.	12.00	17.50	20.42
		Net employment.	18.75	18.75	25.00
		Net Income generated to the economy.	14.00	14.00	25.67
Decommissioning	N/A	N/A	N/A	N/A	N/A
Rehabilitation & Closure	N/A	N/A	N/A	N/A	N/A
ACTION PLAN					

Socio-economic impacts will be managed according to the following principles:

- Assisting communities and other stakeholders to identify development goals;
- Ensuring that positive outcomes of the project are maximised;
- Skills development in the region;
- Reduced impacts on communities of individuals;
- Enhanced benefits to those affected;
- Avoiding delays and obstruction – helps to gain development approval (social license);
- Better community and stakeholder relations (Establish good working relationships with local and district government & affected communities);
- Lowering costs;
- Improved proposals.

The action plan for managing Socio-economic impacts will be incorporated into a number of management plans, strategies and other initiatives which shall include, but is not limited to the following:

Management Plans:

- Social and Labour plan;
- Skills development plans;
- Recruitment policy;
- Community Relation Plan.

Community engagement mechanisms;

- Community liaison forum (CLF);
- Environmental forum to give feedback on environmental matters to affected communities;
- Establish a detailed Grievance mechanism for communities to lodge concerns, suggestions and complaints (Complaints procedure);
- Economic plans for mine closure;
- Environmental Forum.

Strategies:

- Strategy to actively manage expectations;

Other Initiatives:

- Program of Entrepreneurship Development;
- Bursaries and internships;
- Provide business mentorship to identified local businesses;
- Program of Entrepreneurship Development.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in the EMP tables in Section 5, Section 15, Section 51, and Section 81 of the EMP.

21.3 SOILS AND LAND CAPABILITY

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads Establishing stormwater management measures	Loss of soil fertility during footprint clearance	-10.00	-5.25	-6.13
		Soil erosion hazard during footprint clearance	-8.00	-5.25	-6.13
		Soil compaction during footprint clearance	-7.00	-5.25	-6.13
		Loss of soil fertility during establishment of infrastructure	-16.20	-12.00	-16.00
		Soil erosion hazard during establishment of infrastructure	-12.00	-11.00	-12.83
		Soil compaction during establishment of infrastructure	-13.00	-12.00	-16.00
		Chemical pollution	-17.50	-14.00	-17.33
		Change in natural landscape	-12.00	-12.00	-16.00
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's Establishment of dewatering pipelines Establishment of mobile office and ablution block Sewage and sanitation Establishment of fuel storage area Establishment of chemical storage area Establishment of explosives storage area Establishment of general waste area Drilling Blasting Excavations Removal of overburden by dozing and load haul Establishment of internal haul roads Waste rock dumps for backfilling Soil management Concurrent rehabilitation	Reduction of agricultural potential	-17.50	-14.00	-23.33
		Loss of soil fertility	-17.50	-14.00	-23.33
		Soil erosion hazard	-14.00	-14.00	-17.33
		Soil compaction	-17.50	-17.50	-29.17
		Chemical pollution	-20.00	-16.00	-21.00
		Change in natural landscape	-17.50	-17.50	-26.25
Decommissioning	Dismantling and demolition of infrastructure Blasting Safety control	Reduction of agricultural potential	-14.00	-14.00	-19.50
		Soil compaction	-14.00	-14.00	-19.50
		Soil erosion hazard	-14.00	-14.0	-17.33
Rehabilitation &	Backfilling of pits and voids	Reduction of agricultural potential	-17.50	-14.00	-19.50

Closure	Slope stabilisation Erosion control Landscaping Replacing topsoil Removal of alien/invasive vegetation Re-vegetation Restoration of natural drainage patterns Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Soil compaction	-17.50	-17.50	-24.38
		Change in natural landscape	-17.50	-14.00	-18.67
		Reduction of soil fertility	-17.50	-14.00	-18.67
		Soil erosion hazard	-17.50	-14.00	-15.17

ACTION PLAN

The action plan for managing impacts on soil, land use and land capability are incorporated into the **Soil Management Guide** developed by the soil specialist during the soil, land use and land capability survey (see Appendix M) and incorporates the following principles:

- Define an end-use for the area. This should be established as soon as possible;
- Define and agree upon end-goals for the rehabilitation process, such as land use, rehabilitation objectives, areas to be rehabilitated, etc.;
- Ascertain whether the proposed end-use is compatible with the land capability of the area;
- Minimise visual impacts of rehabilitated areas by recreating natural landforms and ensuring that reshaped areas are visually compatible with surrounding landscapes;
- Restore natural landforms such as drainage lines, undulating areas and ridges (which may have been damaged during activities);
- Quantify, restrict and remediate chemical environmental pollution of water and soil as a result of the various mining activities;
- Ensure post-mining soil integrity. This is the most important aspect of rehabilitation as it forms the base from which rehabilitation proceeds. If soils are not correctly prepared, suitable conditions for re-vegetation will not be achieved;
- Monitor and combat alien floral invasion, as this also poses a threat both during and post-rehabilitation activities. Adequate alien and invasive species control measures must be applied.

Identification and recording of soil and terrain units prior to disturbance is an essential part of the planning process. These units must then, as far as possible, be re-instated during rehabilitation to maintain habitat diversity and consequently biodiversity. These units were defined in the soil and land capability study by the method of soil classification and allocating soil form units into land capability classes.

The soil utilization and rehabilitation plan shall aim to prevent, reduce and mitigate impacts to soil and land capability in terms of;

- Loss of soil fertility;
- Loss of agricultural potential;
- Soil erosion;
- Soil compaction;
- Pollution of soils;
- Change in natural landscape.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring party & frequency, targets and indicators in the EMP tables in Section 20, Section 21, Section 55, Section 56, Section 87, and Section 88 of the EMP.

21.4 ECOLOGY – FLORA & FAUNA

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads Establishing stormwater management measures Establishment of firebreak	Transformation of vegetation	-16.25	-12.00	-18.00
		Damage to habitat	-15.00	-11.00	-14.67
		Spread of alien species	-17.50	-12.00	-20.00
		Loss of biodiversity	-16.25	-12.00	-20.00
		Introduction of foreign animals	-7.50	-5.25	-7.88
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's Establishment of dewatering pipelines Establishment of mobile office and ablution block Sewage and sanitation Establishment of fuel storage area Establishment of chemical storage area Establishment of explosives storage area Establishment of general waste area General site management Drilling Blasting Excavations Removal of overburden by dozing and load haul Establishment of internal haul roads Establishment of RoM stockpiles RoM stockpile transport to NBC Glisa De-watering of open pit Waste rock dumps for backfilling Soil management Water management Concurrent rehabilitation Water treatment	Loss of biodiversity	-17.50	-12.00	-24.00
		Damage to habitat	-16.25	-11.00	-18.33
		Direct and indirect mortality (road, hunting, trapping)	-17.50	-12.00	-18.33
		Red Data and Protected species - both provincial and national	-21.25	-13.00	-13.83
		Spread of alien invasive species	-18.75	-12.00	-20.00
		Introduction of foreign animals	-6.75	-5.25	-7.88
Decommissioning,	Dismantling and demolition of infrastructure	Transformation of vegetation	-20.00	-17.00	-26.67

Rehabilitation & Closure	Blasting Safety control Backfilling of pits and voids Slope stabilisation Erosion control Landscaping Replacing topsoil Removal of alien/invasive vegetation Re-vegetation Restoration of natural drainage patterns Remediation of ground and surface water Rehabilitation of external roads Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Spread of alien species	-18.75	-12.00	-20.00

ACTION PLAN

The action plan for managing impacts on Ecology (Flora & Fauna) are incorporated into the **Biodiversity Action Plan** developed by an independent specialist for the Paardeplaats mine as part of the Ecological study (see Appendix E). The Biodiversity action plan is based on the following principles:

- A biodiversity action plan may include individual species action plans as well as habitat or biodiversity feature action plans;
- A biodiversity action plan is characterised by a proactive and coordinated approach that directs, monitors and reviews the effective management of key biodiversity features of the land holdings of a particular land steward;
- A biodiversity action plan includes conservation projects, protection agreements and productive partnerships with stakeholders that deliver sound land use stewardship;
- A biodiversity action plan realizes the potential that responsible biodiversity management has to generate sustained economic benefits for local communities;
- Awareness program: raising awareness regarding biodiversity issues as part of an ongoing program to educate and train employees in the benefits of conserving biodiversity;
- Research: an important step in understanding and better managing biodiversity in and around the relevant land areas;
- Restoration and rehabilitation projects: aim to re-establish or supplement habitat that has been impacted upon, in order to assist in the re-colonization of endemic species.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring party & frequency, targets and indicators in the EMP tables in Section 25, section, 26, Section 27, Section 59, Section 60, Section 91, and Section 92 in the EMP.

21.5 WETLANDS

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting	Loss of wetland habitat	-22.50	-22.50	-41.25
		Disturbance and degradation of wetland habitat	-12.50	-8.75	-14.58
		Increased sediment transport and deposition in wetlands	-13.75	-10.00	-15.00

	Establishment of external haul roads Establishing stormwater management measures	Water quality deterioration	-11.00	-7.00	-9.33
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's Establishment of dewatering pipelines Sewage and sanitation General site management Excavations Establishment of internal haul roads De-watering of open pit Pumping of water to PCD's Water management Concurrent rehabilitation Water treatment	Erosion at water management infrastructure discharge points	-11.00	-6.75	-9.00
		Disturbance and degradation of wetland habitat	-12.50	-7.00	-11.67
		Water quality deterioration	-8.25	-6.75	-11.25
		Increased sediment transport and deposition in wetlands	-15.00	-9.00	-13.50
Decommissioning, Rehabilitation & Closure	Backfilling of pits and voids Erosion control Restoration of natural drainage patterns Remediation of ground and surface water Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Increased surface runoff into wetlands	-18.75	-16.25	-24.38
		Increase in alien vegetation	-16.25	-5.00	-8.33
		Water quality deterioration – AMD	-21.25	-21.25	-42.50

ACTION PLAN

The action plan for managing impacts on wetlands are incorporated into this EMP and are based on the following principles:

- First and foremost, to take all reasonable measures to prevent any disturbance, damage or impact to wetlands;
- Where disturbance or damage to wetlands is unavoidable, the required action will be to fully rehabilitate the wetlands as soon as possible. Rehabilitation will include;
  - Re-vegetation of bare and disturbed areas within wetlands;
  - Alleviation of soil compaction through ripping/ploughing where necessary;
  - The eradication of invasive plant species;
  - Installation of erosion and silt control measures where required;
  - Monitoring and evaluation to assess and ensure successful rehabilitation.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in Section 31, Section 32, Section 63, and Section 95 in the EMP.

21.6 AQUATIC ECOLOGY

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance

Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of external haul roads Establishing stormwater management measures	Loss of aquatic ecosystems	-20.00	-18.75	-31.25
		Erosion and Sedimentation	-16.25	-12.00	-14.00
		Decline in Water Quality	-17.50	-12.00	-18.00
		Altered hydrological regime	-15.00	-9.75	-14.63
		Biodiversity Loss	-14.25	-9.00	-18.00
		Spread of alien fish species	-16.00	-8.25	-12.38
		Erosion and dust from roads and stockpiles	-14.00	-6.50	-6.50
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's Establishment of dewatering pipelines Sewage and sanitation General site management Excavations Establishment of internal haul roads De-watering of open pit Pumping of water to PCD's Water management Concurrent rehabilitation Water treatment	Decline in Water Quality: Seepage	-21.25	-18.75	-28.13
		Water Quality Deterioration: Transport and Stockpiles	-16.00	-13.00	-15.17
		Decline in Water Quality: Sedimentation and Turbidity	-18.75	-10.50	-15.75
		Decline in habitat suitability and availability	-15.00	-10.50	-15.75
		Biodiversity Loss	-20.00	-9.50	-17.42
		Altered hydrological regime	-15.00	-9.00	-15.00
		Spread of alien fish species	-16.00	-8.25	-12.38
Decommissioning, Rehabilitation & Closure	Backfilling of pits and voids Erosion control Restoration of natural drainage patterns Remediation of ground and surface water Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Decline in Water Quality: AMD and Decant	-23.75	-17	-34.00
		Biodiversity Loss	-20.00	-13.50	-24.75
		Decline in Water Quality: Sedimentation and turbidity	-16.25	-12.00	-14.00
		Decline in Water Quality: Spills, leaks	-18.75	-9.75	-11.38

ACTION PLAN

The action plan for managing impacts on aquatic ecology are incorporated into this EMP and are based on the following principles:

- First and foremost, to reduce the mining footprint wherever possible to prevent irreversible loss of aquatic ecosystem resources;
- To take all reasonable measures to prevent any disturbance, damage or impact to aquatic ecosystems outside of mining footprint;
- Considering the potential for some permanent loss of aquatic ecosystems habitat, it is strongly recommended that biodiversity offset measures are considered, preferably by formally protecting intact systems with similar ecosystem components.
- Effective bio-monitoring programme be implemented as soon as possible to assess and mitigate negative impacts on aquatic ecosystems.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in Section 31, Section 63, and Section 95 in the EMP.

21.7 SURFACE AND GROUNDWATER

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
SURFACE WATER					
Pre-construction		N/A	N/A	N/A	N/A
Construction	Vegetation clearance Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Digging trenches and foundations Blasting Establishment of external haul roads Establishing stormwater management measures	Alteration of natural drainage patterns	-17.50	-17.50	-35.00
		Increased erosion and sedimentation	-12.50	-10.00	-16.67
		Chemical pollution of surface water	-11.25	-5.25	-8.75
Operation	Establishment of infrastructure and services Mixing on concrete and concrete works Establishment of PCD's Establishment of dewatering pipelines Sewage and sanitation General site management Excavations Establishment of internal haul roads De-watering of open pit Pumping of water to PCD's Water management Concurrent rehabilitation Water treatment	Chemical pollution of surface water	-11.25	-6.00	-10.00
		Surface water contamination	-15.00	-15.00	-30.00
		Flood risk	-4.50	-4.50	-7.50
Decommissioning	Dismantling and demolition of infrastructure	Chemical pollution of surface water	-12.50	-6.00	-9.00
Rehabilitation & Closure	Backfilling of pits and voids Erosion control Restoration of natural drainage patterns Remediation of ground and surface water Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Decanting of contaminated groundwater into surface water.	-21.25	-18.75	-37.50
GROUND WATER					
Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction	Establishment of construction contractor area Blasting Establishing stormwater management measures	Chemical pollution of groundwater	-6.75	-2.50	-3.75
		Alteration of groundwater levels	-13.75	-13.75	-25.21
		Dewatering of wetlands	-9.00	-9.00	-18.00
Operation	Mixing on concrete and concrete works	Chemical pollution of groundwater	-6.75	-6.00	-9.00

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
	Establishment of PCD's Sewage and sanitation Establishment of fuel storage area Establishment of chemical storage area Establishment of explosives storage area Establishment of general waste area Blasting Removal of overburden by dozing and load haul Removal of ore De-watering of open pit Pumping of water to PCD's Waste rock dumps for backfilling Water management Water treatment	Alteration of groundwater levels	-18.75	-18.75	-27.50
		Contamination of groundwater (AMD)	-18.75	-18.75	-27.50
		Dewatering of wetlands	-18.75	-18.75	-37.50
Decommissioning	Dismantling and demolition of infrastructure	Alteration of groundwater levels	-20.00	-20.00	-36.67
		Contamination of groundwater (AMD)	-20.00	-20.00	-40.00
Rehabilitation & Closure	Backfilling of pits and voids Erosion control Restoration of natural drainage patterns Remediation of ground and surface water Initiate maintenance and aftercare program Environmental aspect monitoring Monitoring of rehabilitation	Decanting of contaminated groundwater into surface water	-20.00	-17.50	-32.08

ACTION PLAN

The action plan for managing impacts on surface and ground water shall be incorporated into an **Integrated Water and Waste Management Plan** (IWWMP) to be developed by a suitably qualified specialist. The aims of the IWMMP shall include, but not be limited to:

- Minimize the loss of run-off surface water;
- Minimize siltation from dust deposition and surface water run-off;
- Minimize hydrocarbon contamination;
- Maximise clean and dirty water separation;
- Minimize contamination of clean water;
- Minimize contamination of surface water resources;
- Minimize contamination of ground water resources;
- Minimize the impact of raw and potable water;
- Restore the surface run-off capture of the catchment post mining;
- Post mining restoration of surface run-off to pre-mining conditions;
- Treatment of polluted water;
- Monthly monitoring to be undertaken; and
- Stormwater management measures as per GN704

The IWMMP shall include a **Surface and Groundwater Monitoring Plan** which shall be integrated with GLISA's existing monitoring program and will be based on the

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance

following principles:

- Develop an understanding of the current surface water and groundwater flow patterns on the mine and monitor how it changes over time;
- Assess impacts of the changes of surface and ground water flow patterns on the receiving environment and the performance of associated prevention measures;
- Assess the development of a cone of depression and how this extends over time;
- Assess changes in groundwater flow/levels within the mine and to monitor how these change with time;
- Prevent pollution and hereby protect the receiving water environment;
- Develop an understanding of the current water pollution on the mine and monitor how it changes over time; and
- Assess performance of pollution prevention measures, i.e. compliance with license conditions and catchment objectives.

The IWMMP shall include an **AMD Mitigation Strategy** which shall be based on the following principles, but shall not be limited to:

- Responsible management of sulphidic mine wastes;
- Development and implementation of site specific strategies to prevent, minimise and control AMD (e.g. the oxidation of sulphides);
- Integration of AMD mitigation strategies into the actual mining process (e.g. Integration with soil management and progressive rehabilitation);
- Continued characterisation and classification of acid generating potential as more samples and data become available;
- Implementation of long term control and treatment technologies (consideration of both passive and active treatments); and
- Ongoing review and implementation of best available technology to mitigate and treat AMD where appropriate and feasible.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in Section 29, Section 62, Section 94, and Section 113 in the EMP. The proposed surface and ground water monitoring plan is presented in section of the EMPR.

21.8 AIR QUALITY

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction, Operation, Decommissioning & Closure	Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations	Nuisance dust-fall	-10.00	-9.00	-16.50
		PM_{10} health impacts	-12.00	-11.00	-18.33
		$PM_{2.5}$ health impacts	-10.00	-9.00	-13.50
		Dust impact on agriculture	-13.00	-11.00	-16.50

	Blasting Establishment of external haul roads Establishing stormwater management measures Establishment of infrastructure and services Establishment of PCD's Establishment of dewatering pipelines Drilling Blasting Excavations Removal of overburden by dozing and load haul Establishment of internal haul roads Removal of ore Establishment of RoM stockpiles RoM stockpile transport to NBC Glisa Concurrent rehabilitation Dismantling and demolition of infrastructure Blasting Safety control Backfilling of pits and voids Slope stabilisation Rehabilitation of external roads Erosion control Landscaping Replacing topsoil				
ACTION PLAN					

The action plan for managing impacts on air quality shall be incorporated into an effective **air quality management programme** to be developed by a suitably qualified specialist and is based on the following principles:

- Open and transparent communication with the public and IAP's about air quality and raising awareness;
- Mitigation of emissions, especially from unpaved roads to lower impacts to more acceptable levels;
- Mitigation of particulate emissions at handling points and during crushing operations should also be considered;
- Development/validation of management tools such as models and inventories;
- Compliance with national and international standards;
- Effective monitoring of ambient air quality, including nuisance dust-fall and PM_{10};
- Providing objective inputs to management;
- Data interpretation and trending to identify future problems or progress against management actions;
- Integration into mines grievance mechanism for communities to lodge concerns, suggestions and complaints with respect to dust which can be dealt with by the Project in a timely manner.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in Section 46, Section 74, and Section 106 in the EMP.

21.9 NOISE

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	Seismic testing geological test borehole drilling	Noise disturbance and noise nuisance from seismic testing and geological test borehole drilling for prospecting purposes	-3.50	-3.50	-4.67
Construction	Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads Establishing stormwater management measures	Noise disturbance and noise nuisance at urban and rural noise sensitive receptors	-6.00	-6.00	-8.00
Operation	Establishment of infrastructure and services Establishment of PCD's Establishment of dewatering pipelines Establishment of mobile office and ablution block Drilling Blasting Excavations Removal of overburden by dozing and load haul Establishment of internal haul roads Removal of ore RoM stockpile transport to NBC Glisa Concurrent rehabilitation	Noise disturbance and noise nuisance at urban and rural noise sensitive receptors	-13.00	-13.00	-17.33
Decommissioning, Rehabilitation & Closure	Dismantling and demolition of infrastructure Backfilling of pits and voids Landscaping Initiate maintenance and aftercare program Environmental aspect monitoring	Noise disturbance and noise nuisance at urban and rural noise sensitive receptors	-6.75	-6.75	-9.00

	Monitoring of rehabilitation				

ACTION PLAN

The action plan for managing impacts on air quality are incorporated into this EMP and are based on the following principles:

- The National Noise Control Regulations and SANS 10103:2008 should be used as the main guidelines for addressing any further noise issues on this project.
- The noise mitigation measures will need to be designed and/or checked by an acoustical engineer in order to optimise the design parameters and ensure that the cost/benefit of the measure is optimised.
- Noise Monitoring Guidelines should be developed for the construction and operational phases of the project. The following details and issues should be addressed:
    - General Details of the Colliery
    - Noise Area of Influence
    - Residual (Baseline) Noise Climate of the Study Area
    - Noise Standards/Impact Criteria
    - Noise Measurement Procedures
    - Selection of Noise Monitoring/Measurement Sites
    - Length of Measurement Period
    - Frequency of Monitoring Measurement

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in Section 11, Section 44, Section 72, Section 104, and Section 110 in the EMP.

21.10 VISUAL

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction	Vegetation clearance Removal of infrastructure Establishment of construction contractor area Stripping and stockpiling of soils Cleaning, grubbing and bulldozing Removal of building waste and cleared vegetation Digging trenches and foundations Blasting Establishment of external haul roads	Visual impact of dust	-11.25	-10.00	-14.58
		Visual Impact during the day	-10.00	-10.00	-11.67
		Visual impact at night	-8.75	-7.50	-7.88
Operation	Drilling Blasting Excavations Removal of overburden by dozing	Visual impact of dust	-17.5	-16.25	-27.50
		Visual Impact during the day	-17.50	-17.50	-22.50
		Visual impact at night	-13.75	-12.50	-15.00

	and load haul Establishment of internal haul roads Removal of ore Establishment of RoM stockpiles RoM stockpile transport to NBC Glisa Waste rock dumps for backfilling Soil management Concurrent rehabilitation				
Decommissioning, Rehabilitation & Closure	Dismantling and demolition of infrastructure Blasting Safety control Backfilling of pits and voids Slope stabilisation Erosion control Landscaping Re-vegetation Restoration of natural drainage patterns Rehabilitation of external roads	Visual impact of dust	-12.50	-11.25	-18.75
		Visual Impact during the day	-12.50	-11.25	-13.33
		Visual impact at night	-7.50	-6.25	-8.33

ACTION PLAN

The action plan for managing impacts on visual impacts are incorporated into this EMP and are based on the following principles identified by the visual specialist during the visual impact assessment (see Appendix O):

The measures should be feasible (economically), effective (how long will it take to implement and what provision is made for management/maintenance) and acceptable (within the framework of the existing landscape and land use policies for the area). To address these, the following principles have been considered:

- Mitigation measures should be designed to suit the existing landscape character and needs of the locality. They should respect and build upon landscape distinctiveness;
- It should be recognized that many mitigation measures, especially the establishment of planted screens and rehabilitation, are not immediately effective;
- Mitigation measures would be feasible and effective in reducing the visual impact on some residential views from within the proposed mining boundary and surrounding residents.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in Section 47, Section 75, and Section 107 in the EMP.

21.11 BLASTING AND VIBRATION

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	N/A	N/A	N/A	N/A	N/A

Construction	N/A	N/A	N/A	N/A	N/A
Operation	Blasting	Ground vibration as a result of blasting could cause damage to structures and upset community.	-9.00	-5.00	-7.50
		Air blast could cause damage to structures and induce effects that will upset homeowners.	-12.00	-5.00	-7.50
		Fly Rock could cause damage to structures, injure people or animals.	-9.00	-5.00	-7.50
Decommissioning, Rehabilitation & Closure	Dismantling and demolition of infrastructure	N/A	N/A	N/A	N/A

ACTION PLAN

The action plan for managing impacts from blasting and vibrations are incorporated into this EMP and are based on the following principles identified by the blasting specialist during the blasting and vibration impact assessment (see Appendix D):

- Mitigation measures for blasting should not be generic, but rather should be designed for individually for each of the POI's that are considered problematic specific to the Portion 30 area.
- The reduction of ground vibration is mitigated through;
  - Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast.
  - Calculate expected ground vibration levels for blast to be done and if necessary re-design to reduce change mass per delay, use of electronic initiation of blast, drilling smaller diameter blastholes that will reduce charge per blasthole and per delay.
- The reduction of air blast and fly rock is mitigated through:
  - Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast.
  - Use of proper stemming lengths of between 25 and 30 blasthole diameters,
  - Use of crushed aggregate with size of 10% the blasthole diameter as stemming material.
  - Record stemming lengths for each blast and correct if necessary prior to every blast blasted.
  - Monitor each blast done.

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in Section 11, Section 45, Section 73, Section 105, and Section 111 in the EMP.

21.12 TRAFFIC

PHASE	ACTIVITY	IMPACT	SIGNIFICANCE		
			Pre-mitigation	Post-mitigation	FINAL Significance
Pre-construction	N/A	N/A	N/A	N/A	N/A
Construction, Operation, Decommissioning	General construction activities Earthworks Access control and security	Impact on Adjacent Road Network. There will be an increase in heavy vehicle traffic on the adjacent road roads.	-5.00	5.50	6.42

& Closure	Removal of overburden by dozing and load haul RoM stockpile transport to NBC Glisa	Impact on Bridges and Culverts.	-2.00	2.50	2.92
		Impact on Communities. Additional heavy vehicles travelling through communities or urban areas.	-6.00	-6.00	-7.00
ACTION PLAN					

The traffic impact assessment has indicated that no significant impacts are expected as a result of increased traffic, should the mining take place. The action plan for managing impacts as a result of increased traffic shall be incorporated into a **traffic management plan** which shall adhere to the following principles as provided by the traffic specialist during the traffic impact study (see Appendix N):

- Make use of existing roads within the site where possible to minimise the impact;
- The traffic management shall identify appropriate routes for heavy vehicles to avoid communities and limit time of operation;
- Monitoring of access roads to identify damage as a result of construction/mining activities;

Detailed mitigation measures/technical management options are provided per activity for each phase, including timeframes, responsible parties, monitoring part & frequency, targets and indicators in Section 22, Section 57, and Section 89 of the EMP.

22 APPROPRIATE TECHNICAL AND MANAGEMENT OPTIONS FOR IMPACTS

22.1 EMP – PRE-CONSTRUCTION PHASE

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	1. Appointment of ECO				
A	The Applicant shall appoint a suitably qualified and competent ECO who shall preferably be independent from the Applicant and the Contractor. The ECO must preferably have a tertiary qualification in an Environmental Management or appropriate field. The ECO should have appropriate training and experience in the implementation of environmental management specifications. For the purposes of implementing the conditions contained in this EMP (e.g. pre-construction survey), the Applicant should appoint the ECO well before (at least 2 weeks) the start of any work. The Applicant shall provide the ECO with the relevant assistance to ensure that the environmental aspects relating to the development is adhered to.	Prior to construction	Applicant	ECO (Once-off)	Appoint ECO to ensure monitoring and implementation of the EMP/Confirmation that ECO has been appointed and is suitably qualified to perform the duties contained in this EMP. (ECO Monthly Checklist/Report)
C	The ECO is responsible for the maintenance, update and review of the EMP. The ECO shall include any recommendations for proposed amendments/alterations of the EMP to the Applicant who shall engage the competent authority with regards to such changes. Only on written approval from the competent authority may such changes be effected in accordance with the provisions of the MPRDA.	As required	ECO	Independent Environmental Auditor (Annually)	Ensure EMP is reviewed and updated where necessary to ensure adequate mitigation for all impacts associated with the operation/Review of EMP and amendment where required. (Annual Performance Assessment Reports) (ECO Monthly Checklist/Report)
	2. Appointment of Contractor				
A	The EMP must be made binding on the contractor and should be included in tender documentation for the mining contract. The costs related to the implementation of the EMP during construction will be the responsibility of the Contractor.	Prior to construction and Ongoing	Applicant	ECO (Once-off)	Ensure that the contractor implements all the mitigation measures as described in the EMP/Confirmation that contractor has received EMP and that EMP has been made contractually binding. (Contractual agreements) (ECO Monthly Checklist/Report)
B	All contractors and sub-contractors must have a copy of the EMP and should be briefed by the Mine EO or ECO with regards to the use and implementation of the EMP.	Prior to construction and Ongoing	Contractor	Mine EO (Weekly) ECO (Bi-Monthly)	Ensure all contractors are aware of EMP requirements/Confirmation that contractors have received training relating to EMP implementation. (Training records) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
C	The Contractor shall appoint a dedicated Contractor's EO who is suitably qualified to perform the necessary tasks and is appointed at a level such that she/he can interact effectively with other site Contractors, labourers, the ECO and the public. The Contractor's EO shall be appointed prior to the onset of construction.	Prior to construction and Ongoing	Contractor	ECO (Once-off)	Ensure a suitably EO is present on site to oversee day to day activities and ensure successful implementation of EMP during construction/Confirmation that EO has been appointed and is suitably qualified to perform the necessary duties contained in this EMP. (ECO Monthly Checklist/Report)
D	The Contractor must ensure that all sub-contractors working under the contractor abide by the requirements of the EMP.	Ongoing	Contractor	Mine EO (Weekly) ECO (Bi-Monthly)	Ensure that the contractor implements all the mitigation measures as described in the EMP/Confirmation that all contractors and sub-contractors abide by EMP provisions. (Mine EO weekly checklist) (ECO Monthly checklist)
		3. Service Detection			
A	The contractor shall engage the Applicant with regards to any existing services on the site. The contractor must take all reasonable measures to ensure the location of underground and above-ground services are identified and damage or interruptions to such services are avoided.	Prior to construction and ongoing	Applicant Contractor	ECO (Once-off)	Ensure no damage or disruption to existing services/Undertake service detection. (Mine EO weekly checklist) (ECO Monthly checklist)
B	In the event that construction or operations must be located near to existing services, thorough service detection should be undertaken and services exposed in the area to be disturbed to ensure there is no damage or disruption to services. Where appropriate, suitable buffer zones should be fenced off or demarcated around such areas to prevent any damage as a result of construction or operational activities.	Prior to construction and ongoing	Applicant Contractor	ECO (Bi-Monthly)	Ensure no damage or disruption to existing services/Undertake service detection and establish buffer to prevent damage. (Mine EO weekly checklist) (ECO Monthly checklist)
C	In all cases where services must be temporarily disrupted, the relevant landowner and/or affected parties must be notified timeously (at least two weeks prior) prior to the service disruption.	Ongoing	Applicant Contractor	Mine EO (weekly) ECO (Bi-Monthly) Construction (Monthly) Operation	Maintain good relations with affected landowners/affected parties/Verification that relevant parties have been timeously notified prior to disruption of services. (Mine EO weekly checklist) (ECO Monthly checklist)
		4. Community Liaison			
A	The Applicant shall develop and implement a community relations plan in consultation with a suitably qualified specialist and shall appoint a champion to deal with community processes. Communicate frequently with the affected stakeholders to ensure that they understand the processes and do not	Prior to construction and ongoing	Applicant	ECO (Once-off)	Mitigate negative impacts of changes to social environment/Approved community relations plan. (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	develop more unrealistic expectations.				
B	The Applicant shall appoint a community liaison officer that deals specifically with the surrounding communities.	Prior to construction and ongoing	Applicant	ECO (Once-off)	Good relations with surrounding landowners & communities/ Appointment letter of community liaison officer. Approved community relations plan. (ECO Monthly Checklist/Report)
C	Develop a strategy to actively manage expectations. This includes the sharing of relevant information in a way that is accessible to all members of the community. Frequent communication is a key aspect in the management of expectations.	Prior to construction and ongoing	Applicant	ECO (Once-off)	Written strategy approved by the board and reviewed on a quarterly basis.
D	Open channels of communication between the Mine and surrounding landowners/communities are essential. The Applicant shall establish a community liaison forum (CLF) that meet every three months – at this forum the mine can give feedback on its activities and keep the communities informed about matters that concern them in a transparent and honest manner. The CLF must be representative of all the groups in the area and include women, youth and the elderly. The relevant authorities shall also be invited to attend CLF meetings. This forum is an important mechanism to manage expectations and build relationships. Meeting minutes must be captured and forwarded to all attendees.	Prior to construction and ongoing	Applicant	ECO (Once-off)	Good relations with surrounding landowners & communities/ Established community liaison forum. (Community forum meeting minutes) (ECO Monthly Checklist/Report)
E	The Applicant shall establish a detailed grievance mechanism (complaints procedure) for communities to lodge concerns, suggestions and complaints which can be dealt with by the Project in a timely manner. The complaints procedure shall aim to accomplish the following objectives; • Identify roles and responsibilities relating to the reporting, recording and addressing of complaints; • Development of a complaints register to record and track complaints and actions taken to address complaints; • Reporting of complaints to DMR.	Prior to construction and ongoing	Applicant	ECO (Once-off)	Adequate procedures to ensure complaints are adequately recorded, tracked and addressed/ Completed community grievance mechanism Mechanism communicated to local residents through a variety of media (Complaints Register) (ECO Monthly Checklist/Report)
F	A complaints register must be developed by the Applicant (Mine EO) to log complaints by landowners, occupants and other Interested and Affected Parties, and response to such complaints. The complaints register should be provided to DMR on an annual basis, and at any point in time if requested by the DMR. The complaints register shall contain, at a minimum, the following information; • Date of the complaint, • Location relating to the complaint, • Contact details of the complainant, • Complaint description (detailed as possible), • Person receiving complaint,	Prior to construction and ongoing	Applicant	ECO (Once-off)	Written record of all complaints and corrective action taken/Tracking of complaints to ensure adequate corrective action has been taken. (Complaints Register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	• Agreed corrective action, • Responsible party for corrective action, • Summary of actions taken (and date action was taken), • Status of complaint (open, closed-out, awaiting feedback etc.).				
	5. Socio-Economic				
A	The Applicant shall develop and implement a recruitment policy that allows equal opportunity to all people (woman, disabled) and give preference to local labour from eMakhazeni. Communicate the policy and requirements to the affected communities through the media, community leadership and a community liaison forum. It is strongly recommended that "labour desks" or "labour offices" should be established in easy accessible areas to facilitate the labour recruitment process.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Maximise employment opportunities for the local labour force/Approved Recruitment Policy. (ECO Monthly Checklist/Report)
B	Enter in discussions with other mines in the area about potential opportunities for sharing resources related to skills development e.g. training courses and internship agreements.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Contribute to skills development in the region/ Strategic agreement about skills development in the region. (ECO Monthly Checklist/Report)
C	Invest in skills development plans, bursaries and internships to ensure scarce skills will be available in time.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Enhance positive impacts of the project on local/regional economy. (ECO Monthly Checklist/Report)
D	Continue to engage with SMME's at the business forum and ensure that local businesses are utilized where possible.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Opportunities for SMME's/ Minutes of business forum. Procurement contracts with local service providers. (ECO Monthly Checklist/Report)
E	Engage with NGO's that are active in the area. Look for partnerships and ways of working together. Mine to approach NGO's to suggest working together.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Ensure alignment with strategies of local NGO's where possible/Verify that NGO's have been engaged and collaborated with where appropriate. (ECO Monthly Checklist/Report)
F	Establish economic plans for mine closures.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Proper planning and allocation of resources for mine closure/Verify that economic plans for mine closure have been developed. (ECO Monthly Checklist/Report)
G	Analyse avenues to undertake import substitution and material beneficiation to increase economic activities in the surrounding areas.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Increase economic activities in the surrounding areas/Verification of initiatives to increase economic activity in local area. (ECO Monthly Checklist/Report)
H	The mine should set up a Compensation Trust Fund in the amount to	Prior to construction and	Applicant	ECO (Monthly)	Compensation for Hadeco employees

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	R17 000 x 477 ha = R8 109 000 which amount could be used as collateral in the event of the Hadeco farm incurring losses as a direct result of environmental damage from the new Paardeplaats mine. The financial mechanisms (e.g. a guarantee in lieu of cash to the Trust Fund) and others can be agreed upon between the mine and Hadeco. Claims against this fund needs to be adjudicated by independent loss assessors and a direct link must be established to the mine as a cause of the financial losses.	Ongoing			that have incurred financial loss directly as a result of the Mine/Verification that the fund has been established. (ECO Monthly Checklist/Report)
I	Program of Entrepreneurship Development. In this regard it would be best to engage SEDA and to assist with the furtherance of this institute's objectives. Experience has shown that when an economic development program is selected and "sold" to the community, these projects invariably become uncompetitive. It is recommended that the mine scrutinise its suppliers and determine which of these products or services can be undertaken in EML. The mine should then liaise with SEDA in EML to identify and develop entrepreneurs. Furthermore the mine should make an honest inventory of SEDA's capacity in EML to ascertain which areas improvements can be made.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Attempt to promote Entrepreneurship Development in the region/Verification that an Entrepreneurship Development programme has been established if feasible. (ECO Monthly Checklist/Report)
6. Local/Regional Infrastructure					
A	Engage with the municipalities to discuss strategic long-term planning with regard to services such as road maintenance and housing. Coordinate the outcomes of the Social and Labour plan with the Integrated Development Plans of the municipalities. The Applicant should become a member of the IDP Forum.	Prior to construction	Applicant	ECO (Monthly)	Minutes of meetings Social and Labour Plan Membership of IDP Forum (ECO Monthly Checklist/Report)
B	Plan for worker accommodation well before the proposed onset of the project. This relates to housing and associated services. Integrate planning process with local government – make sure it is in line with spatial development planning of the area.	Prior to construction and ongoing as required	Applicant	ECO (Monthly)	Proper planning to ensure workers accommodation is ready prior to commencement of work and that it aligns with local governments integrated development planning/ Minutes of meetings with local planning departments (ECO Monthly Checklist/Report)
C	The Applicant should undertake a crack survey at the houses of directly affected neighbours prior to the onset of construction. Data obtained during this survey should be utilised to validate any complaints received relating to infrastructure damage as a result of construction or mining operations.	Prior to construction	Applicant	ECO (Once-off)	Establish baseline condition of houses prior to construction and mining to be used for comparison in the event of claims/Verify that crack survey has been undertaken. Results of crack survey. (ECO Monthly Checklist/Report)
7. Social impacts arising from impacts on the environment					
A	Engage with agriculture community with regard to dust suppression strategies that minimize the impact on their produce.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Maintain good relations with agricultural community and identify and implement appropriate measures to

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
					address dust impacts/Verification that agricultural communities have been engaged regarding dust impacts. (Meeting minutes) (ECO Monthly Checklist/Report)
B	Establish an environmental forum to give feedback to affected communities twice a year regarding environmental aspects such as dust, water and noise pollution and how the Paardeplaats mine manage and mitigate these aspects.	Established prior to construction and meeting Bi-Annually	Applicant	ECO (Bi-Annually)	Maintain communication and good relations with community/Verification that environmental forum is established and continues to meet bi-annually. (Meeting minutes) (ECO Monthly Checklist/Report)
C	Establish fund for pollution incidents and compensate affected parties for actual financial losses.	Prior to construction and Ongoing as required.	Applicant	ECO (Monthly)	Compensate affected parties for actual financial losses resulting from pollution incidents/Verification that fund has been established and affected parties compensated where appropriate. (ECO Monthly Checklist/Report)
	8. Community Health and Safety				
A	Form a partnership with a Non Profit Organisation (NPO) such as Future Families (www.futurefamilies.co.za) to provide the necessary social services to people whose lives are affected by infectious diseases.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Contribute to community health and safety/ Written partnership agreement in place. Monitoring and evaluation reports from NPO (ECO Monthly Checklist/Report)
B	The Applicant shall develop and implement a Workforce Code of Conduct to maximise positive employee behaviour in the local community, and optimise integration.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Maximise positive employee behaviour in the local community, and optimise integration/Verification that Workforce Code of Conduct has been established and is implemented. (ECO Monthly Checklist/Report)
C	Provide advanced communication (i.e. signage, advertisements in local papers) about changes to local access, potential road hazards and expected traffic volumes during construction.	Prior to construction and Ongoing	Applicant	ECO (Monthly)	Ensure community is aware of potential safety hazards/Verification that communication of safety hazards has been communicated effectively where appropriate. (ECO Monthly Checklist/Report)
	9. Emergency Response				
A	The Applicant shall develop emergency procedures for the site and shall ensure that the procedures are in place prior to commencing work. Emergency procedures shall include, but not be limited to, fire, spills, contamination of the ground, accidents to employees, and any other	Prior to construction	Applicant	ECO (Once-off)	Visual observation that written emergency procedures are in place and staff are aware of their implementation and

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	incidents or emergencies. The emergency procedures shall be incorporated into an Emergency Plan which shall be provided to the ECO and authorities upon request.				location/Verification that emergency procedures are in place and approved. (ECO Monthly Checklist/Report)
B	The Applicant shall set up a procedure for dealing with environmental emergencies such as spills, which will include notifying the ECO, and the relevant authorities if required, immediately following the incident, prior to commencing with cleanup procedures. These procedures must be developed with consultation and approval by the appointed ECO. The Applicant/Contractor(s) shall make the necessary provisions (financial, resources, materials) in order to ensure compliance with the procedure.	Prior to construction	Applicant Contractor	ECO (Once-off)	Ensure appropriate measures for addressing environmental incidents/ Verification that environmental emergency procedures are in place and approved. (Emergency response procedure) (ECO Monthly Checklist/Report)
C	The Applicant and/or Contractor shall obtain emergency contact details for a specialist spill response agency that services the area and shall inform them about the proposed project and request them formally to plan for the extension of their services.	Prior to construction	Applicant Contractor	ECO (Monthly)	Ensure prompt spill response in the event of a major spillage/Verification that specialist spill response agency has been engaged and is prepared to extend their services in the event of a major incident. (ECO Monthly Checklist/Report)
E	The Applicant should officially approach the police, inform them about the proposed project and request them formally to plan for the extension of their services.	Prior to construction	Applicant	ECO (Once-off)	Channels of communication setup with police services to allow for speedy response in an emergency. (ECO Monthly Checklist/Report)
	10. Fire Prevention				
A	The Applicant and ECO shall assess the risk of on-coming fires and where required the Applicant shall ensure that fire breaks are created prior to the onset of construction. The creation of fire breaks shall be undertaken in accordance with relevant legislation consultation with surrounding landowners and the local fire control association. Fires breaks must be maintained as necessary to ensure they remain effective.	Prior to construction and Ongoing	Applicant ECO Contractor	Mine EO (Weekly) ECO (Monthly)	Protect site and adjacent properties from oncoming veld fires/Verification that appropriate fire prevention measures, are in place where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	11. Noise & Blasting				
A	Community involvement needs to continue throughout the project. Good public relations are essential. At all stages surrounding receptors should be educated with respect to the potential increase of noise from the mine. The information presented to stakeholders should be factual and should not set unrealistic expectations.	Prior to construction and ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Maintain good relations with community and potential sensitive receptors/Verification that communication with community is ongoing. (CLF meeting minutes) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Local residents should be notified of any potentially noisy field survey works or other works during the planning and design phase and these activities should be undertaken at reasonable times of the day. These works should	Prior to construction and ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Communication with sensitive receptors to ensure noise impacts are known along with mitigating actions to

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	not take place at night or on weekends.				prevent unnecessary complaints/Verification that communication with sensitive receptors is ongoing. (ECO Monthly Checklist/Report)
C	Provide portable acoustic screens to enclose the drill rigs and compressors where necessary and feasible, and as directed by the ECO.	As required	Applicant	Mine EO (Weekly) ECO (Monthly)	Reduce noise impact from preconstruction activities/Verification that mitigation is implemented where necessary and feasible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum.	As required	Applicant	Mine EO (Weekly) ECO (Monthly)	Reduce duration of noise impacts and potential for complaints/Verification that mitigation measures are implemented where necessary. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	During the preconstruction phase, consideration must be given to the noise mitigation measures required during the construction phase and which should be included in the tender document specifications and the design.	Prior to construction	Applicant	ECO (Once-Off)	Proper planning to ensure adequate resources are allocated to noise mitigation measures during subsequent phases (ECO Monthly Checklist/Report)
	12. Rehabilitation				
A	An Integrated Rehabilitation and Closure Plan shall be developed by the Applicant prior to the onset of construction. The Plan must be viewed as a dynamic document and shall be subjected to independent review on an annual basis (together with the quantum for financial provision) and shall be updated/amended as required. As a minimum the Integrated Rehabilitation and Closure Plan shall include the following; • Desired end land use objectives, • Methodology and proposed schedule for progressive rehabilitation to be undertaken concurrently with mining operations, • Details of soil preparation procedures including proposed measures to improve soil fertility (if so required) and the sustainability thereof, • A list of the plant species that will be used in the rehabilitation process. Only indigenous species may be utilised and these species should be representative of the relevant vegetation unit/landscape type of the area, • Procedures for ensuring vegetation growth and survival (watering,	Developed prior to construction and implemented throughout lifespan of project	Applicant	ECO (Once-Off) prior to construction ECO (annually) Independent Environmental Auditor	Ensure adequate planning and provision for effective rehabilitation even in the event of or premature or unforeseen closure/Annual Independent review of Integrated Rehabilitation and Closure Plan and quantum for financial provision. (Annual performance assessments) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	fertilisation etc.), • Details of proposed storm water and erosion control measures to ensure re-vegetation is successful and not hampered by scouring and erosion, • Monitoring procedures that will be implemented to assess re-vegetation efforts (duration and frequency of monitoring, criteria for determining success of rehabilitation), • Procedures for preventing the establishment of alien invasive vegetation in rehabilitated areas.				

22.2 EMP – GENERAL

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	13. Legal Compliance					
A	The Applicant together with the ECO shall identify and comply with all relevant national, provincial and local legislation, including associated regulations and bylaws and shall establish and maintain procedures to keep track of, document and ensure compliance with environmental legislative changes.	Construction Operation Decommissioning Rehab & Closure	Prior to construction & ongoing until closure	Applicant ECO	ECO (Monthly)	Ensure compliance with relevant legislation/Confirmation that legal register is in place and up-to-date. (Legal register) (ECO Monthly Checklist/Report)
B	Should there be changes in legislation and/or regulations the Applicant shall take the necessary actions to incorporate such changes and to pass these requirements on to the Contractors.	Construction Operation Decommissioning Rehab & Closure	Prior to construction & ongoing until closure	Applicant ECO	ECO (Monthly)	Ensure compliance with relevant legislation/Confirmation that requirements in terms of updated legislation are passed onto the contractors. (ECO Monthly Checklist/Report)
C	The Applicant shall ensure that independent verification of the capacity for processing of RoM, disposal of slurry and discard, and treatment of waste is available on NBC Glisa before mining activities commence.	Pre-construction	Prior to construction	Applicant ECO	Independent Environmental Auditor (Once-Off)	Ensure compliance with relevant legislation/Confirmation of capacity in terms of Environmental Principles. (Independent Environmental Assessment)
D	The Applicant shall ensure that the area directly affected by mining shall be appropriately re-zoned both pre-mining and post-mining.	Pre-construction Rehab and Closure	Prior to construction and post-closure	Applicant	Mine Manager (Once-Off)	Ensure compliance with land zoning regulations. (Legal register)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
			14. Community Liaison			
A	Open channels of communication between the Mine and surrounding landowners/communities are essential. The Applicant shall establish a Community Liaison Forum (CLF) that meets every three months – at this forum the mine can give feedback on its activities and keep the communities informed about matters that concern them in a transparent and honest manner. The CLF must be representative of all the groups in the area and include women, youth and the elderly. The relevant authorities shall also be invited to attend CLF meetings. This forum is an important mechanism to manage expectations and build relationships. Meeting minutes must be captured and forwarded to all attendees.	Pre-construction Construction Operation Decommissioning	Prior to construction and throughout the lifespan of the project.	Applicant	ECO (Monthly)	Good relations with surrounding landowners & communities/Effective communication to maintain good relations and proactively address any potential complaints. (CLF meeting minutes) (ECO Monthly Checklist/Report)
B	The complaints register shall be maintained by the Applicant (Mine EO) and shall be distributed to the Mine EO, ECO and Mine manager on a monthly basis.	Pre-construction Construction Operation Decommissioning	Ongoing throughout lifespan of project	Applicant Mine EO	Mine EO (Ongoing) ECO (Monthly)	Written record of all complaints and corrective action taken/Tracking of complaints to ensure adequate corrective action has been taken. (Complaints Register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Maintain good working relationships with local and district government by attending their forums and individual interaction.	Pre-construction Construction Operation	Ongoing throughout lifespan of project	Applicant	ECO (Monthly)	Maintain good relations with local and district government/ Membership of LED forums Minutes of meetings (ECO Monthly Checklist/Report)
D	Ensure good relationships with affected communities by becoming a member of the community and being a responsible neighbour. Attend significant events in the community.	Pre-construction Construction Operation	Ongoing throughout lifespan of project	Applicant	ECO (Monthly)	Maintain good relations with the community/Assessment of complaints register to verify performance. (Complaints Register) (ECO Monthly Checklist/Report)
E	Engage with NGO's that are active in the area. Look for partnerships and ways of working together. Mine to approach NGO's to suggest working together.	Pre-construction Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Alignment with NGO strategies/ Partnerships between mine and NGO's in place. (ECO Monthly Checklist/Report)
			15. Socio-Economic			
A	The Applicant and Contractor(s) shall comply with all relevant legislation pertaining to labour recruitment and	Pre-construction Construction	Ongoing	Applicant Contractor	ECO (Bi-Monthly) ECO (Monthly)	Ensure legal compliance in terms of labour and employment.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	employment.	Operation Decommissioning				(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Provide housing subsidies and encourage staff that travel from outside the municipal area to reside locally through incentives such as preferential skills development opportunities for local residents.	Construction Operation	Ongoing	Applicant Contractor	ECO (Monthly)	Housing policy encouraging local residency/Skills development opportunities limited to local residents. (ECO Monthly Checklist/Report)
C	Implement workforce education programs on cultural diversity and tolerance.	Construction Operation	Ongoing	Applicant Contractor	ECO (Monthly)	Developed and presented information materials on cultural diversity to the workforce. (ECO Monthly Checklist/Report)
D	Implement the recruitment policy that allows equal opportunity to all people (woman, disabled) and give preference to local labour from EMakhazeni. Communicate the policy and requirements to the affected communities through the media, community leadership and a community liaison forum. It is strongly recommended that “labour desks” or “labour offices” should be established in easy accessible areas to facilitate the labour recruitment process.	Pre-construction Construction Operation Decommissioning	Ongoing	Applicant Contractor	ECO (Monthly)	Maximise employment opportunities for the local labour force. (ECO Monthly Checklist/Report)
E	Provide training to employees on wealth management. Thus the importance of saving and paying of bonds on properties to anticipate eventual retrenchment due to mine closure.	Construction Operation	Ongoing	Applicant	ECO (Monthly)	Ensure employees are prepared financially for eventual mine closure/Confirmation that wealth training has been conducted. (ECO Monthly Checklist/Report)
F	Enter in discussions with other mines in the area about potential opportunities for sharing resources related to skills development e.g. training courses and internship agreements.	Pre-construction Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Contribute to skills development in the region/ Strategic agreement about skills development in the region. (ECO Monthly Checklist/Report)
G	Invest in skills development plans, bursaries and internships to ensure scarce skills will be available in time.	Pre-construction Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Enhance positive impacts of the project on local/regional economy/ Social and Labour plan. (ECO Monthly Checklist/Report)
H	Engage with SMME’s at the business forum and ensure that local businesses are utilized where possible.	Pre-construction Construction Operation Decommissioning	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minutes of business forum/Procurement contracts with local service providers. (ECO Monthly Checklist/Report)
I	Provide business mentorship to identified local businesses through forums run by the Chambers of	Construction	Ongoing	Applicant	Mine EO (Weekly)	Project management staff have made allocated time available to

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	Commerce/Business forums.	Operation			ECO (Bi-Monthly) ECO (Monthly)	assist in mentoring local businesses on tender requirements and quality standards. (ECO Monthly Checklist/Report)
J	Provide training to employees on wealth management. Thus the importance of saving and paying of bonds on properties to anticipate eventual retrenchment due to mine closure.	Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure employees are prepared financially for eventual mine closure/Confirmation that wealth training has been conducted. (ECO Monthly Checklist/Report)
K	Where practical, investigate opportunities for integration of Project apprentices into local businesses to facilitate skills transfer to the local community.	Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Facilitation of skills transfer/Suitable local businesses and Project apprentices are identified and matched/Relevant agreements signed. (ECO Monthly Checklist/Report)
16. Local/Regional Infrastructure						
A	Plan for worker accommodation well before the proposed onset of the project. This relates to housing and associated services. Integrate planning process with local government – make sure it is in line with spatial development planning of the area.	Pre-construction Construction	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Proper planning to ensure workers accommodation is ready prior to commencement of work and that it aligns with local governments integrated development planning/ Minutes of meetings with local planning departments (ECO Monthly Checklist/Report)
B	Do a crack survey at the houses of directly affected neighbours. Investigate different blasting procedures.	Pre-construction Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Establish baseline condition of houses prior to construction and mining to be used for comparison in the event of claims/Verify that crack survey has been undertaken. Results of crack survey. (ECO Monthly Checklist/Report)
17. Social impacts arising from impacts on the environment						
A	Obtain baseline data about water resources and boreholes on neighbouring properties before any activities start, and provide affected parties with the information. This information should be kept for the life of the mine to use as evidence in any disputes. Monitor against these baselines and release the monitoring results to affected parties.	Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Baseline data to serve as evidence in the case of disputes. Baseline reports Monitoring results (ECO Monthly Checklist/Report)
B	Environmental forum to give feedback to affected	Pre-construction	Ongoing	Applicant	Mine EO (Weekly)	Communication with community

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	communities twice a year regarding environmental aspects such as dust, water and noise pollution and how the Paardeplaats mine manages and mitigate these aspects.	Construction Operation Decommissioning			ECO (Bi-Monthly) ECO (Monthly)	regarding environmental matters. Environmental forum established. Minutes of meetings with agricultural communities. Pollution fund established. (ECO Monthly Checklist/Report)
C	Establish fund for pollution incidents and compensate affected parties for actual financial losses.	Pre-construction Construction Operation Decommissioning	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Compensate affected parties for actual financial losses resulting from pollution incidents/Verification that fund has been established and affected parties compensated where appropriate. (ECO Monthly Checklist/Report)
D	Actively address the fears of community members relating to water pollution by using experts to explain impacts via newsletters and on community radio stations. Ensure the community relations strategy is properly implemented to ensure on-going communication.	Pre-construction Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Newspaper reports. Interviews on local radio station. Community relations strategy (ECO Monthly Checklist/Report)
	18. Community Health and Safety					
A	Form a partnership with a Non Profit Organisation (NPO) such as Future Families (www.futurefamilies.co.za) to provide the necessary social services to people whose lives are affected by infectious diseases.	Pre-construction Construction Operation Decommissioning	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Contribute to community health and safety. Written partnership agreement in place. Monitoring and evaluation reports from NPO (ECO Monthly Checklist/Report)
B	Develop and in house infectious diseases strategy to address health issues with the workforce. Align strategy with community HIV strategy followed by NPO.	Pre-construction Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Documented strategy (ECO Monthly Checklist/Report)
C	The Applicant shall develop and implement a Workforce Code of Conduct to maximise positive employee behaviour in the local community, and optimise integration.	Pre-construction Construction Operation Decommissioning	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Contribute to community health and safety/ Approved Workforce Code of Conduct. (ECO Monthly Checklist/Report)
D	Encourage workers to live in established residential areas. Provide transport from these areas to the mine.	Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Signed transport agreements with relevant service providers. (ECO Monthly Checklist/Report)
E	Implement a Health and Safety Program on site, including safety consciousness and awareness training. The program should also include relevant health aspects, e.g. sexual health, fatigue management, social health.	Pre-construction Construction Operation Decommissioning	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Health and safety of employees/Provision of safety training on site to all workers. (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
F	The Applicant shall provide advanced communication (i.e. signage, advertisements in local papers) about changes to local access, potential road hazards and expected traffic volumes during construction.	Pre-construction Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Design of appropriate signage and communication material. (ECO Monthly Checklist/Report)
G	The Applicant shall develop an Employee Assistance Program (EAP) to assist employees in dealing with personal issues and minimise impact on family assistance services locally.	Pre-construction Construction Operation	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Approved EAP provided to employees and their immediate family members. (ECO Monthly Checklist/Report)
19. Environmental Awareness Training						
A	Ongoing environmental awareness training shall be undertaken throughout the lifespan of the project in accordance with the Environmental Awareness Plan presented in this EMP (see EMPR Section 19).	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure that the contractor is aware of EMP requirements/Confirmation that awareness training is being undertaken. (Training records) (ECO Monthly Checklist/Report)
20. Site Clearance						
A	Should any threatened or Red Data species be encountered on the site, in situ conservation is unlikely to be successful and it is recommended that a specialist be consulted for possible relocation.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No disturbance or harm to threatened or red data species. (Contractor EO weekly checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	The area where vegetation will be cleared for construction and mining should be kept to the minimum area required to limit disturbance to vegetation and soil.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise construction footprint/Limit area cleared to minimum area required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
21. Topsoil and Sub-Soil Management						
A	The Applicant and contractor(s) shall adopt and implement the soil management guide developed for the Paardeplaats Mine.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Protection of soil resources/visual observation that soil management guide is being adhered to. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Topsoil shall be removed from all areas where physical disturbance of the surface will occur (up to a maximum of 30 cm depth). Topsoil must be stockpiled for re-use in subsequent rehabilitation activities outside of areas prone to erosion and 1:100 year flood plain demarcation.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate topsoil stripped for successful rehabilitation/Visual observation that sufficient topsoil is stripped. (Mine EO weekly checklist)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
						(ECO Monthly Checklist/Report)
C	To the greatest extent possible topsoil shall only be handled twice, only-once during the initial stripping of topsoil and a second time to replace it.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimal impact on soil structure and fertility/Visual observation that topsoil handling complies with EMPR conditions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	It must be ensured that the topsoil is separated from the subsoil and that the topsoil is stockpiled separately from the subsoil and construction materials.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimal loss, dilution or contamination of topsoil/Visual observation that topsoil stockpiles comply with EMPR conditions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	To prevent the development of anoxic conditions, soil compaction and loss of soil biota, stripped topsoil will be placed/stored in stockpiles which must be limited in height (preferably not exceeding 2 meter in height), and storage shall be for the shortest period possible. It is recommended that any topsoil stockpiles that are expected to remain in place for longer than 30 days be reseeded with an appropriate indigenous grass seed mix (to be approved by the ECO).	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Successful rehabilitation/Visual observation that topsoil storage complies with EMPR conditions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	Topsoil and sub-soil stockpiles must be located such that the potential for erosion is minimised. Areas with existing erosion and stability issues must be avoided. Topsoil stockpiles will not be placed within the 1:100 year floodline of a water course, and will not be placed within the path of a stormwater channel, and if necessary, will be provided with a silt fence around the perimeter of the foot of the stockpile (as directed by ECO). Stockpiles are to be stabilised if signs of erosion are visible. Any evidence of erosion, scouring, sedimentation, and/or undercutting must be rectified and rehabilitated immediately.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No erosion of topsoil/Visual observation of topsoil stockpile locations/Visual inspection for signs of erosion. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	Compacting of soil must be avoided as far as possible. The contractor should restrict the use of heavy machinery, particularly in areas outside of the physical mining footprint area to reduce the compaction of soils. No vehicles or machines will be allowed to drive over or be parked on the topsoil stockpiles.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No impact on topsoil structure/Visual inspection of topsoil stockpiles for signs of compaction/vehicular movement. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	The growth of weed species on the stockpile will be controlled. Appropriate measures shall be taken to prevent the establishment of seed bank or accumulation of other	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly)	Prevent spread of alien vegetation/Visual observation of stockpiles.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	propagules of alien invasive plants within/on the topsoil stockpile as directed by the ECO.	Decommissioning Rehabilitation			ECO (Bi-Monthly) ECO (Monthly)	(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	Topsoil shall be used for rehabilitation purposes only. During rehabilitation, all reasonable efforts should be made to return soil in reverse order to which it was removed, thereby retaining the correct soil profile, ensuring that topsoil is replaced last. Under no circumstances should subsoil be placed on top of topsoil.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Reinstate functional ecosystem by maintaining ecosystem processes/Visual observation during backfilling. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
J	There must be no contamination of topsoil. The biological, chemical and physical properties of the topsoil must not be changed by introducing detrimental foreign material, gravel, rock, rubble or mine residue to such soil (MPRDA Regulation 70(7)). This also includes littering, waste disposal, fuel or chemical contamination, plant matter dumping or other activity occurs that may introduce pollutants or foreign plant species into stockpiled soils. Material laydown areas and stockpiles of construction materials must be clearly separated from topsoil stockpiles in order to limit any contamination of the topsoil.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No contamination of topsoil/Visual inspection of topsoil stockpiles. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	Should any topsoil become polluted with a hazardous substance, the polluted soil should be managed as hazardous waste as described elsewhere in this EMP.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No contamination of the environment/Visual inspection of topsoil stockpiles. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
L	Care must be taken to protect topsoil resources on site and thereby avoid the need to obtain additional topsoil from outside the site for rehabilitation. However, in the event that additional topsoil needs to be sourced from outside the site, this shall be done with extreme caution not to introduce any alien or invasive species to the site. The topsoil shall be sourced from a location approved by, and a standard, acceptable to the ECO.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent establishment of alien vegetation/Visual observation that topsoil is sourced from an appropriate, legal source. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	22. Site access, Security and Traffic Management					
A	Access to the site must be controlled. The entire site shall be fenced so as to restrict unauthorised personnel from entering the site. Only authorised personnel are allowed on site.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No contamination of topsoil/Visual inspection of topsoil stockpiles. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	On-site vehicles must be limited to approved access routes and areas (including turning circles and parking) on the site so as to minimise excessive environmental disturbance to the soil and vegetation on site, and to	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Minimise footprint of environmental impact/Visual observation of vehicle access.

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	minimise disruption of traffic.	Rehabilitation			ECO (Monthly)	(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Site vehicles are only permitted within the demarcated construction camp or construction site as required to complete their specific task. The contractor must ensure that all staff his/her staff and employees remain within the demarcated construction site at all times.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise footprint of environmental impact/Visual observation of vehicle access. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Any new access (if required) shall first be approved by the Mine Manager and ECO (method statement may be required) and should be provided with erosion and silt pollution prevention measures.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure adequate placement (avoid sensitive areas) and design of access tracks/apply mitigation for erosion. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Labourers and contract workers (if any) should be accompanied by a responsible supervisor at all times. Construction workers shall not be allowed to receive visitors while they are within the construction site. The Labourers on site must retain some means of identification.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit potential for security risk. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	No person will be allowed to keep or use alcohol, recreational drugs, traditional or modern weapons, snares or otherwise dangerous objects on-site, or to enter the site while under the influence of alcohol or drugs.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure safety and security are maintained on site. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	Staff, employees and construction workers will not be allowed to keep (or have in their possession at any point in time) any animals, including livestock, poultry, wildlife or pets.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Avoid public nuisance, introducing foreign species/diseases to area and unsanitary conditions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	If imported sand, stone, or aggregate material is used in the construction or upgrading of access roads (or for any other purpose, this material shall be obtained from a legal source. The contractor shall inspect the premises of any prospective suppliers of such material and shall only utilise a supplier that conducts itself in an environmentally responsible manner. A copy of the relevant mining permits/right shall be obtained from the supplier and kept on record for auditing purposes.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure construction materials obtained from legal source to ensure legal compliance. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	Visitors to the site must undergo a site induction which shall include basic environmental awareness and site specific environmental requirements (e.g. site sensitivities and relevant protocols/procedures). This induction should	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Ensure visitors are aware of site environmental sensitivities, and procedures.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	be presented or otherwise facilitated by the Contractors EO/Mine EO wherever possible.	Rehabilitation			ECO (Monthly)	(Induction training registers) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
J	In the case of dual or multiple use of access roads by other users, arrangements for multiple responsibility must be made with the other users. If not, the maintenance of access roads will be the responsibility of the Applicant and/or Contractor(s). Road condition must be assessed regularly for signs of damage.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit safety risk due to damaged roads/Visual observation of road condition. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	Damage caused to public roads as a result of the construction and/or mining activities shall be repaired in consultation with the relevant municipal authorities.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit safety risk due to damaged roads/Visual observation of road condition. Verification that damaged roads are adequately repaired. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
L	Heavy vehicles should not travel at night, they should be clearly marked for visibility purposes, and travel during peak times should be avoided. These precautions should be written into the contracts of all service providers, and they should be fined if they do not adhere to the requirements.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors Safety Officer (weekly) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit the potential for road accidents. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
M	Vehicles should be in good working condition to prevent disruption of traffic in adjacent road networks and internal roads.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Visual observation of plant and vehicles for compliance with EMPR requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
N	Construction shall be limited to normal working hours, in order to limit disturbance from vehicles and construction activity.	Construction	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Visual observation of working hours. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
O	All construction and mining vehicles using public roads shall be in a roadworthy condition and their loads secured. They must adhere to the speed limits and all local, provincial and national regulations with regards to road safety and transport.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly) ECO (Bi-Monthly) ECO (Monthly)	Visual inspection of vehicles for compliance with EMPR requirements. (Vehicle inspection records)
P	Proper signage must be present in the vicinity of the site to prevent accidents. Adequate and appropriate traffic warning signage and appropriate speed limits for construction vehicles should be implemented and adhered to.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate traffic signage to prevent accidents. (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
Q	Speed humps may be constructed where appropriate to avoid speeding. Experienced drivers should be hired to drive construction vehicles in order to prevent disruption of traffic on adjacent road network and internal roads.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department (weekly)	Driver competency to be audited by HSE department/Visual observation that vehicles are not speeding. (HSE inspection reports)
R	The Applicant shall assess the Traffic EIA report (see Appendix N) and implement the recommended measures where appropriate and feasible. Some of the proposed mitigation measures are presented below.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant	ECO (Monthly)	Reduce impacts of traffic on road infrastructure/verification (ECO Monthly Checklist/Report)
23. Proposed mitigation measures for access roads and infrastructure (from Traffic EIA report – see Appendix N)						
S	The traffic impact assessment determined that no mitigation measures will be required with regards to capacity as the additional development traffic will have a minimal impact at the intersections. However, in terms of the geometry, mitigation measures should be considered at the following intersections to accommodate the heavy vehicles, in particular interlink vehicles for hauling coal, particularly from a manoeuvrability perspective: Mine access / Spitskop Road; Spitskop Road / R33; and R33 / Access to rail sidings. The mitigation measures suggested are as follows: • Minimum width of 4m for all lanes on approach to intersection; • Increasing the corner radii to 20m to ensure abnormal roads do not run over the pavement; • Right turn refuges at all intersections that are able to accommodate two heavy vehicles without restricting the flow of traffic; These mitigation measures are suggested in order to ensure that the heavy vehicles are able to successfully negotiate these intersections without running onto the pavement edges and causing damage and that they are safe for all users. With regards to the links themselves the traffic assessment showed that none of the links require upgrades in terms of capacity, but as with the intersections, mitigation measures may be required in order to ensure the roads stay in a condition fit for their purpose.					
T	It is assumed that the access to the mine will be via the existing access to ensure the minimum access on Spitskop Road. Currently the access road is not paved and it is recommended that the road be paved in the future. The reason for paving this road is to reduce the amount of gravel surfacing been dislodged and dragged / spread on to the Spitskop Road. It is recommended that the section of road to be paved, as a minimum, 50m from the intersection with Spitskop Road. The road should be a minimum width of 4m per lane.					
U	Spitskop Road is currently in a good condition and at present requires no upgrades. It is recommended that the condition of the road is monitored during the lifespan of the mine and be maintained as and when required.					
V	Some widening is required along the section of the R33 used by heavy vehicles. The widening should be carried out to specification in line with the expected vehicle loading in the future and to the relevant local authority standards and requirements.					
W	As part of the workings a number of haul roads will be constructed within the mine to carry the coal between the pit and the processing plant. The width of these roads will vary between 10m and 22m, depending on their purpose and final destination. These should be designed as gravel roads with the required layer works to ensure that they are fit for their purpose.					
X	Within the site there are a number of ponds and streams that have important, sensitive eco-systems associated with them. Ensure that roads are located outside of wetland areas by designing the mine layout in such a way that the routes between the pit and the processing plant and other areas are the shortest possible, but avoid these sensitive areas. If it is not possible to avoid these areas, then the culverts should be designed to have the minimum impact on the environment as possible and should be temporary structures that can be removed as soon as that section of the road is not required.					
Y	For the external road network it is recommended that a structural assessment of the culverts themselves is undertaken. This is required in order to determine the structural condition of these culverts. Once this has been carried out it will be possible to determine if these culverts have the structural integrity to cope with the expected loadings during the operational lifespan of the mine. If mitigation measures are required then it is recommended that they are designed to have as little impact as possible and should be designed in such a way that they can be removed at a later stage, if required.					
Z	Current public transport facilities on Spitskop Road are limited and it is recommended that a lay by be provided on Spitksop Road westbound, downstream of the Spitskop Road / Access intersection. This is suggested as the nearest lay by is currently located on the R33 and constructing a lay by in close proximity to the access road will reduce the distance that employees					

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	have to walk.					
	24. Construction and Site Camps					
A	Construction camps, site camps, offices, workshops, and any other facilities on the site shall be situated in a manner that does not adversely affect the environment. The site selection shall be undertaken in consultation with the Mine Manager and ECO, and shall be located as far as is practicable, outside the flood plain, and above the 1 in 50 flood level mark within the boundaries of the mining area. No camp or office site shall be located closer than 100 metres from a stream, river, spring, dam or pan. Any temporary structures erected during construction will be restricted to the construction camp site.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit construction footprint and minimise excessive environmental disturbance to the environment and potential for pollution/Visual observation that construction camp complies with EMP conditions. (ECO Monthly Checklist/Report)
B	No construction or mine worker shall be allowed to stay on the neighbouring sites, unless it is cleared with the neighbouring owner. In such an event all requirements for the contractor's camp will apply.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit construction footprint and minimise excessive environmental disturbance to the Environment and potential for pollution/Visual observation that construction camp complies with EMP conditions. (ECO Monthly Checklist/Report)
C	The physical footprint of any construction or site camp shall be minimised and vegetation clearance should be kept to the minimum required area. Topsoil shall be handled in accordance with the soil management principles presented in this EMP and the soil management guide developed for the Mine.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit construction footprint and minimise excessive environmental disturbance (ECO Monthly Checklist/Report)
D	All construction and/or site camps shall be enclosed with a fence. The mesh size should be small enough for the fence to act as a catch net for blown debris and as a demarcation of the site. The fence shall be maintained as required to ensure access control remains effective. All temporary fences erected by the contractor shall be removed and the site restored on completion of construction, unless otherwise agreed in writing with the Applicant.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Visual observation that fences are maintained and comply with EMP provisions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Site and construction camps must be kept in a clean, neat and tidy condition at all times. The Applicant and/or contractor shall maintain good housekeeping practises and shall comply with the relevant HSE regulations in terms of materials storage. Stockpiles of construction materials may only be placed within demarcated areas within the construction camp. Laydown areas must be kept neat and	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of the environment/Visual observation that litter control and housekeeping materials comply with EMP requirements and construction regulations.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	tidy and free of litter or waste at all times.					(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	A waste storage area must be established within the site camp/construction camp that provides for appropriate and adequate waste storage and waste separation for recycling. All waste must be adequately contained so as to prevent ground and/or water pollution. The total volume of general waste stored shall not exceed 100m^3. In the case that a storage capacity exceeding this amount is required or planned for, the necessary waste permits must be obtained in accordance with the NEMWA beforehand (GN718).	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate waste storage to reduce potential for pollution of environment/Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	The site camp/construction camp shall have adequate provision for the storage of hazardous waste (e.g. old oil filters, soil from spills etc.) and the waste shall be contained within closed containers to prevent the possibility of spillages. The total capacity of hazardous waste storage shall not exceed 35m^3. In the event that a larger storage volume of hazardous waste is expected or planned for, the necessary waste permits must be obtained in accordance with the NEMWA beforehand (GN718).	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate hazardous waste storage to reduce potential for pollution of environment/Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	All fuel storage areas shall be bunded to contain at least 110 % of the volume stored and will comply with the relevant safety regulations. Fuel storage areas may not be located within 100m of the watercourse and the total volume of fuel stored on site may not exceed 30 cubic metres (30 000l) without the necessary authorisation in terms of the NEMA. Fuel storage areas must be provided with an impervious surface with the provision to contain any potential fuel spillages during refuelling (e.g. a sealed concrete slab which drains to a sump/oil separator). No person smoke or take part in any activity that may results in sparks in the vicinity of fuels and other flammable substances to prevent ignition.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate fuel storage to reduce potential for pollution of environment/Visual observation that fuel storage complies with EMP requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	All hazardous substances shall be stored within designated areas that comply with the relevant HSE standards (e.g. access control, HSE signage, fire fighting equipment etc.) and that provide for spill prevention and containment. It is recommended that a dedicated, bunded and fenced Hazardous Storage Area is provided within the construction camp for this purpose.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate hazardous storage to reduce potential for pollution of environment/Visual observation that hazardous substance storage complies with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
J	Site camps/construction camps shall be provided with portable fire extinguishing equipment, in accordance with all relevant legislation and this equipment must be readily accessible.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate fire prevention measures/Visual observation that fire fighting equipment is readily available and maintained to standard. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	Batching of concrete and mixing of other construction materials must be conducted in an environmentally responsible manner and all mixing of these materials must be done within bunded areas or on top of impervious liner materials (e.g. batching boards) so as to prevent pollution of the ground and/or water. If a batching plant is necessary, run-off should be managed effectively to avoid contamination of any adjacent areas and must be contained within a bunded area.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of soil and water resources/Visual observation that mixing of concrete and other construction materials complies with EMPR requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
L	There may be no uncontrolled discharge of polluted water from the site camp/construction camp. Plant and equipment washing areas must be situated away from watercourses and areas of shallow groundwater, and the use of biodegradable soaps is recommended. All effluent water from the camp / office sites shall be disposed of in a properly designed and constructed system, designed to avoid erosion and situated so as not to adversely affect any water sources. Only domestic type wastewater shall be allowed to enter this system and any discharge into the environment shall comply with the applicable DWAF standards. As a general rule, the “General Limit” as presented in the DWAF Water Quality Standards and Guidelines shall apply unless otherwise directed by the ECO or authorities.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of water resources/Visual observation that no polluted water is discharged into environment. (Water quality monitoring data and reports) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
M	The Applicant/contractor(s) shall designate restricted eating areas for eating during normal working hours. There shall be adequate provision of refuse bins near to eating areas that must be cleaned on a daily basis. The feeding, or leaving of food, for stray or other animals in the area is strictly prohibited.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Avoid pollution of environment and provide hygienic and uncontaminated conditions to prevent illness/Visual observations that eating areas comply with EMPR requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
N	No open fires shall be permitted within the site camp/construction camp, except where approved by the responsible safety officer and ECO and within a designated structure designed for that purpose. In such	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Prevent veld fires and damage to environment or harm to people and animals/Visual observation for compliance with EMPR condition.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	cases fire fighting equipment must be readily available in the vicinity of the fire place and an appropriate safety representative should be present at all times during burning of the fire. All fires shall be fully extinguished after use.				ECO (Monthly)	(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
25. Sensitive Areas, Fauna and Flora						
A	The Applicant and Contractor(s) shall implement the Biodiversity Management Plan developed for the Paardeplaats mine.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise and minimise impacts on biodiversity/Verification that Biodiversity Management Plan is implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	The destruction of sensitive landscape feature shall be avoided where possible and otherwise minimised through effective planning. In areas where the destruction cannot be avoided, these features should be re-introduced in the post mining landscape.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise destruction of habitat and minimise losses of biodiversity/Observation that sensitive landscape features are avoided where possible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Where possible infrastructure should be kept on already transformed areas such as cultivated fields, forestry stand and existing homesteads. Existing infrastructure should rather be upgraded and development kept together rather than developing new infrastructure away from existing infrastructure. Construction should be planned so that migratory corridors are not destroyed to allow for regional species viability.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise destruction of habitat, loss of biodiversity and fragmentation/Verification that EMP condition is implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Infrastructure should be designed to rather follow the edge of natural areas than crossing it. If crossing it is the only option, then the area should be transected so that one large area remains rather than two equally sized areas. Infrastructure should be condensed to prevent unnecessary sprawl into sensitive areas.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise habitat loss and fragmentation/ Verification that EMP condition is implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	The staff of the mine should be educated/ informed about the risk that the introduction of foreign species have to the indigenous species. Abandoned homesteads should be monitored for the presence of domestic animals such as dogs and cats and appropriate control measures put in place. It is imperative that livestock remain isolated from the demarcated sensitive areas and that a “rotational” system of cattle camps be implemented depending on the grassland condition/trampling frequency to prohibit free-	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No introduction of foreign species. (Awareness training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	roaming of cattle.					
F	The workforce should be informed that it is illegal to harvest natural resource without the relevant permits and should be prosecuted if found in transgression of the law.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Avoid direct impacts on flora and flora and minimise loss of biodiversity. (Awareness training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	Appropriate culverts should be implemented in order to facilitate movement of mammals throughout the site and limit fragmentation. All hillslope seeps areas, especially those that support contemporary as well as historical Broad-tailed Warbler and Grass Owl habitat should be adequately buffered.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Facilitate natural biodiversity corridors and minimise fragmentation. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	All staff and workers on site shall be informed of the no-go areas on site. Follow-up training should be conducted from time to time to reinforce the sensitivity and access restriction to these areas and disciplinary action should be taken against any person that does not comply with these restrictions.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No access or impact on demarcated sensitive areas/Visual observation that access to no-go areas is prevented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	No construction workers or mine employees may disturb, hunt, set traps/snares, utilise dead or alive fauna/livestock/wildlife/fish. This includes the killing of any animal caught in construction works. No construction workers or mine employees may collect or remove firewood or medicinal plants or other plants/crops/fruits from the site or areas adjacent to the site. Disciplinary action must be taken in the event that any flora or fauna is wilfully disturbed or killed.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Avoid and limit harm to fauna and flora/Visual observation that no such prohibited activities occur on site. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
J	Any animals found within excavations should be carefully returned without harm to an adjacent area away from potential harm, but preferably not further than 200m away from where it was found.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Avoid impacts to fauna/Return animals to suitable area. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	The contractor shall ensure that no snakes discovered in excavated areas, on or near the construction site are killed or otherwise harassed. The Mine EO must be notified should a snake be found on or near the site. The Mine EO will be responsible to ensure that an appropriately skilled person is summoned to remove the snake from the site for relocation to a suitable nearby location.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Safe removal and relocation of any snake discovered to a suitable nearby location. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
L	Damage or harm to threatened plant species is illegal in terms of the National Environmental Management:	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly)	No harm to any threatened or red data list plants/Appropriate

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	Biodiversity Act (Act 10 of 2004). Threatened species are defined in terms of the most recent Red Data list of Southern African Plants. Employees and workers shall be educated with regards to any potential threatened species that may be encountered on site, and shall take the necessary actions to prevent of harm to any such species found on site.				ECO (Bi-Monthly) ECO (Monthly)	environmental training. (Training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	26. Alien Vegetation					
A	All alien vegetation occurring on the site must be controlled in accordance with CARA. The area should be assessed and the alien invasive species controlled prior to the commencement of the construction activities. The area should be monitored for the establishment and spread of alien invasive species during and after the construction phase. The weed management plan and principles for weed management presented in this EMP must be implemented throughout the lifespan of the project.	Pre-construction Construction Operation Decommissioning Rehabilitation Closure Post Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent establishment and spread of alien vegetation/Visual observation that alien vegetation is adequately controlled in accordance with EMP provisions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	All soil stockpiles shall be kept free of any weeds or alien invader plant species.	Construction Operation	Throughout the lifespan of the project	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent establishment and spread of alien vegetation/Visual observation that alien vegetation has been controlled. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	27. Weed Management Plan					
A	The Applicant, in consultation with the ECO, shall develop an appropriate weed management plan, to be implemented throughout the lifespan of the project. The weed management plan shall aim to eradicate and control alien vegetation in accordance with CARA. Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion. Specialist input shall be sought in developing the plan to ensure the potential for residual or latent impacts resulting from alien vegetation removal are minimised and mitigated. The weed management plan shall include appropriate measures for removal/control of alien vegetation across the entire site. The weed management plan shall include the following measures as a minimum; • Weeds and invader plants will be controlled in the manner prescribed for that category by the Conservation of Agricultural Resources Act or in terms of Working for Water guidelines, • Alien invasive tree species such as black wattle and blue gum should be eradicated, • Institute an eradication/control programme for early intervention if invasive species are detected, so that their spread to surrounding natural ecosystems can be prevented, • Institute a monitoring programme to detect alien invasive species early, before they become established and, in the case of weeds, before the release of seeds (including closure and post closure monitoring), The Plan must clearly define the areas from which alien vegetation must be removed as well as the plant, equipment, materials and methodology to be used (including safe disposal).					
B	Any action taken to control weeds or invader plants must be executed with caution and in a manner that will have minimal environmental impact. This is particularly important for any removal of alien species within riparian or wetland areas.					
C	Alien vegetation shall be disposed of in a responsible manner so as to prevent the potential for further dispersal or establishment. The method of disposal may vary for different species and shall be determined on a case by case basis by the ECO, who shall obtain advice from a suitably qualified expert if so required. Disposal methods to be considered may include; • Burning of the removed vegetation at an appropriate facility (burning shall not be permitted on the Mine property),					

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	• Disposal at a landfill site, Reuse of certain parts of alien vegetation may be considered but must be approved by the ECO (e.g. wood from alien trees used for firewood).					
D	The weed management plan take into account the potential for dispersal of alien vegetation (including dispersal resulting from disposal of alien vegetation). Appropriate measures to limit dispersal of alien vegetation must be included in the plan and may include, but will not be limited to the following; • If working within areas infested with alien invasive species, worker's boots and clothing, vehicles, drilling equipment and other plant/machinery/tools should be cleaned from mud, dust and other possible sources of seed/propagules before moving to other areas, in order to prevent the spread of alien invasive plant species. • Particular care must be taken to avoid the dispersal of alien seed/propagules into wetlands or aquatic ecosystems. • Proper disposal of cleared alien vegetation to prevent the further spread of alien invasive plant species. The ECO may advise on additional measures to prevent the further spread of alien invasive plant species.					
E	The use of herbicides should only be considered as a last resort if alternative methods are not feasible or practical. Application of herbicides shall only be undertaken by a suitably qualified individual in accordance with the relevant legislation and regulations. Herbicides shall only be administered by a registered Pest Control Operator (PCO).					
F	Follow up clearing may be necessary if the species re-establish following the initial clearing. Other alien species (non-listed) occurring on site may not be used in the landscaping and should be removed from site where possible.					
	28. Water Management					
A	The Applicant and Contractor(s) shall comply with the requirements of the National Water Act and GN704.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure compliance with legal provisions/Verification that contractors activities comply with NWA and GN704.
B	Any abstraction of water must be undertaken within the parameters of any relevant existing abstraction permit/license requirements or legal thresholds.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure sustainable and legal water use/Confirmation that water abstraction complies with relevant permits/authorisations. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	All water abstraction from surface or groundwater resources shall be quantified on a daily basis and details of such shall be included in environmental reports. The Mine EO shall report water usage statistics to the Mine Manager and ECO on a regular basis (at least monthly).	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure sustainable water use/Confirmation that water use complies with requirements of relevant permits/authorisations. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Adequate drinking water must be available at all times for the workforce. All drinking water must be from a legal source and comply with recognized standards for potable use (SANS 241). If water is stored on site, drinking water and multi-purposed water storage facilities shall be clearly distinguished and demarcated.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure adequate provision of potable water from a legal source/Confirmation that water source is legal. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Restrict use and/or abstraction of water from the surface and ground water resources.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly)	Minimise impacts on hydrological regime and ensure sustainable

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		Decommissioning Rehabilitation			ECO (Bi-Monthly) ECO (Monthly)	use of water resources /Assessment of water use records. (water use records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	Water must be used efficiently and sparingly. Water minimisation strategies shall be incorporated in the project design, including everything from wash basins and flush systems to capturing and reusing dirty water.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Ensure sustainable use of water resources/Confirmation that water is being used efficiently and sparingly. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	29. Surface Water, Storm Water and Erosion Control					
A	Clean and dirty water system infrastructure must be installed prior to any construction activities and take into consideration the design capacities and locations restrictions stipulated in GN 704 of the NWA.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Separation of clean and dirty water sources. Minimise impacts on watercourses/Observation that appropriate mitigation measures are implemented. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	No development should occur within the 1:100 year flood line of any drainage line. Clean and dirty water system infrastructure must be located away from surface water resources and drainage lines.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit potential for impacts to water resources/Confirmation that development and infrastructure is appropriately located. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Clean and dirty water system infrastructure must allow for clean water to re-enter the receiving environment and dirty water to be contained in PCD's.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise potential for dewatering and other impacts to water resources/Verification that storm water system is functioning as required. (GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	It must be ensured that clean and dirty water system infrastructure is operating effectively and efficiently to separate clean and dirty water. The ECO shall re-assess clean and dirty water system infrastructure on an ongoing basis and its placement to maximise system efficiency and	Construction Operation	Ongoing	Applicant Contractor ECO	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Separation of clean and dirty water sources. Minimise impacts on watercourses/Observation that appropriate mitigation measures are implemented.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	effectiveness.					(GN704 Audits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Where clean water is diverted away from construction and/or mining areas, its point of re-entry into the natural watercourse should be well protected against erosion. In addition, sediments should be effectively trapped before re-entry.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Avoid erosion, scouring and siltation of watercourses/Verification that adequate erosion and silt control measures have been implanted at discharge points. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	Considering the slope of the site, it is recommended that an additional sediment trapping facility or settling dams be located downstream of construction and upstream of Glisa Colliery. Areas should be sloped to allow for free runoff toward either clean and dirty water separation systems infrastructure and appropriately re-directed depending on whether water is either clean or dirty.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise sedimentation of watercourses/ Additional sediment trapping facility or settling dams. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	Adequate planning is required to ensure the vegetation clearance area is minimised to decrease the likelihood of erosion.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise potential for erosion/Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	No wastewater may run freely into any of the surrounding environment or neighbouring properties. The contractor shall implement the storm water design in accordance with the approved Storm Water Management Plan. The Applicant and Contractor(s) shall ensure compliance with the requirements of the National Water Act and GN704.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	No polluted runoff from site/Visual observation that stormwater is contained and managed, i.e. no rill or gulley formation. Visual observation that erosion control measures are effective. (GN704 audits) (Water monitoring reports) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	All areas susceptible to erosion shall be protected by ensuring that there is no undue soil erosion resultant from construction and/or mining activities. Berms shall be constructed where necessary to direct all runoff into the stormwater system. Care must be taken to avoid scouring and erosion and suitable measures should be placed in	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent erosion and scouring/Implement effective storm water and erosion control measures. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	areas where runoff concentrates, in order to detain the sediment load and slow down the runoff. All erosion damage shall be repaired as soon as possible as directed by the ECO.					
J	The disturbance of steep slopes, for example by the removal of vegetation, may result in slope instability and erosion by rain and surface runoff. All slopes that are disturbed during construction shall immediately be stabilised to prevent erosion.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise potential for erosion/Visual inspection of slopes for compliance with EMP requirements and signs of erosion. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	All storm water and erosion control mechanisms must be inspected frequently and shall be maintained on a regular basis to ensure they remain effective. Appropriate remedial action, including the rehabilitation of eroded areas, shall be undertaken under direction from the ECO.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Maintain storm water & erosion control measures to ensure erosion is effectively mitigated/Visual observation that measures are maintained and remain effective. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
L	Dirty water dams (e.g. PCDs) must be lined to prevent potential contamination of ground and/or surface water resources. All dams must be equipped with an appropriate silt trap that is regularly cleaned and maintained.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise pollution of surface water resources/Confirmation that dams have been designed and constructed with appropriate lining. (Civil design drawings) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
30. Guide to Installing Erosion and Siltation Management Measures (from the Wetland EIA Report – see Appendix P)						
A	These are made up of Bidim™ and /or shade cloth held in place with poles every 1 meter (maximum) apart. The Bidim should be placed against the y-poles and an extra length of about 1 meter should lie on the bottom of the stream facing upstream to ensure no sediment can escape underneath the wall. The height of the Bidim walls should be 10cm above the water level. These walls must cover the whole breadth of the gully and should not allow any water through that has not passed through the Bidim wall. These sediment barriers must be inspected every week to ensure they are still functioning. If a build-up of sediment occurs then the sediment must be removed. If the barriers are washed away by a flood or damaged in any way the replacement should occur as soon as possible.					
B	These should be placed horizontal to the flow direction and should cover the whole length of the slope or preferential flow path. Firstly a trench about 20cm (about half the height of the fibre roll) should be made in the flow path fibre roll placed in the trench. The trench should then be filled around the roll and compacted- using hand tools. The roll should then be permanently attached to the gully using wooden stakes leaving no more than 50mm of the stake protruding from the top of the roll. If high flow volumes are expected a double stake should be placed on both sides of the roll. These two stakes should then be tied together using wire and pulled taught.					
C	These should be placed in their length across areas where erosion gulleys have formed. Excavation of soil should be done to a depth half that of the bales. The bales should then be placed in the trench and secured using stakes. If any of the bales being used disintegrates it should be replaced. Broken bales will break up even further once in free flowing water. Surrounding soil needs to be replaced and compacted using hand tools.					
D	The stakes should all preferably be made from treated wood. The standard length of the stakes should be 800mm long and 40mm wide to ensure a wide variety of applications. To ensure the stakes are properly used they should all be installed a minimum of 500mm below the surface. Any protrusions above any structures should not exceed 50mm.					

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E	Netting should be used that allows 60% of the surface to be open to allow for the germination of seeds through the netting. These nets come in widths of 1.3 and 1.5 meters. These should be anchored to the bank walls with wooden stakes 1.5-2 meters apart. The hessian should also be applied vertically. The hessian should not be placed as far as the bottom or aquatic zone but should still reach the fibre rolls. Before the installation of the hessian, proper soil preparation by hand using a hoe must be done to ensure the proper seed beds are formed.					
31. Wetlands and Aquatic Ecology						
A	Limit the extent of the development footprint to exclude aquatic resources as far as possible.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise damage to wetlands and aquatic ecology/ Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Take the necessary precautions to avoid any impacts to wetlands outside of the required construction and/or mining footprint. These areas should be considered as no-go areas, and the restriction should be enforced.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise damage to wetlands and aquatic ecology/ No damage to wetlands outside of required development footprint. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Where construction and/or mining is required within wetland areas, the contractor shall ensure that the limits of the activities are clearly demarcated prior to the onset of construction/mining in these areas so as to avoid unnecessary direct impacts to the vegetation beyond the limits of construction/mining.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise damage to wetlands and aquatic ecology/ Visual inspection to confirm that development/mining areas are clearly demarcated. No damage to vegetation beyond limits of construction/mining. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Any wetlands impacted during the construction process on site should be rehabilitated in accordance with the principles and guidelines presented in this EMP (see Section 32 below).	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise damage to wetlands and aquatic ecology/ Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Re-vegetate all bare wetland areas not directly within the footprint of the developments as soon as possible. The extent of the disturbance should be limited to a minimum.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Effective rehabilitation of wetlands/Visual inspection to confirm that rehabilitation efforts are adequate. (Mine EO weekly checklist)

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						(ECO Monthly Checklist/Report)
F	A shallow berm should be constructed between the proposed opencast footprint and the downslope wetlands to prevent sediment rich runoff from excavated areas entering the wetlands. These berms should thus be constructed prior to the commencement of excavating the opencast pit.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise sedimentation of wetlands/Observation that berm has been constructed. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	Implement an aquatic bio-monitoring and water quality programme. Where target endpoints are not met, recommendations should translate directly into follow-up action that is recorded and auditable.	Pre-construction Construction Operation Decommissioning Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Monitor potential impacts on aquatic ecology/Verification that bio-monitoring program is implemented. (Bio-monitoring reports) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	Prohibit the stocking of any alien fish species into dams or streams within the mining area. If alien fish species are present or observed within the mining area, they should be removed.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent spread of alien fish species and impacts on indigenous fish populations. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	Should fish from the dams within the mining area be utilised as a food source, a Human Health Risk Assessment must first be done to ensure that the fish is safe for human consumption. Until such studies have been conducted, consumption of such fish should be avoided.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent health impacts arising from consumption of fish that may be exposed to contamination. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
J	Construction of a low berm, approximately 1m high by 2-3m wide between the stockpiles and the wetlands. These berms would serve to intercept flows containing suspended sediments and create a depositional environment. They should be located outside the wetland boundaries and should be created prior to construction and vegetation clearing on the stockpile footprint commencing.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise damage to wetlands and aquatic ecology/ Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	No dirty water may be discharged into any wetland or water resource on site unless treated to the required standards.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise damage to wetlands and aquatic ecology/ Visual inspection to confirm that the minimum possible area is cleared for construction and mining activities inside wetlands. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
L	Regular monitoring of the success of wetland rehabilitation measures must be undertaken. Where required, the necessary adjustments should be made to ensure the complete re-establishment of the natural vegetation.	Construction Operation Decommissioning Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure successful rehabilitation of wetlands is undertaken/Verification that monitoring and corrective actions are undertaken as required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
32. Wetland Rehabilitation Guidelines (from the Wetland EIA Report – see Appendix P)						
Addressing Soil Compaction	Soil compaction should be alleviated through ploughing/ripping and scarifying, followed by landscaping to the natural/surrounding landscape profile. Where ploughing/ripping takes place on slopes leading towards wetland areas or water courses, sediment barriers (see below) should be installed along the lower edge of the ploughed area.					
Re-vegetation	Once soil preparation is complete, seed beds should be prepared as follows: Furrows should be made in the soil by hand using hoes. Furrows must be made horizontally in the soil (parallel to slope) and should be spaced 0.4 meters (maximum) apart and at least 10 cm deep. Work should commence from the top of the slope and be conducted downwards and any loose soil and rocks from the process should be removed to prevent siltation of the wetlands downwards. The beds should follow the contours of the land and not in any way allow water to collect or flow in high volumes, thus creating erosion gullies. Larger clumps of soil and stones should be removed to prevent impeded flow of water. On steep slopes and high erosion risk areas the use of hessian blankets is recommended to increase erosion protection.					
	Seeding should commence as soon as the hessian is in place and seed bed preparation has been completed. Either hand or hydro-seeding can be considered, depending on the area required to be planted. Both hand and hydro-seeding must be done by professionals only. If any fertilizers are recommended these should be applied to the side slopes only and not within the wetland. If hydro seeding is selected for the seeding process the hydro-seeders used must run for 10 minutes at least before the commencement of the seeding project. This is to ensure adequate mixing of the seed and water. Water extraction for the hydro-seeding from the wetlands and pans is not allowed unless authorization is received from the Department of Water Affairs. A good rehabilitation grass mix can be obtained from Advanced-seed or African grass seeds, but must contain indigenous grass species which are conspicuous in the Highveld grassland. Once the initial rehabilitation has been completed the rehabilitated areas should be checked for erosion at the end of the first summer. If erosion is observed, appropriate action should be taken to limit its extent.					
Alien Vegetation Control	Alien plants are likely to colonise the areas disturbed during the construction/decommissioning process. Areas disturbed during the construction process should be checked on a 6 monthly basis and any undesirable plants encountered in the areas immediately upstream and downstream of the rehabilitated areas should be removed, ideally by hand so as to reduce the risk of herbicides being transferred further into the wetlands.					
	The removal of Category 1, 2 and 3 Declared Weeds is compulsory in terms of the regulations formulated under “The Conservation of Agricultural Resources Act” (Act No. 43 of 1983).					
	Exotic plantations should be checked for breeding owls and breeding raptors. If there are any, then these trees should be left as is, if at all possible.					
33. Ground Water Pollution						
A	The Applicant and contractor(s) must take all reasonable measures to avoid and limit pollution of groundwater resources as a result of site activities. Pollution could result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage, waste water containing organic waste, detergents, solid waste and litter etc. The Applicant and Contractor(s) shall comply with the requirements relating to hazardous materials and spill management presented in this EMP.	Construction Operation Decommissioning Rehabilitation Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Avoid and limit pollution of groundwater/Verification that EMP mitigation measures are implemented to avoid and limit groundwater pollution. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
B	In the event of pollution caused as a result of construction activities, the responsible party, according to section 20 of the National Water Act (Act No. 36 of 1998) shall be responsible for all costs incurred by organisations called to assist in pollution control and/or to clean up polluted areas.	Construction Operation Decommissioning Rehabilitation Closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Compliance with NEMA/Polluter pays principle. (ECO Monthly Checklist/Report)
34. Heritage Features						
A	In the event that graves or cemeteries must be relocated, a full grave relocation process must be undertaken that includes comprehensive social consultation. The grave relocation process must include: • A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, which will be at least 60 days in length; • Site notices indicating the intent of the relocation • Newspaper Notice indicating the intent of the relocation • A permit from the local authority; • A permit from the Provincial Department of Health; • A permit from the South African Heritage Resources Agency, if the graves are older than 60 years, or unidentified and thus presumed older than 60 years; • An exhumation process that keeps the dignity of the remains and family intact; • The whole process must be done by a reputable company that is well versed in relocations; • The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.	Pre-construction Construction Operation Decommissioning Rehabilitation	As required	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Exhumation process that keeps the dignity of the remains and family intact and complies with legal requirements/Verification that a proper relocation process is undertaken. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction and mining employees.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Awareness regarding cultural heritage and appropriate protective measures and procedures/Verify that training has been conducted. (Training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	All buildings must be evaluated for the possible presence of infant burials through social consultation. A permit from the Provincial Heritage Resources Authority Mpumalanga	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly)	Compliance with relevant legal requirements and contribution to knowledge and research through

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	would be required if heritage structures need to be demolished. The remains of the buildings should be mapped and documented by photographs and drawings.	Decommissioning			ECO (Bi-Monthly) ECO (Monthly)	documentation of findings by a specialist/Verify that specialist has carried out appropriate procedure and permits are in place prior to demolition. (Destruction permits) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	If a possible heritage site is discovered during construction or mining activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions. Depending on the type of site this can include initiating a grave relocation process, documentation of structures or archaeological excavations.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Protection of Heritage resources/Visual observation that no heritage sites have been unearthed or damaged. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	35. Palaeontology					
A	The Applicant shall assess the Heritage EIA report (see Appendix G) and implement the recommended measures relating specifically to Palaeontology where appropriate and feasible (see below).	Construction Operation Decommissioning	Ongoing	Applicant	ECO (Monthly)	Contribute to understanding and research of paleontological features/Verification that excavations are monitored for signs of fossils and where these are found a specialist is afforded the opportunity to document the findings. (ECO Monthly Checklist/Report)
	36. Proposed mitigation measures relating to Palaeontology (see Heritage EIA Report – Appendix G)					
A	When the potential exists for new fossils to be exposed through excavations, it is the responsibility of the on-site Contractors EO and/or Mine EO to monitor excavation activities and report the occurrence of any fossiliferous material to SAHRA and an appropriate palaeontological expert, to allow the material to be thoroughly assessed, recorded and professionally excavated or sampled.					
B	Inspections should be performed during any excavations that disturb bedrock, and between blasting cycles in open cast mines, when the face wall and floor of the pit are exposed; in the case of underground mining activities, it would be particularly the roof of the shaft that would be examined for evidence of fossil floras.					
C	In the event that lenses of sedimentary rocks containing well-preserved plant fossils are found, a palaeontologist must be afforded the opportunity to excavate a representative sample of the flora, and to document the depositional context as reflected by the adjacent rocks and coal seams; a scientifically useful palaeobotanical collection must be made. There is little value in collecting a few blocks of the material – this is not a representative sample of a fossil flora. A strategy of bulk collecting must be employed, whereby a relatively large and unbiased sample of the flora is collected, with collectors not giving undue attention to those elements that are attractive, well-preserved or rare. The associated geology, which will also be destroyed during mining must be documented photographically (with scale). Floras with no context are increasingly coming to be considered of limited palaeontological value.					
D	To avoid delays, the mine must be prepared to assist in the removal of blocks containing high quality plant fossil material, and in the storage on the mine property of unprepared fossiliferous blocks until such a time as the material can be properly processed by a palaeontologist. Storage facilities must be such that the blocks are not exposed directly to the elements.					
	37. Hazardous Substance Management					

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
A	All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate hazardous storage to reduce potential for pollution of environment/Visual observation that hazardous substance storage complies with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Hazardous substances shall be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. Hazardous storage areas shall be bunded (impermeable) with adequate containment (at least 110% the volume stored) for potential spills or leaks. Bunded storage areas shall be either be provided with an oil separator or sump. Waste from spillages can then be removed and recycled or disposed of responsibly.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate provision for spill prevention and containment/Visual observation that storage facilities comply with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	All fuel storage areas shall be bunded to contain at least 110 % of the volume stored and will comply with the relevant safety regulations. Fuel storage areas must be provided with an impervious surface with the provision to contain any potential fuel spillages during refuelling (e.g. a sealed concrete slab which drains to a sump/oil separator). The applicant and Contractor(s) must ensure that employees and labourers do not smoke or take part in any activity that may results in sparks in the vicinity of fuels and other flammable substances to prevent ignition.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate fuel storage to reduce potential for pollution of environment/Visual observation that fuel storage complies with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Refuelling may only take place within a dedicated area inside the site camp that is subject to appropriate spill prevention and containment measures Refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. Drip trays must be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages shall be contained and cleaned up promptly.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Pollution prevention during refuelling/Visual observation that use of spill prevention measures such as drip trays is adequate. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Any containers in which hazardous substances (e.g. fuel, paints, solvents) are stored shall be clearly marked as to the contents therein (in accordance with OHSA regulations).	Pre-construction Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Clear identification of hazardous substances to ensure correct fire prevention and spill response measures can be applied in the

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
		Decommissioning Rehabilitation			ECO (Monthly)	event of a spillage/Prevent accidental ingestion of hazardous substances/Visual observation that storage containers are adequately marked. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	All relevant national, regional and local legislation and relevant norms and standards with regard to the transport, use and disposal of hazardous materials shall be strictly complied with.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Compliance with relevant legislation, regulations, norms and standards. (Legal register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	Any excess or waste material or chemicals should be removed from the site and should preferably be recycled (e.g. oil and other hydrocarbon waste products). Any waste materials or chemicals that cannot be recycled shall be disposed of at a suitably licensed waste facility.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Responsible management of hazardous substances to prevent pollution of the environment. Waste minimisation/Visual observation that wastes are managed appropriately. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	Hazardous waste may only be disposed of at a licensed hazardous waste disposal facility. A specialist waste contractor shall dispose of such waste and shall be required to provide waste manifests and safe disposal certificates. The 'cradle-to-grave' principle must be complied with.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate disposal of hazardous waste/Environmental audits of waste register and manifests to ensure cradle-to-grave principle has been complied with. (Waste register/Waste manifests) (Safe disposal certificates) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	The Contractor shall ensure that all relevant personnel on site are properly trained concerning the proper use, handling and disposal of hazardous substances. If required, advice shall be obtained from the manufacturer with regard to the safe handling and storage of hazardous materials.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate training to ensure proper use, handling and disposal of hazardous substances/Visual observation that hazardous substance management complies with EMP requirements. (Environmental training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
J	The contractor shall supply the Mine EO with a list of all hazardous materials that would be present on site during	Pre-construction	Ongoing	Applicant	Contractors EO (Daily)	Documentation available on site relating to correct use, handling,

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	the construction period. The same applies to any sub-contractor that should provide the contractor with this information. The Mine EO shall develop and maintain a hazardous substance register for all hazardous materials that shall be kept on site during all phases of the project. The register shall be provided to the ECO upon request. Material Safety Data Sheets (MSDS) must be available on site and readily accessible for all hazardous substances stored. It is recommended that copies of the MSDS for all hazardous substances stored are kept within the hazardous storage area for quick reference in the event of a spillage.	Construction Operation Decommissioning Rehabilitation		Contractor	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	storage and disposal of hazardous substances/Audits to confirm that MSDS records are adequate and sufficient training has been conducted. (Hazardous substance register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	Storage areas must be kept as dry as is practically possible and all storm and rain water collected in storage areas must be removed and disposed of in the PCD's.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Reduce potential for pollution of water resources/Visual observation that appropriate mitigation measures are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
			38. Pollution Prevention			
A	Plant and equipment used during construction and mining must be adequately maintained so that during operations it does not spill oil, diesel, fuel, or hydraulic fluid. All plant and equipment must be inspected regularly (daily) to ensure that it is in good working condition, clean, and free from leaks of oil, petrol, diesel, hydraulic fluid and contaminating compounds.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit leaks and spills that can pollute the environment/Visual inspection of plant and equipment that it complies with EMP requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Any equipment that may leak, and does not have to be transported regularly, shall be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays shall be of a size that the equipment can be placed inside it. Daily inspections shall be carried out to ensure such spill prevention measures are in place and remain effective. Drip trays shall be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate spill prevention measures to avoid pollution of the environment/Visual observation that drips trays are present and utilised. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Appropriate measures must be implemented to ensure that rainwater does not run into areas containing cement, oil, diesel etc. as this could result in a pollution threat. Storage areas for these substances should be placed on high-lying ground, and surrounded by erosion control measures e.g.	Pre-construction Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent polluted runoff contaminating environment/Visual observation that hazardous materials storage does not result in polluted runoff.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	rows of filled onion bags, silt fences etc.					(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Servicing and maintenance of vehicles on-site shall be avoided as far as possible. Where possible, the maintenance of vehicles and equipment used for any purpose during the construction and/or mining operation will take place only in the maintenance yard area (subject to suitable spill prevention and containment measures). If emergency repairs are required elsewhere on the construction site, this shall be undertaken with the necessary spill prevention measures in place, as directed by the Mine EO.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit leaks and spills that can pollute the environment/Visual observation that appropriate measures are in place during emergency repairs. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Runoff from the site must be free of oil and waste and litter before joining the stormwater system. This will be ensured by securing any hazardous substances, in order that it does not enter runoff, and by cleaning up any refuse and construction material from the site.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of the environment from contaminated runoff/Visual observation that runoff into the stormwater system is not polluted. Water quality results if required. GN704 audits (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	39. Concrete/Cement Mixing and Batching					
A	Cement and liquid concrete are hazardous to the natural environment on account of the very high pH of the material, and the chemicals contained therein. As a result the contractor shall ensure that: • Concrete shall only be mixed on mortar boards, and not directly on the ground, • The visible remains of concrete, either solid, or from washings, shall be physically removed immediately and disposed of as waste, (Washing of visible signs into the ground is not acceptable). • All excess aggregate shall also be removed.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of soil or water resources/Visual observation that batching areas comply with EMP provisions. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Batching of concrete and mixing of other construction materials must be conducted in an environmentally sensitive manner and all mixing of these materials must be done within bunded areas or on top of impervious liner materials (e.g. batching boards) so as to prevent pollution of the ground and/or water.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of soil or water resources /Visual observation that mixing of concrete and other construction materials complies with EMPR requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
C	The Applicant and Contractor(s) should rather try to make use of ready mix concrete. However, if a batching plant is necessary, run-off should be managed effectively to avoid contamination of any adjacent areas and the plant must be contained within a bunded area.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of soil or water resources/Visual observation concrete mixing and washing of plant and equipment complies with the EMP requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Trucks delivering concrete shall not be washed on the site (including washing out the chute). Concrete trucks must be washed off site at a dedicated and approved area for such activity.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of soil or water resources/Visual observation that concrete washing takes place on site. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	The Applicant and Contractor(s) shall inspect the premises of any prospective concrete supplier and shall only utilise a supplier that conducts itself in an environmentally responsible manner. The contractor is advised in this regard that the washing large concrete-mixing trucks should only be done off-site, within a designated area designed for that purpose which allows for containment of the wastewater for appropriate disposal and prevents pollution of the environment.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Duty of care to the environment/Site inspection to ensure supplier conducts itself in an environmentally responsible manner. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	Water from washing mixing equipment (mixers, tools and the like) shall not be discharged overland. The washing of equipment shall be done in a demarcated area which has provision for spill prevention. Such water shall be collected, and removed from the site and disposed of in the correct manner. It is recommended that water from washing equipment is reused as far as possible to reduce the amount of waste water that must be removed from site.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of soil or water resources/Visual observation that equipment is washed within dedicated area and pollution is prevented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
40. Waste Management						
A	The Contractor shall take note of the environmental management principles referenced in the NEMA (see EMPR Section 13). In respect of waste management, the 'cradle-to-grave' principle in particular must be adhered to so as to ensure accountability for correct waste handling, storage and disposal.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Accountability for waste management /Paperwork audits to verify compliance with cradle-to-grave principle. (Waste register) (Waste disposal records) (Safe disposal certificates) (ECO Monthly Checklist/Report)
B	Environmental awareness training given to workers on site	Construction	Ongoing	Applicant	Contractors EO (Daily)	Ensure adequate awareness is

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	shall include explanations and examples of the Environmental management principles referred to above, particularly the 'duty of care' and 'cradle-to-grave' principles, and how these relate to waste management activities on site. The information shall be conveyed in manner that is clear and easy to understand and shall also be given in the preferable language of the workers.	Operation		Contractor	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	created amongst workforce to ensure adequate implementation of waste management system. (Training records) (ECO Monthly Checklist/Report)
C	The Applicant and/or Contractor(s) shall implement a refuse control and removal system that prevents the spread of refuse within and beyond the construction site. Refuse refers to all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste etc.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure waste is adequately controlled in a responsible manner/Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Contractor EO daily checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	The waste management system shall provide for adequate waste storage (in the form of bins with lids), waste separation for recycling, and frequent removal of non-recyclable waste for permanent disposal at an appropriately licensed waste disposal facility. No waste material is to be disposed of on site. Under no circumstances may there be any burial of waste on the site.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure waste is adequately controlled in a responsible manner/Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Waste register) (Waste disposal records) (Safe disposal certificates) (Contractor EO daily checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	All refuse shall be disposed of in refuse bins which shall be emptied on a daily basis. These bins must be adequate in number and accessibility. Refuse bins shall be watertight, wind-proof and scavenger proof and shall be appropriately placed throughout the site and shall also be conspicuous (e.g. painted bright yellow). Refuse must also be protected from rain, which may cause pollutants to leach out. Particular caution is to be exercised with regards to handling of hazardous waste, to ensure that it does not spill or leak from the waste collection containers.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure waste is adequately controlled in a responsible manner/Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Contractor EO daily checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	If skips are utilised for waste storage, these shall be provided with tarps to prevent the ingress of water and waste being blown by the wind. Skips utilised for inert material such as concrete rubble or wood do not need to	Pre-construction Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Prevent contamination of environment from waste storage/Visual observation that waste management complies with

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	be covered with tarps.	Decommissioning Rehabilitation			ECO (Monthly)	EMP requirements and relevant norms and standards. (Contractor EO daily checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	Waste shall be separated into reusable, recyclable and non-recyclable waste, and shall be further separated as follows: • Hazardous waste, consisting of substances that may be harmful to the receiving environment, and therefore require precautionary measures when handled. Examples include (but not limited to) oil, paint, diesel. • General waste, consisting of non-hazardous substances and substances that cannot be recycled. Examples include (but not limited to) construction rubble, excess construction materials that cannot be reused. • Recyclable waste, (where volumes are sufficient to make recycling feasible) shall preferably be deposited in separate bins. Recyclable material includes paper, tins and glass. The contractor is advised that "Collect-a-Can" collect tins, including paint tins, chemical tins, etc. for recycling.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure proper categorisation of waste to ensure correct handling and disposal/Visual observation that waste categorisation and separation complies with EMP requirements. (Contractor EO daily checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	The total capacity of hazardous waste storage shall not exceed 35m^3. In the event that a larger storage volume of hazardous waste is expected or planned for, the necessary waste permits must be obtained in accordance with the NEMWA beforehand (GN718).	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate hazardous waste storage to reduce potential for pollution of environment/Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	The total volume of general waste stored shall not exceed 100m^3. In the case that a storage capacity exceeding this amount is required or planned for, the necessary waste permits must be obtained in accordance with the NEMWA beforehand (GN718).	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Appropriate waste storage to reduce potential for pollution of environment/Visual observation that waste management complies with EMP requirements and relevant norms and standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
J	The appointed waste removal company shall truck refuse	Pre-construction	Ongoing	Applicant	Contractors EO (Daily)	Ensure responsible waste disposal

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	collected out of the site. Refuse which cannot be reused or recycled must be disposed of at a suitably registered disposal facility, which is also approved of by the ECO. Refuse may not be burned or buried on, or near the adjacent properties (nor on any other properties that are not specifically registered for such activity).	Construction Operation Decommissioning Rehabilitation		Contractor	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	and compliance with legal requirements/Visual observation that waste is disposed of at the approved facility. (Waste register) (Waste disposal records) (Safe disposal certificates) (Contractor EO daily checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	Littering shall be strictly prohibited. The contractor shall provide labourers to clean up the site camp and construction site on a daily basis. These areas shall then be inspected by the contractor to ensure compliance with this requirement. A litter patrol around the construction area is to take place twice a week to ensure that all litter is cleared up.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent contamination of environment from litter/Visual observation that site is free of litter/regular litter patrols to remove litter. (Contractor EO daily checklist) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
L	The Contractor shall maintain a waste register which shall be used to track all waste removed from site. Proof of appropriate waste disposal shall be kept on file at the site for auditing purposes.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Responsible management of waste in compliance with cradle to grave principle/Audits to verify compliance. (Waste register) (Waste disposal records) (Safe disposal certificates) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	41. Sewage and Sanitation					
A	There must be adequate provision for safe and effective sanitation (i.e. ablution facilities) at the site and these shall conform to all relevant health and safety standards and codes. The Contractor shall ensure compliance with the OSH Act in terms of sewage and sanitation (managed by safety department). Under no circumstances will pit latrines, french drain systems or soak away systems be allowed.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department ECO (Bi-Monthly) ECO (Monthly)	Safe and effective sanitation that complies with legal provisions of OHSA and regulations/Visual observation that EMP and legal requirements relating to sewage and sanitation are met. (Safety audit reports) (ECO Monthly Checklist/Report)
B	Toilets must be easily accessible. Toilets shall be placed outside areas susceptible to potential flooding and shall not be placed within 50m of any wetland or watercourse. Ablution facilities shall be located a sufficient distance from	Pre-construction Construction Operation	Ongoing	Applicant Contractor	Safety Department ECO (Bi-Monthly) ECO (Monthly)	Safe and effective sanitation that complies with legal provisions of OHSA and regulations/Visual observation that EMP and legal

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	any offices or eating areas to prevent nuisance from offensive odours. Sanitary arrangements shall also be to the satisfaction of the ECO.	Decommissioning Rehabilitation				requirements relating to sewage and sanitation are met. (Safety audit reports) (ECO Monthly Checklist/Report)
C	In the case of chemical toilets, there must be a minimum of one chemical toilet provided per 15 persons. The toilets shall be of a neat construction and shall be provided with doors and locks and shall be secured to prevent them from falling over. Toilet paper dispensers shall be provided in all toilets and toilet paper shall be supplied at all times. Construction labourers and mine employees may only make use of formal toilets provided on site.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department ECO (Bi-Monthly) ECO (Monthly)	Safe and effective sanitation that complies with legal provisions of OHSA and regulations/Visual observation that EMP and legal requirements relating to sewage and sanitation are met. (Safety audit reports) (ECO Monthly Checklist/Report)
D	The Contractor (or reputable toilet-servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. Chemical toilets or conservancy tanks (as the case may be) shall be emptied/serviced frequently to avoid offensive odours (at least weekly). Toilets must be kept in a clean, neat and hygienic condition. The contractor shall ensure that all chemical toilets are cleaned and emptied before the builders' or other public holidays.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department ECO (Bi-Monthly) ECO (Monthly)	Ensure clean and sanitary conditions and prevent nuisance from offensive odours/Visual observation that ablution facility location and servicing complies with EMP requirements. (Safety audit reports) (ECO Monthly Checklist/Report)
E	All reasonable measures shall be taken to ensure that no spillage occurs when chemical toilets are cleaned and emptied. Any accidental spillage must be reported to the Contractors EO and cleaned up immediately.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of environment/Visual observation that there are no spillages from cleaning of chemical toilets. (Safety audit reports) (ECO Monthly Checklist/Report)
F	If the Contractor (or reputable toilet-servicing company) fails to provide and/or maintain all site sanitation facilities in a clean and hygienic condition, the ECO (or public) may request the contractor to suspend work until the requirements have been met.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department ECO (Bi-Monthly) ECO (Monthly)	Prevent pollution of environment/Visual observation that there are no spillages from cleaning of chemical toilets. (Safety audit reports) (ECO Monthly Checklist/Report)
G	Disposal of sewage shall be in a safe and responsible manner and at an approved facility specifically for that purpose. The Contractor shall retain proof of sewage removal and disposal slips on file for auditing purposes.	Pre-construction Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department ECO (Bi-Monthly) ECO (Monthly)	Responsible disposal of sewage/Visual observation that there are no spillages from cleaning of chemical toilets. (Safety audit reports) (ECO Monthly Checklist/Report)
42. Environmental Emergency Response						

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
A	Lists of all emergency telephone numbers / contact persons must be kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project. Emergency contact details shall include, but not be limited to, • The Mine Manager; • The Mine EO; • The ECO; • Local municipal authorities; • Local police and traffic police; • Local fire departments; • Local medical facilities and ambulance; and • Specialist emergency spill response agency.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure emergency contact numbers are readily available on site. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	All medium and major incidents (see EMPR Section 17.4) must be reported to the Mine EO, ECO and Mine Manager within the same shift. An incident report shall be compiled for all medium and major incidents and these shall be submitted to the Mine Manager and ECO within 5 working days of the occurrence. All incidents shall be addressed with adequate corrective action and within the timeframe specified by the ECO (in consultation with the Mine Manager). All environmental incidents must be recorded in the relevant incident registers maintained by the Contractors EO, Mine EO and ECO.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate corrective action to address incidents and reduce environmental impact/Visual observation to confirm there are no unreported and/or unrectified incidents. (Incident reports and registers) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	All environmental incidents (including minor incidents) must be reported to the Contractors EO in accordance with the incident reporting procedure immediately once they occur or are discovered on site. All forms of environmental awareness training (site induction, training sessions, toolbox talks, informal training, awareness posters) shall emphasise this requirement.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate corrective action to address incidents and reduce environmental impact/Visual observation to confirm there are no unreported and/or unrectified incidents. (Incident reports and registers) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Adequate spill cleanup materials and equipment (e.g. spill kits) must be readily available on site to deal with spillage of the hazardous substances present should they occur, and staff shall be trained in terms of their use.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate provision for spill response and cleanup/Visual observation that spill kits are in place and adequate. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	All spillages must be addressed as soon as possible after occurrence. This is necessary to prevent the spillage from	Construction	Ongoing	Applicant	Contractors EO (Daily)	Timeous spill cleanup to prevent contamination of the

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	spreading and to mitigate the impact of the spillage on the environment. In the case of large spillages, a specialist spill response agency must be contacted immediately to clear the spillage. The clean-up of spills caused as a result of the construction activities, and any damage to the environment, shall be for the contractor's own account.	Operation Decommissioning Rehabilitation		Contractor	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	environment/Visual observation that any spills are timeously and adequately cleaned up. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	In the event of an emergency incident (unexpected sudden occurrence), including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the Applicant shall notify the relevant authorities in accordance with Section 30(3) of the National Environmental Management Act (Act 107 of 1998).	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Compliance with legal provisions. (Incident registers) (Correspondence with Authorities) (ECO Monthly Checklist/Report)
	43. Fire Prevention					
A	The Applicant and ECO shall assess the risk of on-coming fires and where required the Applicant shall ensure that fire breaks are created and maintained. The creation of fire breaks shall be undertaken in accordance with relevant legislation consultation with surrounding landowners and the local fire control association. Fires breaks must be maintained as required to ensure they remain effective.	Preconstruction Construction Operation Decommissioning Rehabilitation	As required	Applicant ECO Contractor	Mine EO (Weekly) ECO (Monthly)	Protect site and adjacent properties from oncoming veld fires/Verification that appropriate fire prevention measures, are in place where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Environmental awareness training and the site induction program shall include fire risks in order to create an awareness of the risks of fire. The contractor, subcontractors and all employees on site shall be expected to be conscious of fire risks and shall take all the necessary precautions to ensure that fires are not started as a consequence of his activities on site.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate training to sensitise staff and labourers to risks of fire/Visual inspection of fire prevention measures. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	No open fires shall be permitted on the site, except where approved by the safety department and ECO and within a designated structure designed for that purpose. In such cases fire fighting equipment must be readily available in the vicinity of the fire place and an appropriate safety representative must be present at all times during burning of the fire. All fires shall be fully extinguished after use.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent veld fires and damage to environment or harm to people and animals/Visual observation for compliance with EMPR condition. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Smoking shall not be permitted in those areas where it is a fire hazard. Such areas shall include the fuel storage areas and any areas where the vegetation or other material is such as to make liable the rapid spread of an initial flame. It is recommended that dedicated smoking areas are created on site that are provided with fire extinguishers and adequate provision for discard of cigarette butts. No	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent accidental fires/Visual observation that smoking areas are available. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	person will be allowed to discard cigarettes or cigarette butts (or any other potential ignition source) into the environment.					
F	The Applicant and Contractor(s) shall ensure that there is basic fire fighting equipment available on site at all times. The contractor shall appoint a member of his staff to be responsible for the installation and inspection of this equipment. Fire extinguishers and other fire fighting equipment shall be serviced at intervals as defined in the relevant regulations.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Adequate fire fighting equipment in the event of a fire/Visual observation that fire fighting measures are adequate. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	44. Noise					
A	All reasonable precautions shall be taken to minimise noise generated on site, especially when working in areas, or on activities, that may impact on neighbouring land owners and users. Every effort shall be made to limit exceedingly noisy activities. Technical solutions to reduce the noise impact shall include, but is not limited to; • Using the smallest/quietest equipment for the particular purpose; • Ensuring that equipment is well-maintained and fitted with the correct and appropriate noise abatement measures; • Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20dBA. Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).All construction vehicles and equipment are to be kept in good repair; • Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum; • Noise from labourers on site must be controlled; • The contractor must attempt to restrict noisy activities as far as is possible to times and locations whereby the potential for noise nuisance is reduced; • When working near (within 800 meters) to a potential sensitive receptor(s), the Contractor shall limit the number of simultaneous activities to the minimum; • All machines should be equipped with appropriate	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Reduce potential for noise nuisance/Visual observation that appropriate efforts are made to reduce noise levels. Visual inspection of plant and vehicles. (Noise Monitoring) (Complaints Register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	noise reduction equipment; • All machines should be roadworthy (including meeting maximum noise specifications); • The vehicles exhaust and baffle systems must be maintained regularly to ensure that the noise from these vehicles is within the required noise specification; • All plant and equipment must be operated in accordance with the specifications provided by the manufacturer; • Safety measures that generate noise, including reverse gear alarms, should be adjusted to minimise noise where possible.					
B	Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Reduce potential for noise nuisance and complaints/verify that site camps have been appropriately located. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Apart from the requirement that noisy activities should be limited to normal business working hours, if possible, such activities should be avoided during cold and calm weather conditions, particularly during winter mornings (when ambient noise is carried most easily).	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent nuisance to nearby residents and impact on sense of place/Visual observation that activities on site do not cause unnecessary disturbance. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	A channel of communication should be established and promoted between the mine and surrounding stakeholders. All noise complaints must be recorded and investigated. If required, the complaints should be investigated by an acoustical consultant.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure all complaints are recorded and addressed/Confirmation that complaints are recorded and investigated. (Complaints register) (ECO Monthly Checklist/Report)
E	As a general rule, construction operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993). The Applicant and Contractor(s) shall obtain a copy of the relevant noise regulations and take all reasonable measures to abide by these regulations. Sound pressure levels should not exceed the specified threshold level for the relevant area in accordance with SANS10103, as experienced by the nearest noise sensitive receivers (i.e. local residents).	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Compliance with noise regulations/Assessment of monitoring reports to determine legal compliance. (noise monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
F	In the event that noise levels exceed the specified thresholds in terms of the noise regulations, the Applicant shall appoint a suitably qualified acoustic engineer to identify sources of the elevated noise levels and to suggest suitable and reasonable mitigation measures.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit the potential for noise nuisance/Confirmation that noise levels do not exceed specified thresholds. (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report)
G	With regard to unavoidable very noisy activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact. Information that should be provided to the potential sensitive receptor(s) includes: • Proposed working times, • How long the activity is anticipated to take place, • What is being done, or why the activity is taking place, • Contact details of a responsible person where any complaints can be lodged should there be an issue of concern. The Mine shall maintain open and transparent communication with the community and surrounding landowners regarding noise and shall supply monitoring records to the public upon request.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Maintain good relations with potential sensitive receptors, nearby residents/Verify that communication with community is ongoing and that monitoring data is provided upon request. (Meeting minutes) (Monitoring records) (ECO Monthly Checklist/Report))
			45. Blasting and Vibration			
A	The reduction of ground vibration is fundamental in different ways and shall include the following measures: • Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast • Calculate expected ground vibration levels for blast to be done and if necessary re-design to reduce change mass per delay, use of electronic initiation of blast, drilling smaller diameter blastholes that will reduce charge per blasthole and per delay.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure safety is maintained during blasts and prevent damage to structures and minimise potential for public nuisance/Verify that appropriate mitigation measures are implemented. (Approved blast designs) (Blasting reports) (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report)
B	The reduction of air blast is fundamental in different ways and shall include the following measures: • Detailed blast design for each blast with consideration the effects from blasting i.e. ground vibration and air blast.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure safety is maintained during blasts and prevent damage to structures and minimise potential for public nuisance/Verify that appropriate mitigation measures are implemented.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	• Use of proper stemming lengths of between 25 and 30 blasthole diameters. • Use of crushed aggregate of 10% the blasthole diameter as stemming material • Record stemming lengths for each blast and correct if necessary prior to every blast blasted. • Monitor each blast done.					(Approved blast designs) (Blasting reports) (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report)
C	The mine should liaise with local residents on how best to minimise the impact of blasting. Information that should be provided to the potential sensitive receptor(s) includes: • Proposed blasting schedules, • How long the activity is anticipated to take place, • What is being done, or why the activity is taking place, • Contact details of a responsible person where any complaints can be lodged should there be an issue of concern. The Mine shall maintain open and transparent communication with the community and surrounding landowners regarding blasting and vibration and shall supply monitoring records to the public upon request.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Maintain good relations with potential sensitive receptors, nearby residents/Verify that communication with community is ongoing and that monitoring data is provided upon request. (Meeting minutes) (Monitoring records) (ECO Monthly Checklist/Report)
			46. Air Quality			
A	It is important to note that dust could be a major disturbance, especially during the dry winter periods to people residing around the site. All reasonable measures must be utilised to minimise the generation of dust as a result of activities on site. Such measures shall include, but shall not be limited to; • Measures aimed at reducing the extent of unpaved roads, e.g. surfacing roads • Traffic control measures aimed at reducing the entrainment of material by restricting traffic volumes and reducing vehicle speeds; • Regular and effective measures aimed at binding the surface material or enhancing moisture retention, such as wet suppression and chemical stabilisation; • Application of chemical dust palliatives and the optimal selection of wearing course materials (where possible environmentally friendly products should be utilised); • Appropriate scheduling of dust-generating activities	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent dust pollution or nuisance to sensitive receptors/Visual observation that dust suppression is done effectively. (Dust Monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	(e.g. the clearing of parking areas should be postponed until the construction programme requires the clearing of that specific area). • Avoid excavation and stockpiling activities during periods of strong winds. • Increase dust suppression efforts during conditions conducive to excessive dust creation (e.g. dry and windy conditions). • Limit the height of soil stockpiles where possible, and wetting down of soil stockpiles when excessive dust is generated from these stockpiles; and • Areas where excessive or difficult to manage fallout dust and erosion occur remain may be treated with chemical dust suppressant or paved as opposed to using water.					
B	The Applicant/Contractor(s) shall comply with the National Dust Control Regulations, Promulgated under the National Environmental Management: Air Quality Act (Act 39 of 2004).	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Compliance with dust regulations. (Dust Monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	In the event that dust levels exceed the specified thresholds in terms of the dust control regulations, the Applicant shall appoint a suitably qualified specialist to identify sources of the excessive dust levels and to suggest suitable and reasonable mitigation measures.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit the potential for dust pollution or dust nuisance/Confirmation that dust levels do not exceed specified thresholds. (Complaints register) (Dust monitoring) (Safety Reports) (ECO Monthly Checklist/Report)
D	Any water used for dust suppression must be obtained from a legal source in accordance with relevant legislation and regulations. The amount of water used for dust suppression shall be recorded on a daily basis and details of such shall be included in environmental reports submitted to Mine EO (daily). The Mine EO shall report water usage statistics to the Mine Manager and ECO on a regular basis (at least monthly).	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure sustainable and legal water use/Confirmation that water use complies with conditions of relevant permits or regulations. (Water use records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Environmental awareness training shall include the requirement for all staff, employees and construction workers to report any excessively dusty conditions to the contractor or responsible representative and corrective and preventative measures are to be implemented.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Ensure appropriate action is taken to mitigate dust/ Visual observation that dust suppression is done effectively. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
F	The Applicant and Contractor(s) must ensure that no transported materials escape from the construction and mine vehicles (no spillage on roads or dust clouds). If necessary, the load bin of the vehicle shall be covered with a tarpaulin to prevent dust.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Prevent dust pollution or dust nuisance/Visual observation that excessive dust is not created during transportation of construction materials. Dust Monitoring (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	The mining operator must monitor air quality at the mine boundary, especially where handling activities are clustered. This expansion of the dust-fall monitoring network should be in addition to the dust buckets that are already in place.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Monitor air quality to inform management options/Verification that air quality monitoring is undertaken as required. (Monitoring records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	The Mine shall maintain open and transparent communication with the community and surrounding landowners regarding air quality and shall supply monitoring records to the public upon request.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Maintain good relations with potential sensitive receptors, nearby residents/Verify that communication with community is ongoing and that monitoring data is provided upon request. (Meeting minutes) (Monitoring records) (ECO Monthly Checklist/Report)
47. Visual Impact						
A	Dust suppression methods must be applied when necessary to restrict the visual impact of dust pollution.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit visual impact/Observation that dust suppression is undertaken where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Vegetation clearance must be restricted to the minimum area possible to reduce the impact from dust.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit visual impact of dust/Observation that minimum possible area required is cleared at any given time. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Rehabilitate / restore exposed areas as soon as possible after construction and mining activities are complete.	Construction Operation Decommissioning	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Limit visual impact of dust/Observation that exposed areas are rehabilitated as soon as possible.

Item No.	Technical or Management Option	Phase	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
		Rehabilitation			ECO (Monthly)	(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Public movement areas (pathways and roads) should be lit with low level 'bollard' type lights and avoid post top lighting.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise potential for light pollution/Verification that light design minimises light impact. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Avoid high pole top security lighting along the periphery of the project area and use only lights that are activated on illegal entry to the project area.	Construction Operation	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Minimise potential for light pollution/Verification that light design minimises light impact. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
			48. Safety			
A	The Applicant and Contractor(s) shall ensure: • Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993) and associated regulations; • That reasonable measures are taken to ensure the safety of all site staff; • Provide appropriate Personal Protective Equipment (PPE) where required; • That all construction vehicles using public roads are in a roadworthy condition, that they adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to; • That all accidents and incidents are recorded and reported to the Mine manager and EO/ECO; and • The Applicant and Contractor must ensure that he/she has the contact details of the nearest emergency rooms (hospitals) to the site, of both private and public hospitals.	Construction Operation Decommissioning Rehabilitation	Ongoing	Applicant Contractor	Safety Department	Ensure compliance with legal provisions of OHSA and regulations. (ECO Monthly Checklist/Report)

22.3 EMP – CONSTRUCTION PHASE

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
		49. Legal Compliance			

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
A	The Contractor shall comply with all relevant national, provincial and local legislation, including associated regulations and bylaws.	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Ensure compliance with relevant legislation/Audits to verify legal compliance. (Legal register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	50. Community Liaison				
A	Adjacent landowners and any other affected parties must be informed prior to commencement of construction. The surrounding landowners must be provided with a schedule of construction activities prior to commencement, and provided with scheduling updates throughout the construction process if requested to do so.	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Prevent nuisance to nearby residents and impact on sense of place/Confirmation that adequate notification and schedule was provided prior to construction. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	The Contractor(s) shall adopt and implement the technical management options relating to community liaison presented in this EMP (see Section 14).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Maintain good relations with the community and surrounding landowners/Verify that EMP commitments relating to community liaison are complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	The Contractor(s) shall comply with the complaints procedure developed by the Applicant and shall report any complaints from the public to the Mine EO to be captured in the complaints register.	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Appropriate and timeous resolution of complaints/Assess complaints register. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	Where specific concerns are raised regarding the construction operations, applicable preventative and protective measures must be agreed upon with the Applicant and the complainant. The agreed upon corrective actions shall be captured in the complaints register and shall be implemented within the agreed timeframe.	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Appropriate and timeous resolution of complaints/Assess complaints register. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	51. Socio-Economic				
A	The Contractor(s) shall adopt and implement the technical management options relating to socio-economics presented in this EMP (see Section 15).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Enhance socio-economic benefits of the project. Manage and mitigate negative socio-economic impacts/Verify that EMP commitments relating to socio-economic impacts are implemented.

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
					(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
52. Community Health and Safety					
A	The Contractor(s) shall adopt and implement the technical management options relating to community health and safety presented in this EMP (see Section 18).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Enhance community health and safety. Manage and mitigate negative impacts on community health and safety/Verify that EMP commitments relating to socio-economic impacts are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
53. Nuisance Prevention and Sense of Place					
A	The Contractor (s) shall take necessary actions described in this EMP to avoid nuisance in terms of noise, dust and visual impact as well as other potential impacts which may cause public nuisance.	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Prevent nuisance to nearby residents and impact on sense of place/Visual observation that activities on site do not cause unnecessary disturbance or nuisance (Complaints register). (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
54. Environmental Awareness Training					
A	Prior to the commencement of activities on site the Contractor(s) must ensure that the construction crew attend an environmental briefing and training session with regard to commitments made in this EMP.	Prior to construction.	Contractor	ECO (Once-off)	Ensure that the contractor is aware of EMP requirements/Confirmation that initial awareness training has been undertaken. (Training records) (ECO Monthly Checklist/Report)
B	The Contractor (s) shall adopt and implement the environmental awareness plan presented in this EMP (see Section 19).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Promote environmental awareness/Verify that environmental awareness program is implemented. (Training records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
55. Site Clearance					
A	Trees and natural vegetation, or any other natural features inside and outside the work area, which will not be cleared for construction purposes,	Ongoing	Contractor	Contractors EO (Daily)	Minimise damage to environment/Visual observation

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	shall not be defaced, painted for benchmarks or otherwise damaged, even for survey purposes. The latter can only be done if agreed to by the ECO. Any natural feature defaced by the contractor shall be reinstated to the satisfaction of the ECO.			Mine EO (Weekly) ECO (Bi-Monthly))	that no natural features have been damaged outside the required construction footprint. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	The Contractor (s) shall adopt and implement the technical management options relating to site clearance presented in this EMP (see Section 20).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Verify that EMP commitments relating to site clearance presented are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
56. Topsoil and Sub-Soil Management					
A	The Contractor(s) shall adopt and implement the soil management guide developed for the Paardeplaats Mine as well as the principles and technical management options presented in this EMP (see Section 21).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Protection of soil resources/Observation that soil management principles are adhered to. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
57. Site access, Security and Traffic Management					
A	The Contractor (s) shall adopt and implement the technical management options relating to site access, security and traffic management presented in this EMP (see Section 22).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Verify that EMP commitments relating to site access, security and traffic management are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
58. Construction Camps					
A	The Contractor (s) shall adopt and implement the technical management options relating to site/construction camps presented in this EMP (see Section 24).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Verify that EMP commitments relating to site/construction camps are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Once construction is complete the construction camp and other related infrastructure shall be completely dismantled and the entire area completely rehabilitated (in accordance with rehabilitation guidelines elsewhere in this EMP). If the construction camp area is required for use in the operational phase, the contractor and Applicant shall enter into a written agreement prior to the completion of construction which shall describe in detail the infrastructure which shall remain on the site, and which areas shall be rehabilitated. This written agreement shall be provided to the ECO for record purposes.	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Ensure disturbed areas are rehabilitated wherever possible and as soon as possible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

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59. Sensitive Areas, Fauna and Flora					
A	The Contractor (s) shall comply with the technical management options relating to Sensitive areas, Fauna and Flora presented in this EMP (see Section 25).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Verify that EMP commitments relating to Sensitive areas, Fauna and Flora are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
60. Alien Vegetation					
A	The Contractor (s) shall adopt and implement the weed management plan and principles for weed management presented in this EMP (see Section 27).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly))	Verify that weed management plan and principles for weed management are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
61. Water Management					
A	The Contractor (s) shall adopt and implement the technical management options relating to water management presented in this EMP (see Section 28).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to water management are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
62. Surface Water, Storm Water and Erosion Control					
A	The Contractor (s) shall adopt and implement the technical management options relating to surface water, storm water and erosion control presented in this EMP (see Section 29).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to surface water, storm water and erosion control are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
63. Wetlands and Aquatic Ecology					
A	The Contractor (s) shall adopt and implement the technical management options relating to wetlands and aquatic ecology presented in this EMP (see Section 31).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to site/construction camps are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
64. Ground Water Pollution					
A	The Contractor (s) shall adopt and implement the technical management options relating to ground water pollution presented in this EMP (see Section 33).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to site/construction camps are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

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65. Palaeontology and Heritage Features					
A	The Contractor (s) shall adopt and implement the technical management options relating to palaeontology and heritage features presented in this EMP (see Section 34 and Section 35).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to site/construction camps are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
66. Concrete/Cement Mixing and Batching					
A	The Contractor (s) shall adopt and implement the technical management options relating to Concrete/Cement Mixing and Batching presented in this EMP (see Section 39).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to Concrete/Cement Mixing and Batching are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
67. Pollution Prevention					
A	The Contractor (s) shall adopt and implement the technical management options relating to pollution prevention presented in this EMP (see Section 38).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to pollution prevention are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
68. Waste Management					
A	The Contractor (s) shall adopt and implement the technical management options relating to waste management presented in this EMP (see Section 40).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to waste management are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
69. Sewage and Sanitation					
A	The Contractor (s) shall adopt and implement the technical management options relating to sewage and sanitation presented in this EMP (see Section 41).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to sewage and sanitation are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
70. Environmental Emergency Response					
A	The Contractor (s) shall adopt and implement the technical management options relating to environmental emergency response presented in this EMP (see Section 42).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to environmental emergency response are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

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	71. Fire Prevention				
A	The Contractor (s) shall adopt and implement the technical management options relating to fire prevention presented in this EMP (see Section 43).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verify that EMP commitments relating to fire prevention are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	72. Noise				
A	The Contractor (s) shall take all reasonable measures to reduce noise as a result of construction activities in accordance with the detailed technical management options presented in this EMP (see Section 44).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Reduce noise impacts and nuisance/Observation that appropriate management options are adopted where required. (Mine EO weekly checklist) A(ECO Monthly Checklist/Report)
A	All traffic associated with the construction of the facility should be routed as far as practically possible from potentially sensitive receptors to reduce the potential for noise nuisance.	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Limit potential for public nuisance/Visual observation that traffic routes avoid sensitive receptors wherever possible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Working hours for all construction activities shall be limited to between 08:00 and 17:00 during weekdays (Monday to Friday) and between 08:00 and 13:00 on Saturdays. No work may take place on a Sunday or Public Holidays. Any deviations to these work hours must be cleared with the relevant official prior to implementation.	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Verification that working hours are not exceeded without surrounding community approval. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	As a general rule, construction operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993). The Contractor shall obtain a copy of the relevant noise regulations and take all reasonable measures to abide by these regulations. Sound pressure levels due to construction activities should not exceed the specified threshold level for the relevant area in accordance with SANS10103, as experienced by the nearest noise sensitive receivers (i.e. local residents).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Compliance with noise regulations. (noise monitoring) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	In the event that noise levels exceed the specified thresholds in terms of the noise regulations, the Applicant shall appoint a suitably qualified acoustic engineer to identify sources of the elevated noise levels and to suggest suitable and reasonable mitigation measures.	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Limit the potential for noise nuisance/Confirmation that noise levels do not exceed specified thresholds. (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report)
E	Construction staff working in areas where the 8-hour ambient noise levels	Ongoing	Contractor	Safety Department	Prevent hearing loss as a result of

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	exceed 75dBA should wear ear protection equipment. Employees working with equipment and within areas where the experienced sound pressure levels exceed 85db must utilise appropriate hearing protection at all times.			ECO (Bi-Monthly)	exposure to excessive sound pressure levels. (Noise monitoring) (Safety Reports) (ECO Monthly Checklist/Report)
	73. Blasting and Vibration				
A	In the event of any blasting, the Applicant and/or Contractor(s) shall implement the technical management options relating to blasting and vibration presented in this EMP (see Section 45).	Ongoing	Applicant Contractor	Safety Department Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Ensure safety is maintained during blasts and prevent damage to structures and minimise potential for public nuisance/Verify that appropriate mitigation measures are implemented. (Approved blast designs) (Blasting reports) (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report)
	74. Air Quality				
A	The Contractor (s) shall take all reasonable measures to reduce dust and impacts on air quality as a result of construction activities in accordance with the detailed technical management options presented in this EMP (see Section 46).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Reduce dust nuisance and other impacts resulting from air quality impacts/Verification that appropriate management options are adopted where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	75. Visual Impact				
A	The Contractor (s) shall take all reasonable measures to reduce visual impacts as a result of construction activities in accordance with the detailed technical management options presented in this EMP (see Section 47).	Ongoing	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Minimise visual impacts/Verification that appropriate management options are adopted where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	76. Safety				
A	The Contractor (s) must develop a Health and Safety method statement that is in accordance with the Occupational Health and Safety Act (Act 85 of 1993) and regulations which must be approved by the Applicant and Mine Manager.	Prior to construction	Contractor	ECO (Once-Off)	Ensure adequate planning and provision is made for health and safety requirements to be met. (ECO Monthly Checklist/Report)
B	The Contractor(s) shall ensure:	Ongoing	Contractor	Safety Department	Ensure compliance with legal

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	• Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993) and associated regulations; • That reasonable measures are taken to ensure the safety of all site staff; • Provide appropriate Personal Protective Equipment (PPE) where required; • That all construction vehicles using public roads are in a roadworthy condition, that they adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to; • That all accidents and incidents are recorded and reported to the Mine manager and EO/ECO; and • The Applicant and Contractor must ensure that he/she has the contact details of the nearest emergency rooms (hospitals) to the site, of both private and public hospitals.				provisions of OHSA and regulations. (Safety Reports)
77. Rehabilitation					
A	The Contractor (s) shall prepare a decommissioning and rehabilitation method statement for the construction camp and any additional areas impacted on by construction at least 3 months prior to completion of construction that shall align with the Mines Integrated Rehabilitation and Closure Plan. The method statement shall be submitted to the Mine manager and ECO for approval.	3 months prior to completion of construction	Contractor	ECO (Once-off)	Ensure adequate provision for appropriate decommissioning and rehabilitation/Confirmation that decommissioning and rehabilitation plan is in place and is adequate. (ECO Monthly Checklist/Report)
B	Once construction is complete the construction camp and other related infrastructure shall be completely dismantled and the entire area completely rehabilitated (re-vegetation with indigenous vegetation) in order to restore the original aesthetic and ecological value of the area. The contractor shall only make use of indigenous vegetation for the rehabilitation of disturbed areas. If the construction camp area is required for use in the operational phase, the contractor and Applicant shall enter into a written agreement prior to the completion of construction which shall describe in detail the infrastructure which shall remain on the site, and which areas shall be rehabilitated. This written agreement shall be provided to the ECO for record purposes.	Upon completion of construction.	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Ensure disturbed areas are rehabilitated/Visual observation that rehabilitation is undertaken and is adequate. (ECO Monthly Checklist/Report)
C	Infilling of all excavation work shall take place, ensuring that subsoil is filled in first, to ensure that topsoil is present on the surface in order to ensure a suitable plant growth medium. Substrate that is not suitable for plant growth should not be used for infilling of excavations unless used at a suitable depth e.g. deeper than 2 m.	Upon completion of construction.	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Ensure disturbed areas are rehabilitated/Visual observation that rehabilitation measures have been complied with. (ECO Monthly Checklist/Report)
D	All vehicles, equipments and other assets belonging to the Contractor must be removed from the property upon completion of the construction works, including any excess aggregate, gravel, stone, concrete, temporary fencing	Upon completion of construction.	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Ensure disturbed areas are rehabilitated/Visual observation that rehabilitation measures have

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	and the like.				been complied with. (ECO Monthly Checklist/Report)
E	No discard materials of whatsoever nature shall be buried on the site, or on any vacant or open land in the area. Waste material of any description, including receptacles, litter, scrap, rubble and tyres, will be removed entirely from the construction site and disposed of at a recognised landfill facility. It will not be permitted to be buried or burned on the site.	Upon completion of construction.	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Ensure disturbed areas are rehabilitated/Visual observation that rehabilitation measures have been complied with. (ECO Monthly Checklist/Report)
F	Steep and unstable slopes must have stabilising measures put in place to prevent collapse of the slopes or soil erosion. Slope stabilisation and soil erosion prevention measures include the placement of silt fences, staked grass sods and rows of filled onion bags. The exposed ground should be seeded and mulched with an appropriate stabilising grass mixture (to be approved by the ECO). A good endemic stabilising grass seed mix should be used.	Upon completion of construction.	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Ensure disturbed areas are rehabilitated/Visual observation that rehabilitation measures have been complied with. (ECO Monthly Checklist/Report)
G	The site should be watered following seeding and mulching, and continued on a regular basis, the frequency depending on the amount rainfall received. Should germination not occur within one month of planting, the site should be reseeded and mulched.	Upon completion of construction.	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Ensure disturbed areas are rehabilitated/Visual observation that rehabilitation measures have been complied with. (ECO Monthly Checklist/Report)
H	Rehabilitated areas must be monitored on a regular basis (at least weekly) following reinstatement to ensure adequate re-vegetation and rehabilitation is achieved. The contractor shall remain responsible for maintenance (additional seeding where required, erosion control measures etc.) of rehabilitated areas until such time as the rehabilitation is signed-off by the ECO.	Construction phase, following rehabilitation until sign-off.	Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Ensure disturbed areas are rehabilitated/Visual observation that rehabilitation measures have been complied with. (ECO Monthly Checklist/Report)
	78. Documentation and Records				
A	The Contractor (s) shall supply copies all documentation and records relating to the construction phase to the Applicant for record keeping purposes.	Upon completion of construction.	Contractor	ECO (Once-Off)	Ensure documentation relating to construction is available on site for auditing purposes. (ECO Monthly Checklist/Report)

22.4 EMP – OPERATIONAL PHASE

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Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	79. Legal Compliance				
A	The Applicant shall implement the technical management options relating to legal compliance presented in this EMP (see Section 13).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure compliance with relevant legislation/Confirmation that legal register is in place and up-to-date. (Legal register) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	80. Community Liaison				
A	Adjacent landowners and any other relevant affected parties must be informed prior to commencement of mining.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Prevent nuisance to nearby residents and impact on sense of place/Confirmation that adequate notification and schedule was provided prior to construction. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	The Applicant shall implement the complaints procedure and ensure any complaints are from the public are reported to the Mine EO to be captured in the complaints register.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Appropriate and timeous resolution of complaints. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Where specific concerns are raised regarding the mining operations, applicable preventative and protective measures must be agreed upon with the complainant. The agreed upon corrective actions shall be captured in the complaints register and shall be implemented within the agreed timeframe.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Appropriate and timeous resolution of complaints. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	The Applicant shall adopt and implement the technical management options relating to community liaison presented in this EMP (see Section 14).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Maintain good relations with the community and surrounding landowners/Verify that EMP commitments relating to community liaison are complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	81. Socio-Economic				
A	The Applicant shall implement the technical management options relating to socio-economics presented in this EMP (see Section 15).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Enhance socio-economic benefits of the project. Manage and mitigate negative socio-economic impacts/Verify that EMP commitments relating to socio-economic impacts are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

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	82. Local/Regional Infrastructure				
A	Plan for worker accommodation well before the proposed onset of the project. This relates to housing and associated services. Integrate planning process with local government – make sure it is in line with spatial development planning of the area.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Proper planning to ensure workers accommodation is ready prior to commencement of work and that it aligns with local governments integrated development planning/ Minutes of meetings with local planning departments (ECO Monthly Checklist/Report)
B	Do a crack survey at the houses of directly affected neighbours. Investigate different blasting procedures.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Establish baseline condition of houses prior to construction and mining to be used for comparison in the event of claims/Verify that crack survey has been undertaken. Results of crack survey. (ECO Monthly Checklist/Report)
	83. Social impacts arising from impacts on the environment				
A	Obtain baseline data about water resources and boreholes on neighbouring properties before any activities start, and provide affected parties with the information. This information should be kept for the life of the mine to use as evidence in any disputes. Monitor against these baselines and release the monitoring results to affected parties.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Baseline data to serve as evidence in the case of disputes. Baseline reports Monitoring results (ECO Monthly Checklist/Report)
B	Environmental forum to give feedback to affected communities twice a year regarding environmental aspects such as dust, water and noise pollution and how the Paardeplaats mine manage and mitigate these aspects.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Communication with community regarding environmental matters. Environmental forum established. Minutes of meetings with agricultural communities. Pollution fund established. (ECO Monthly Checklist/Report)
C	Establish fund for pollution incidents and compensate affected parties for actual financial losses.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Compensate affected parties for actual financial losses resulting from pollution incidents/Verification that fund has been established and affected parties compensated where appropriate. (ECO Monthly Checklist/Report)
D	Actively address the fears of community members relating to water pollution by using experts to explain impacts via newsletters and on community radio stations. Ensure the community relations strategy is properly implemented to ensure on-going communication.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Newspaper reports. Interviews on local radio station. Community relations strategy (ECO Monthly Checklist/Report)

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	84. Community Health and Safety				
A	The Applicant shall implement the technical management options relating to community health and safety presented in this EMP (see Section 18).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Enhance community health and safety. Manage and mitigate negative impacts on community health and safety/Verify that EMP commitments relating to socio-economic impacts are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	85. Nuisance Prevention and Sense of Place				
A	The Applicant shall take necessary actions described in this EMP to avoid nuisance in terms of noise, dust and visual impact as well as other potential impacts which may cause public nuisance.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Prevent nuisance to nearby residents and impact on sense of place/Visual observation that activities on site do not cause unnecessary disturbance. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	86. Environmental Awareness Training				
A	The Applicant shall adopt and implement the environmental awareness plan presented in this EMP (see Section 19).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Promote environmental awareness/Verify that environmental awareness program is implemented. (Training records) (Mine EO weekly checklist)
	87. Site Clearance				
A	The Applicant shall implement the technical management options relating to site clearance presented in this EMP (see Section 20).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to site clearance presented are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	88. Topsoil and Sub-Soil Management				
A	The Applicant shall implement the soil management guide developed for the Paardeplaats Mine as well as the principles and technical management options presented in this EMP (see Section 21).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Protection of soil resources/Observation that soil management principles are adhered to. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	89. Site access, Security and Traffic Management				
A	The Applicant shall implement the technical management options relating to site access, security and traffic management presented in this EMP (see	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to site access, security and traffic

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	Section 22).				management are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
90. Site Camps					
A	The Applicant shall implement the technical management options relating to site camps/construction camps presented in this EMP (see Section 24).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to site/construction camps are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
91. Sensitive Areas, Fauna and Flora					
A	The Applicant shall comply with the technical management options relating to sensitive areas, Fauna and Flora presented in this EMP (see Section 25).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to Sensitive areas, Fauna and Flora are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
92. Alien Vegetation					
A	The Applicant shall implement the weed management plan and principles for weed management presented in this EMP (see Section 27).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that weed management plan and principles for weed management are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
93. Water Management					
A	The Applicant implement the technical management options relating to water management presented in this EMP (see Section 28).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to water management are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
94. Surface Water, Storm Water and Erosion Control					
A	The Applicant shall implement the technical management options relating to surface water, storm water and erosion control presented in this EMP (see Section 29).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to surface water, storm water and erosion control are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Upstream clean and dirty water system infrastructure must be installed close to the edge of the pit in order to effectively deviate clean water flow around the pit and prevent it from entering.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Upstream clean and dirty water system infrastructure must be protected from	Ongoing	Applicant	Mine EO (Weekly)	(Mine EO weekly checklist)

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	erosion through the installation of surface water energy disruptors to reduce storm water velocity.			ECO (Monthly)	(ECO Monthly Checklist/Report)
D	Dirty water contained and pumped from the pit must be stored in lined PCD's and Pit dewatering dam all equipped with silt traps.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Continue with concurrent rehabilitation efforts and backfilling to keep the open pit as small as is practically possible reduce the amount of surface water able to come in contact with the pit and contaminated water.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
95. Wetlands and Aquatic Ecology					
A	The Applicant shall implement the technical management options relating to wetlands and aquatic ecology presented in this EMP (see Section 31).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to site/construction camps are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
96. Ground Water Pollution					
A	The Applicant shall implement the technical management options relating to ground water pollution presented in this EMP (see Section 33).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to site/construction camps are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Pits must be kept as dry as is practically possible in order to reduce contact time of water and oxygen with exposed rock material and keep contamination to a minimum. Groundwater inflows into the pit must be pumped out and into the pit dewatering dam and PCD's respectively.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit potential for AMD/Verification that appropriate measures are implemented to minimise AMD. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	The Applicant and contractor(s) must take all reasonable to keep contamination to a minimum and to draw contamination to the pit and contain it within the mine property. This includes removing as much coal as possible from the pit to limit potential for contamination.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Limit potential for AMD/Verification that appropriate measures are implemented to minimise AMD. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	The Applicant shall continue to monitor groundwater quality and levels in accordance with the IWWMP and monitoring program. The results of water monitoring should be used to feedback into management controls.	Ongoing	Applicant	Mine EO (Weekly) ECO (Bi-Monthly) ECO (Monthly)	Monitoring of water resources/Confirmation that water monitoring is undertaken in accordance with monitoring plan and IWWMP. (Monitoring records) (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	Negotiate with affected surface rights holders and if necessary compensate for loss of the use of boreholes which run dry due to dewatering located	Ongoing	Applicant	ECO (Bi-Monthly) ECO (Monthly)	Compensation for loss of groundwater resources/Confirmation that

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	within the cone of depression				appropriate compensation has been provided where appropriate. (ECO Monthly Checklist/Report
97. Palaeontology and Heritage Features					
A	The Applicant shall implement the technical management options relating to palaeontology and heritage features presented in this EMP (see Section 34 and Section 35).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to site/construction camps are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
98. Concrete/Cement Mixing and Batching					
A	In the event that any mixing or batching of concrete or similar construction materials is required during operation, the Applicant shall implement the technical management options presented in this EMP (see Section 39).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to Concrete/Cement Mixing and Batching are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
99. Pollution Prevention					
A	The Applicant shall implement the technical management options relating to pollution prevention presented in this EMP (see Section 38).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to pollution prevention are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
100. Waste Management					
A	The Applicant shall implement the technical management options relating to waste management presented in this EMP (see Section 40).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to waste management are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
101. Sewage and Sanitation					
A	The Applicant shall implement the technical management options relating to sewage and sanitation presented in this EMP (see Section 41).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to sewage and sanitation are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
102. Environmental Emergency Response					
A	The Applicant shall implement the technical management options relating to environmental emergency response presented in this EMP (see Section 42).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to environmental emergency response are implemented.

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
					(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
103. Fire Prevention					
A	The Applicant shall implement the technical management options relating to fire prevention presented in this EMP (see Section 43).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Verify that EMP commitments relating to fire prevention are implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
104. Noise					
A	The Applicant shall implement the technical management options relating to noise presented in this EMP (see Section 44).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Reduce noise impacts and nuisance/Observation that appropriate management options are adopted where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	The design of all major equipment for the colliery is to incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous day/night rating level (L_{Rdn}), namely a noise level of 70dBA (just inside the property projection plane, namely the property boundary of the colliery) as specified for industrial districts in SANS 10103.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure compliance with relevant noise thresholds and standards /Verification that acoustic designs have been taken into account to reduce noise levels. Assessment of noise monitoring data to verify compliance with standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	Notwithstanding the above provision, the design is also to take into account the maximum allowable equivalent continuous day and night rating levels of the land use type of potentially impacted sites outside the Paardeplaats Project property. Where the noise level at such an external site is presently lower than the maximum allowed, the maximum shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased by more than indicated as acceptable in SANS 10103	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure compliance with relevant noise thresholds and standards /Verification that acoustic designs have been taken into account to reduce noise levels. Assessment of noise monitoring data to verify compliance with standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	The latest technology incorporating maximum noise mitigation measures for components of the complex should be designed into the system. Ideally, equipment should meet the following specification: The sound power level (LW) should be such that the sound pressure level (SPL – i.e. the noise level) measured at 1 metre from the surface of the given equipment should not exceed 85dBA.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure compliance with relevant noise thresholds and standards / Verification that acoustic designs and specifications have been taken into account to reduce noise levels. Assessment of noise monitoring data to verify compliance with standards. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
E	When ordering equipment, manufacturers should be requested to provide details of the sound power level. Where possible, those with the lowest sound power level (most quiet) should be selected.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Minimise potential for noise nuisance and complaints/Verification that acoustic designs and specifications have been taken into account to reduce noise levels. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	The stockpiles of spoil rock and overburden (berms) from the opencast pit excavations should, where possible, be used as interim or long-term noise attenuation barriers. Berms should particularly be considered around the whole periphery of the pit.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Minimise potential for noise nuisance and complaints/Verification that recommended measures have been implemented where appropriate and feasible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
G	Where possible, very noisy activities should not take place at night (between the hours of 20h00 to 06h00). Specifically, blasting should take place to a regular programme and should be restricted to the period between 08h00 and 16h00.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Minimise potential for noise nuisance and complaints/Verification that timing of noisy activities has been timed appropriately. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	With drilling operations in preparation for blasting in the pit, portable acoustic shields should be considered to enclose the drills.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Minimise potential for noise nuisance and complaints/Verification that recommended measures have been implemented where appropriate and feasible. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
105. Blasting and Vibration					
A	In the event of any blasting, the Applicant and/or Contractor(s) shall implement the technical management options relating to blasting and vibration presented in this EMP (see Section 45).	Ongoing	Applicant Contractor	Safety Department Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Ensure safety is maintained during blasts and prevent damage to structures and minimise potential for public nuisance/Verify that appropriate mitigation measures are implemented. (Approved blast designs) (Blasting reports) (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report)
106. Air Quality					

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
A	The Applicant shall take all reasonable measures to reduce dust and impacts to air quality as a result of mining activities in accordance with the detailed technical management options presented in this EMP (see Section 46).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Reduce dust nuisance and other impacts resulting from air quality impacts/Observation that appropriate management options are adopted where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	107. Visual Impact				
A	The Application shall take all reasonable measures to reduce visual impacts as a result of mining activities in accordance with the detailed technical management options presented in this EMP (see Section 47).	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Minimise visual impacts/Verification that appropriate management options are adopted where required. (Mine EO weekly checklist) (ECO Monthly Checklist/Report
	108. Safety				
A	The Applicant shall ensure: • Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993) and associated regulations; • That reasonable measures are taken to ensure the safety of all site staff; • Provide appropriate Personal Protective Equipment (PPE) where required; • That all construction vehicles using public roads are in a roadworthy condition, that they adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to; • That all accidents and incidents are recorded and reported to the Mine manager and EO/ECO; and • The Applicant and Contractor must ensure that he/she has the contact details of the nearest emergency rooms (hospitals) to the site, of both private and public hospitals.	Ongoing	Applicant	Safety Department	Ensure compliance with legal provisions of OHSA and regulations. (safety reports)
	109. Progressive Rehabilitation				
A	The Applicant shall ensure that progressive rehabilitation is undertaken concurrently with mining activities. The Mine EO and ECO shall oversee rehabilitation efforts to ensure progressive rehabilitation is undertaken in accordance with the Integrated Rehabilitation and Closure Plan.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure progressive rehabilitation is undertaken to limit any long term impact on wetland through dewatering/Visual observation that rehabilitation plan is implemented. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	Rehabilitation will include returning the slope to the minimum possible	Ongoing	Applicant	Mine EO (Weekly)	No steep slopes that may result in

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	gradient (preferably less than 1:3), the topsoil will be replaced for vegetation re-establishment and contour drains will be built to prevent erosion if necessary.			ECO (Monthly)	instability and erosion/Visual observation that slopes are reduced to minimum possible gradient. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	The area must be rehabilitated using indigenous vegetation from the area in such a way that it will return as close as possible to the original production potential. The rehabilitated area must be returned to a self sustaining ecosystem that is consistent with the original vegetation type.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Rehabilitation to return area to self sustaining ecosystem/Confirmation that rehabilitation has been successful and shall remain self sustaining. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	The effectiveness of the rehabilitation process and the vegetation growth must be monitored. Where required, the necessary adjustments should be made to ensure the complete re-establishment of the natural vegetation. The rehabilitation process must ensure that the right grass species are used to ensure that erosion is minimised and to ensure a self-sustaining cover of indigenous species representative of the area and vegetation type.	Ongoing	Applicant	Mine EO (Weekly) ECO (Monthly)	Monitoring to ensure successful rehabilitation/Visual observation that rehabilitation is successful. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

22.5 EMP – DECOMMISSIONING PHASE

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
			110. Noise		
A	Demolition activities, and particularly the noisy ones, are to be confined to reasonable hours during the day and early evening to prevent noise nuisance. With regard to unavoidable very noisy demolition activities in the vicinity of noise sensitive areas, the mine should liaise with local residents on how best to minimise the impact.	During demolition activities	Applicant	Mine EO (Weekly) ECO (Monthly)	Reduce potential for public nuisance as a result of demolition activities/Observation that demolition is undertaken at appropriate hours. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
			111. Blasting and Vibration		
A	In the event of any blasting, the Applicant and/or Contractor(s) shall implement the technical management options relating to blasting and vibration presented in this EMP (see Section 45).	Ongoing	Applicant Contractor	Safety Department Contractors EO (Daily) Mine EO (Weekly) ECO (Bi-Monthly)	Ensure safety is maintained during blasts and prevent damage to structures and minimise potential for public nuisance/Verify that appropriate mitigation measures are implemented.

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
					(Approved blast designs) (Blasting reports) (Complaints register) (Noise monitoring) (ECO Monthly Checklist/Report)
112. Decommissioning					
A	All infrastructure, equipment, plant, temporary housing and other items used during the mining period will be removed from the site (section 44 of the MPRDA). Infrastructure should be removed down to foundations to prevent loss of soil productivity.	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure all plant and infrastructure are removed from site to allow successful rehabilitation of the site/Visual observation that decommissioning complies with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	All vehicles, equipments and other assets belonging to the Applicant/Contractor(s) must be removed from the property upon completion of the mining operation, including any excess aggregate, gravel, stone, concrete, temporary fencing and the like.	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure all plant and infrastructure are removed from site to allow successful rehabilitation of the site/Visual observation that decommissioning complies with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	No discard materials of whatsoever nature shall be buried on the site, or on any vacant or open land in the area. Waste material of any description, including receptacles, scrap, rubble and tyres, will be removed entirely from the mining area and disposed of at a recognised landfill facility. It will not be permitted to be buried or burned on the site.	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure all plant and infrastructure are removed from site to allow successful rehabilitation of the site/Visual observation that decommissioning complies with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	During decommissioning, all boreholes which will not be required for later monitoring or other useful purposes should be grouted to prevent possible cross flow and contamination between aquifers.	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure all plant and infrastructure are removed from site to allow successful rehabilitation of the site/Visual observation that decommissioning complies with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	In the event that the landowner requests the retention and use of any boreholes, the Department of Water Affairs must be consulted with regards	Upon completion of mining.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure all plant and infrastructure are removed from site to allow successful

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	to the necessary legal requirements (e.g. water use licences and/or borehole registration).				rehabilitation of the site/Visual observation that decommissioning complies with EMP and legal requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

22.6 EMP – REHABILITATION AND CLOSURE PHASE

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
113. Surface and Groundwater					
A	Decant water must be contained at the decant point(s) anticipated. Decant must be collected into a dedicated lined PCD. Decant water must be treated and tested to comply with relevant water standards before discharge.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Effective treatment of polluted water/Visual observation that mitigation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
B	The Applicant shall appoint a suitably qualified specialist to investigate potential treatment options. Treatment options may include passive and/or active treatment technologies. Where appropriate, decant water should also be treated at the water treatment plant located on NBC Glisa.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Effective treatment of polluted water/Visual observation that mitigation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	The Applicant shall ensure there is continued maintenance of clean and dirty water system infrastructure. Continued maintenance of all dams is required to ensure there are no spills, seepages or leakage.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Limit potential for contamination of water resources/Visual observation that mitigation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
D	The Applicant shall continue to investigate various water treatment options including pH adjustment, controlled release and further containment options.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Effective treatment of polluted water/Visual observation that mitigation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	There should be ongoing review and implementation of best available technology to mitigate and treat AMD where appropriate and feasible.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Effective treatment of polluted water/Visual observation that mitigation measures have been complied with. (Mine EO weekly checklist)

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
					(ECO Monthly Checklist/Report)
F	Ensure that proper backfilling is undertaken throughout the operation to ensure less recharge of oxygen rich water and reduction in AMD produced.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Effective treatment of polluted water/Visual observation that mitigation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
	114. Rehabilitation				
A	Upon completion if the mining operation and closure of the facility, the Applicant shall ensure that all cleared and/or disturbed areas (as a result of the activity) within and outside the boundaries of the site shall be rehabilitated in accordance with the Integrated Rehabilitation and Closure Plan.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure disturbed areas are rehabilitated/Visual observation that rehabilitation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
C	The ECO will specify where ripping and/or scarifying is necessary to remediate compacted areas. Before topsoil is spread, the compacted area will be deep-ripped to a depth of at least 30 cm where soil depth permits.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Visual observation that rehabilitation is undertaken in accordance with EMPR requirements. (EMPR checklist)
D	Rehabilitation will include returning the slope to the minimum possible gradient (preferably less than 1:3), the topsoil will be replaced for vegetation re-establishment and contour drains will be built to prevent erosion if necessary.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	No steep slopes that may result in instability and erosion/Visual observation that slopes are reduced to minimum possible gradient. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
E	The area must be rehabilitated using indigenous vegetation from the area in such a way that it will return as close as possible to the original production potential. Rehabilitation shall be overseen by a suitably qualified specialist who shall approve the indigenous seed mix to be used. The rehabilitated area must be returned to a self sustaining ecosystem that is consistent with the original vegetation type.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Rehabilitation to return area to self sustaining ecosystem/Confirmation that rehabilitation has been successful and shall remain self sustaining. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
F	The use of inorganic fertiliser to improve the success of re-vegetation should only be undertaken with caution and should be considered in consultation with a suitably qualified specialist. It must be born in mind that fertilisation with inorganic fertilisers is more of a short term solution. Long term sustainability will only be achieved with adequate soil improvement in terms of soil structure, Soil Organic Matter (SOM) and soil biota. Soil improvement measures will increase the speed at which the vegetation in the rehabilitated areas will establish and return to a self—sustaining ecosystem. Measures which must be investigated and implemented where appropriate shall include, but not be limited to, • Improving the soil organic matter (SOM) content of the topsoil to	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Appropriate soil improvement to ensure sustainable soil fertility and ecosystem functioning/Confirmation that appropriate soil improvement has been undertaken. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
	improve soil structure, aeration and ensure long term sustainability through the addition of manure, compost, mulch etc. (not alien plant matter to be used); and • Improving the quantity and diversity of soil biota through inoculation with appropriate Mycorrhizae and other soil biota.				
G	The post mining environment should be planned with specific land uses in mind which would prevent the additional transformation of natural areas in the landscape. Local landscape features such as rocky outcrops and wetlands should be re-constructed in areas which would facilitate the movement of fauna in the area. Trained zoologists/ecologists should advise on the recreation of destroyed landscape features in order to optimize rehabilitation.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Avoid and prevent loss of habitat and biodiversity (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
H	Any access road or portions thereof, constructed by the Applicant which will no longer be required by the landowner/tenant, shall be removed and/or rehabilitated to the satisfaction of the ECO and Regional Manager (DMR).	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Rehabilitation of disturbed areas/ Visual observation that rehabilitation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
I	Any gate or fence erected by the Applicant which is not required by the landowner/tenant, shall be removed and the situation restored to the pre mining situation.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Rehabilitation of disturbed areas/ Visual observation that rehabilitation measures have been complied with. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
J	Erosion control measures shall be implemented where necessary (such as berms, brushpacking, silt fences etc.). Erosion control and silt prevention measures shall be inspected regularly and shall be maintained whenever required to ensure they remain effective.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Prevent erosion during and after rehabilitation/Visual observation that rehabilitation is undertaken in accordance with EMP requirements. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
K	No alien or invader plant species should be introduced on site during rehabilitation. The weed management plan shall be implemented throughout the rehabilitation and closure phase. Regular monitoring of the rehabilitated area shall be undertaken and all alien vegetation shall be eradicated and/or controlled prior to it setting seed. Weed management shall be to satisfaction of the ECO and Regional Manager (DMR). Where required, the necessary adjustments should be made to ensure the complete re-establishment of the natural vegetation.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Establishment of natural vegetation. No invasive or alien vegetation/Visual observation that weeds are eradicated/controlled. (Mine EO weekly checklist) (ECO Monthly Checklist/Report)
L	Regular monitoring of the success of rehabilitation measures will be implemented by a suitably qualified independent party for a period of at least ten (10) years following cessation of mining activities.	Upon completion of decommissioning.	Applicant	Mine EO (Weekly) ECO (Monthly)	Ensure adequate rehabilitation/Confirmation that rehabilitation has been successful and natural vegetation has been re-established.

Item No.	Technical or Management Option & Action Plan	Timeframe	Responsible Party	Monitoring Party (Frequency)	Target / Indicator (Monitoring Tool)
					(Mine EO weekly checklist) (ECO Monthly Checklist/Report)
115. Mine Closure					
A	Should the activity ever cease or become redundant the applicant shall undertake the required closure process in accordance with Section 43 of the MPRDA.	Upon Closure.	Applicant	Independent Environmental Auditor (Once-Off)	Ensure proper closure process is followed/Visual observation that rehabilitation is undertaken in accordance with EMP and legal requirements. (Final performance assessment, environmental risk assessment and Closure Plan).
116. Post-Closure Monitoring					
A	The post-closure monitoring and management period will be implemented by a suitable qualified independent party for a minimum of ten (10) years following cessation of mining activities. The monitoring activities during this period will include but not be limited to: • Bodiversity monitoring; • Ground and surface water; • Air quality monitoring; • Bio-monitoring; • Re-vegetation of disturbed areas where required; • Weltands; and • Maintenance on installed access control or fencing. Provision must be made to monitor any unforseen impact that may arise as a result of the proposed mining activities and incorporated into post closure monitoring and management.	Post-closure	Applicant	Independent Environmental Auditor (Annually)	Ensure proper rehabilitation is accomplished/Visual confirmation that rehabilitation is undertaken in accordance with EMP and legal requirements. (Annual performance assessment, environmental risk assessment).

23 PLANNED ENVIRONMENTAL MONITORING

23.1 ENVIRONMENTAL ASPECTS THAT REQUIRE MONITORING

Several environmental impacts (identified in Section 11) will require on-going monitoring during various phases of the proposed project. In order to monitor these impacts, the following environmental aspects require, prior to project commencement, the development of a detailed monitoring programme. The monitoring programmes to be designed must take into account the following monitoring considerations which have been identified by the specialists responsible for contributing to this report, the Integrated Environmental Management Programme.

23.2 AIR QUALITY MONITORING

The design and implementation of an air quality monitoring programme must incorporate the following considerations:

- Linkage to the existing Glisa air quality monitoring programme;
- Monitor select ambient parameters such as dust fall out, PM_{10} and $PM_{2.5}$ concentrations;
- Detailed identification of all emissions sources;
- Implementation of source based controls;
- Use of source and receptor based key performance indicators in monitoring strategies;
- Implementation of the technical management options stipulated in the EMPR;
- Internal and external auditing; and
- Review and amendment of the monitoring programme as required.

It is further recommended that air quality monitoring of the ambient parameters discussed above is to take place near sensitive receptors within the mine boundary and in near-by Siyathuthuka and eMakhazeni. The neighbouring residential areas of Siyathuthuka and eMakhazeni should additionally have PM_{10} monitoring established under the auspices of the District or Local Municipality in order to fulfil the legal mandate of the municipalities to monitor ambient air quality.

This recommendation to air quality monitoring is based on the proximity of mining operations to the residential areas and concerns raised by several I&AP's. Provision of the results of ambient air quality monitoring to both the local Air Quality Officer and to the public is also encouraged.

23.3 BLASTING AND VIBRATION MONITORING

The design and implementation of a blasting and vibration monitoring programme must incorporate the following considerations:

- The Applicant must undertake a pre-blast baseline survey including photographic inspections of privately owned structures within 1500 m of the mine;
- Monitoring of each individual surface blast must be undertaken and the limits as stipulated by the blasting specialist) adhered to; and
- Further points for off-site vibration and blasting monitoring must also be identified in consultation with surrounding landowners and legal occupiers.

In addition, the following reconditions should be incorporated into the blasting and vibration monitoring programme:

- Blasting should not be undertaken in the early morning when it is still cool and the possibility of inversion is present or too late in the afternoon in winter;
- No blasting must be undertaken in the evenings;
- Refrain from blasting when wind conditions are unfavourable and in the direction of receptors;
- Development of a standard blasting time and placement of blast notices to inform I&AP’s of blasting operations;
- Develop a list of all boreholes within the project area including location, conditions, and water levels;
- Maintain ground vibration levels below 50 mm/s;
- Document and audit each operation; and
- Provision of blast data and recordings to I&AP’s who request it.

It is further recommended that the blasting and vibration monitoring programme make extensive use of third party consultation and monitoring. The impact of blasting and vibration is a significant concern raised by I&AP’s and some have suggested that they are uncertain if the blast and vibration levels are within acceptable limits. The provision of blast and vibration information to I&AP’s will alleviate this concern as well as provide for a more complete sensitive receptor database to be consulted with prior to and post any blasting operations and the monitoring thereof.

23.4 BIODIVERSITY MONITORING

The design and implementation of biodiversity monitoring programme must incorporate the following considerations:

In terms of mammals the following apply to the monitoring programme:

- The exceptional diversity of meso and small carnivores on the site, including species outside of their known distributions (side-striped jackal and African civet recorded at Glisa) warrant further investigations in the form of monitoring;
- It is recommended that a full, in season small mammal baseline should be done prior to construction phase. This will provide adequate baseline data to be used for rehabilitation, as small mammals are excellent environmental indicators;
- It is the primary recommendation that a carnivore monitoring program be implemented in order to quantify and qualify the conditions that have given rise to such an exceptional meso and small carnivore assemblage;
- Implementation of permanent or regular camera trap monitoring points;
- Collaring of key predators to monitor movements;
- Regular seasonal monitoring of small mammals through sherman trapping; and
- Regular spoor tracking and applicability to operation;

In terms of invertebrates the following apply to the monitoring programme:

- Monitoring of the invertebrate diversity and composition on maintenance and rehabilitation areas by comparing data from the rehabilitated areas with that of un-mined grasslands (on the maintenance areas). Data will be applied to evaluate rehabilitation effort and to advise the revision of the livestock and fire management plans; and
- The latent effect of acid mine drainage should be evaluated by regional monitoring of water bird populations on selected wetland features within the landscape (including areas outside Exxaro's jurisdiction).

As part of the planned biodiversity monitoring programme, the Applicant will also implement an alien/invasive/weed management plan to control the spread of these species. This will be achieved through active eradication and establishment of natural vegetation on disturbed sites as well as on-going monitoring and assessment.

23.5 SURFACE AND GROUNDWATER MONITORING

A long-term monitoring programme must be developed by a suitably qualified specialist based on the guideline documented in Best Practice Guideline G3. Water Monitoring Systems (2007) available from DWA. These guidelines are summarised and implemented in the proposed monitoring plan.

The objectives of the management action can be defined as:

- Identify, quantify and monitor surface and groundwater flow in the vicinity of the mine.
- Identify, quantify and monitor all point and diffuse pollution sources and associated plumes on the mine.

23.5.1 OBJECTIVES OF THE SURFACE AND GROUNDWATER MONITORING PROGRAM

These objectives must adhere to the requirements of being specific, measurable and feasible. The surface and groundwater monitoring system should consist of the following components as a minimum:

- Surface water/groundwater quality monitoring system;
- Flow/water level monitoring system; and
- Data and information management system.

The monitoring programme must include the following as a minimum:

- The location of all monitoring points (indicated on a map);
- The type of data to be collected;
- The data collection protocol/procedure/methodology;
- Frequency of monitoring and parameters determined;
- Quality control and assurance;
- Management (database and assessment); and
- Reporting procedures.

When designing the monitoring system the following issues must also be taken into consideration:

- Potential or actual water use;
- Aquifer or catchment vulnerability;

- Design initial monitoring programme;
- Implement monitoring programme;
- Collect and capture data
- Report on information and data;
- Evaluate monitoring programme and recommend changes;
- Toxicity of chemicals;
- Potential for seepage or releases;
- Quantities and frequency of release to the environment (point and non-point); and
- Management measures in place to minimize risk.

23.5.2 DATA REQUIREMENTS

The data requirements are dictated by:

- Area influenced by groundwater dewatering/flooding;
- Groundwater discharge points;
- Groundwater abstraction points; and
- Point and diffuse sources of pollution and associated pathways.

Indicators of pollution and changes in groundwater flow directions are determined for the above-mentioned factors.

23.5.3 LOCATION OF MONITORING POINTS

Proposed monitoring points have been suggested in the Hydrology report (see Appendix H). The potential monitoring points are chosen to:

- Determine any changes in groundwater levels and quality on the mining property before affecting the down gradient environment; and
- Perform a regional groundwater screening to ensure that the monitoring points on site are sufficient.

The positions of the proposed monitoring points will be finalised once all field investigations and data interpretation are complete.

23.5.4 MONITORING PARAMETERS

There are two sets of monitoring parameters. A comprehensive analysis must be conducted on surface and ground water monitoring points within or close to the mine and a screening analysis must be conducted on surface and ground water points further away. Samples must be tested for trace elements once mining commences. The parameters that must be sampled for are listed below:

Table 83: Sampling parameters

A (Standard set of parameters)	B (Screening parameters)	C (Trace elements)
pH	pH	Ba
EC	EC	As
Ca		Co
Mg		Cr
Na		Ni
K		Pb
Total Alk		Se
F		Sr
CL		V
NO_2(N)		Zn
NH_4 (N)		Nb
NO_3(N)		Mn
PO_4		Cu
SO_4		Ga
Al		Ge
Fe		Rb
Mn		Y
		Zr
		Sn
		W
		Bi
		Th
		U
		Hg

23.5.5 APPLICABLE STANDARDS

- SANS241-1: 2011 guidelines
- WHO guidelines if no SANS guideline

If any parameters exceed SANS241-1: 2011 guidelines (or WHO guidelines if no SANS guideline available) then that parameter must become part of list A (see Table 83). Laboratory analysis techniques will comply with SABS guidelines. Laboratories must be accredited.

23.6 NOISE MONITORING

The design and implementation of a noise monitoring programme must incorporate the following considerations:

- Clear and thorough identification of Noise Sensitive Receptors (including maps/diagrams);
- Determination of noise profiles for machinery to be used;
- Further determination of the baseline noise environment;
- Define appropriate statistical analysis and data interpretation; and
- Provide appropriate data presentation, analysis and trending (including diagrams and graphs).

Furthermore, it is recommended that the results of the noise monitoring program be provided to I&AP's on request. Noise nuisance is a common I&AP concern that must be addressed through application of the management measures suggested and on-going monitoring.

23.7 REHABILITATION MONITORING

The design and implementation of a rehabilitation monitoring programme must incorporate the following considerations:

- Project description and objectives;
- Clear definition of the study area (define spatial boundaries, including maps/diagrams);
- Determination appropriate criteria for determination of successful re-vegetation and rehabilitation;
- Assessment and control of any alien vegetation;
- Percentage ground cover and species composition;
- Soil fertility, pH and salinity;
- Presence of invertebrate species;
- Surface and groundwater quality; and
- Conditions of downstream ecosystems;

It is also recommended that the land use post-mining be determined in consultation with relevant stakeholders including I&AP's. I&AP involvement should also include independent assessment of the success of rehabilitation efforts.

23.8 WETLANDS AND AQUATIC ECOLOGY MONITORING

The design and implementation of a wetland and aquatic ecology monitoring programme must incorporate the following considerations:

- wetlands on site must be monitored to ensure the effectiveness of the technical management and mitigation measures employed as well inform further improvements where necessary;
- Any activities leading to vegetation removal (during all project phases) subsequent re-vegetation must be monitored to ensure successful establishment. The following broad monitoring parameters are applicable and confirmed with site specific details by a suitably qualified specialist:
  - Monthly monitoring during first 6 months and thereafter annual monitoring during the growing season;
  - Monitoring during the first 6 months should focus on vegetation cover;
  - 70% cover must be achieved after 3 months; and
  - Annual monitoring of representative samples of re-vegetated sites must be undertaken until the appointed specialist is satisfied that a sustainable vegetation cover has been established.
- All wetland areas requiring re-vegetation must also be monitored for signs of erosion. In addition the following areas should also be included in the monitoring of erosion:
  - All storm water discharge points;
  - All clean water diversion discharge points;
  - All road crossings; and
  - All river diversions (if any).

As part of wetland and aquatic monitoring, the proposed Paardeplaats Coal Mine must also develop a surface water quality and bio monitoring plan which must include:

- Monitoring both upslope (if possible) and downslope of the proposed mining activities in all water resources where a part of the catchment will be impacted on by mining activities.

The parameters below must be included in the monitoring plan to be developed:

- Water quality (pH, EC, TDS, SO_4 as well as standardised anions and cations) on a monthly basis;
- Aquatic macro-invertebrates (SASS5) on a biannual basis and at the start of the wet season; and
- Diatoms on a biannual basis also at the start of the wet season.

The development of the wetland and aquatic ecology monitoring plan must consider the input of the specialists above and be implemented as soon as possible and at the latest at the onset of construction.

24 THE EMPR PERFORMANCE ASSESSMENT

According to Regulation 55 of the MPDRA regulations compliance with the EMPR must be monitored on a continuous basis. This requirement shall be accomplished through the continuous monitoring of compliance undertaken by the Mine EO and ECO. The performance assessment will focus on the following Key Aspects:

- Compliance with the Approved EMPR; and
- Appropriateness and validity (technical content) of the EMPR.

An EMPR performance assessment report shall be submitted to the Department of Mineral Resources (DMR) after each year of mining and before applying for closure. The holder of the mining right may appoint an independent qualified person for the monitoring and to compile a report, but the responsibilities remain the holder’s. The performance assessment will include:

- The period when the performance assessment was conducted;
- The scope of the assessment;
- The procedures used for conducting the assessment;
- Interpreted information gained from monitoring the EMPR (e.g. ECO reports);
- Evaluation criteria used during the assessment; and
- Results of the assessment are to be discussed and mention must be made of any gaps in the EMPR and how it can be rectified.

25 CLOSURE GOALS & OBJECTIVES

According to Section 43 of the MPRDA the mineral rights holder remains responsible for any environmental liability, pollution or ecological degradation until a closure certificate has been issued. According to Regulation 56 of the MPRDA the closure process starts with the commencement of mining activities and continues throughout the mining process. Environmental impacts must be identified and quantified and managed proactively. The land on which the mining operations occur must be rehabilitated, as far as is practical, to its natural state or where the land use conforms to the concept of sustainable development.

Based on the MPRDA, the following requirements must be met in order to obtain closure of a mining operation:

- Application for closure certificate (Regulation 58) – Standard DME form to be completed and signed by the mineral rights holder. The application must be made within 180 days of the lapsing or completion of the mining activity.
- Final performance assessment (Regulation 55) – this document serves to prove that all relevant legislation has been met, closure objectives have been met, all residual environmental impacts associated with the foregoing activities have been identified and risks of latent impacts have been assessed.
- Environmental risk report (Regulation 60) – including an environmental screening risk report (based on input from existing data), second level risk assessment (based on sampling, data monitoring), identifying of alternative risk mitigation measures to be implemented for potential second level risks identified.
- Closure plan (Regulation 62) – closure objectives, summary of regulatory requirements, summary of results of risk report, proposed closure costs and monitoring, sketch plan of proposed final and future land use, description of interested and affected party consultation.

Reichardt and Reichardt Consulting (Pty) Ltd was appointed to compile a Mine Closure and Rehabilitation Plan and Estimate for Financial Provision for the proposed Paardeplaats Goal Mine. The closure plan was developed under the regulations as set out in the Mineral and Petroleum Resources Development Act 28 of 2002 (MPRDA) and took cognisance of the features that describe the pre-mining environment. The financial provision for closure was calculated based on information made available by the Applicant, using a methodology in line with the Department of Mineral Resource (DMR) guideline as well as other known best-practise principles.

25.1 CLOSURE GOALS AND OBJECTIVES

The closure objectives identify the key objectives for mine closure and will guide the management of environmental impacts. For the project, the following broad closure objectives and goals are proposed:

- To rehabilitate all disturbed land to a state that is suitable for its post closure use to be determined in consultation with I&AP's and other key stakeholders;
- To ensure that affected areas are safe, secure and non-polluting for both human and animal activities;
- The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated or adequately minimised;
- To rehabilitate all disturbed land to a state where limited or preferably no post closure management is required;
- To rehabilitate all disturbed land to a state that facilitates compliance with current environmental quality objectives; and
- To limit the impact on personnel whose positions may become redundant on decommissioning of the mine.

As the proposed Paardeplaats Coal Mine is planned to operate as an extension of NBC Glisa, the closure goals and objectives listed above have been aligned to NBC Glisa's closure goals and objectives which include the construction of a safe, stable and non-polluting land form that can be re-integrated into the current agricultural, wilderness and economic activities of the area at the cessation of mining activities.

25.2 POST-CLOSURE MONITORING AND MANAGEMENT

The post-closure monitoring and management period is anticipated to be 10 years at the Paardeplaats Coal Mine. Monitoring activities during this period will include:

- Bodiversity monitoring;
- Groundwater water;
- Air quality monitoring;
- Bio-monitoring;
- Re-vegetation of disturbed areas where required;
- Weltands;

- Maintenance on installed access control or fencing; and
- Annual third party environmental compliance monitoring.

The aspects listed above that should be monitored post-closure are a guide. Provision must be made to monitor any unforeseen impact that may arise as a result of the proposed mining activities and incorporated into post closure monitoring and management.

25.3 LAND USE FRAMEWORK AND REHABILITATION

25.3.1 CURRENT LAND CAPABILITY AND LAND USE

The current land capability of the proposed project area is a mixture of arable, grazing, wilderness, wetlands and other land capability classes. Moderate and high arable potential are the most prevalent land capabilities followed closely by grazing. The identification of these land capability units have been recorded and will be used for re-instatement during rehabilitation in order to facilitate and promote biodiversity. Current land capability is summarised below:

Table 84: Land Capability

Capability Class	Map unit	Area (ha) + %
Arable, high	**dHu, dCv, dAv, dHu/Cv**	446.74 (30.56%)
Arable, moderate	**mdHu, mdCv, mdAv, mAv/Cv**	353.76 (24.20%)
Grazing	**mdCv/Lo, sDr**	392.77 (26.87%)
Wilderness	**sDr/R**	85.11 (5.82%)
Wetland	**mdKd, W, Dam**	154.31 (10.56%)
Other	**B**	22.32 (1.53%)
Total		**1 461.86** (100%)

The current land uses on the proposed project area comprises of a mixture of commercial agriculture (arable and grazing), the Hadeco cold climate bulb operation and village for workers as well as stands of exotic plantations. Most of the commercial agriculture on site involves the farming of maize monoculture as well as grazing for livestock such as cattle, sheep, springbok, and blesbok. Some dams are present and used for trout fishing on a small commercial scale and recreationally by surface rights holders.

25.3.2 POTENTIAL FUTURE LAND CAPABILITY AND LAND USE

The area in which the proposed Paardeplaats Coal Mine is situated, according to the eMakhazeni Spatial Development Framework, is earmarked for proposed multi-purpose centres along the N4 National highway. In addition, the proposed mine is also located immediately west of a proposed urban expansion and integration area. As an extension of NBC Glisa, the potential future land use of the proposed Paardeplaats Coal Mine needs to be coordinated to align to those of the existing mine. As the post mining land use objective of NBC Glisa is the achievement of wilderness land supporting some wetland area with trout farming and small commercial land uses implemented as alternatives, dependant on economic and planning realties at the time of closure, so should the potential future land use of Paardeplaats be aligned.

As such, the future post mining land use of the proposed Paardeplaats Coal Mine should seek to re-establish grazing and wilderness land supporting both wetlands and dams in approximate locations where these uses existed prior to mining. The re-established topography following closure should also allow for the re-establishment of pre-mining drainage patterns of surface and near-surface water in a westerly direction. This would be achieved primarily through adherence to the Paardeplaats Soil Management Guide.

By returning the various categories of soil back to as close to their original location and vertical sequence as possible, Paardeplaats will also have the best chance of re-creating the surface and near–surface water flow patterns for a landform that resembles the pre-mining landform as far as possible. Equally this would allow the return of land utilised for agricultural purposes prior to mining, to its pre-mining usage if this is what I&AP's and other key stakeholders desire. Once established as stable, non-polluting land forms additional commercial or eco-tourism land uses could be considered depending upon on the economic and planning reality as well as further stakeholder input.

26 REHABILITATION AIMS AND OBJECTIVES

As a result of the closure goals and objectives, the consequent rehabilitation aims for the proposed Paardeplaats Coal Mine are outlined below:

- The visual impact of rehabilitated areas should be minimised by recreating natural landforms and ensuring that where possible, reshaped area conform to the surrounding topography and are suited to natural surroundings;
- Soils must be stockpiled, stored and correctly prepared as they are the most important aspect of any rehabilitation plan. If soils are not correctly stockpiled, stored and prepared suitable conditions for rehabilitation will not be possible to achieve;
- All alien and invasive floral species must be controlled and eradicated in order to contribute toward effective rehabilitation and the reinstitution of biodiversity; and
- Artificial wetlands or phytoremediation options must be employed to clean up chemical pollution in order to improve the integrity of the natural resources on site.

As the neighbouring NBC Glisa has operated as an underground mine between 1985 and 2006, and intermittently as an open-cast operation since 1999 it is certain that near surface and underground movement of water through mined out areas will affect water quality. In addition 27% of the proposed Paardeplaats mining area is covered by wetlands and a further 1% by dams. As a result drainage management through wetlands and dams must form an integral part of the post-closure land use and therefore it is necessary to add two additional objectives for rehabilitation, namely:

- The use of natural, restored and artificial wetlands on site, as well as wetland offsets nearby must form the core of the long-term water pollution management control approach; and
- The long water pollution control approach must take into account the areas natural pre-mining drainage patterns and volumes (both surface and underground) in order to be sustainable.

26.1 MINE CLOSURE PROCESS

The mine closure process will be funded by the Financial Quantum for Closure which will be set aside. The process consists of the following phases:

- Making safe and the dismantling of infrastructure;
- Landform design, erosion control and re-vegetation;
- Monitoring, maintenance and relinquishment;

Each phase of the Mine closure process I described below and in detail.

26.1.1 PHASE 1: MAKING SAFE

Following decommissioning the area would be cleaned up and the sections to be rehabilitated made safe. This involves the following:

- Removal of infrastructure and unused or unwanted equipment. No facilities will remain on site unless with the written approval of the post-mining land-owner, post-mining land user as per Spatial Development Frameworks (SDF) projects, or relevant authority. This includes the removal temporary office structures and any associated ablution facilities as well as pipelines as well as any waste that may still be stored at the Paardeplaats waste collection facility;
- Removal of rubbish from the Paardeplaats temporary waste collection and storage facility for disposal at approved sites. Particular care will be required with residual toxic or

hazardous materials including contaminated hydro-carbons, packaging or containers, although these volumes should be minimal;

- Removal of all services unless these are specifically required for post-mining land-use, post-mining SDF projects or have been requested by the post-mining land owner;
- Removal or burial of all concrete slabs, foundations, footings etc. unless these are required by the post-mining land-owner, post-mining user as per SDF projects, or have been designated and approved for post-mining use by the relevant authority;
- Backfilling of the final pit void with the stockpiled spoils and soils according to the requirements of the Paardeplaats Soil Management Guide.;
- Backfilling of any other pits, dams or similar excavations unless these are required for use by the post-mining land-owner, post-mining user as per SDF projects, or have been designated and approved for post-mining use by the relevant authority; and
- Restricting or preventing public access by removal or closure of access roads and tracks.

26.1.2 PHASE 2: LANDFORM DESIGN, EROSION CONTROL AND RE-VEGETATION LANDFORM DESIGN & EROSION CONTROL

The re-shaping and re-grading of an impacted site is essential for rehabilitation and closure to take place. Unless slopes and surfaces have been stabilized the effectiveness of subsequent rehabilitation and re-vegetation is greatly reduced and maintenance will be prolonged. As per the requirements of the Paardeplaats Soil Management Guide, final landform design will consider the following factors:

- Erosion potential of materials on site;
- Recognition of pre-existing surface and groundwater flow patterns ;
- Alignment with existing topographical features;
- A preference for shallow, less erodible slopes;
- Slope angles and lengths to be visually compatible with the surrounding area and stable under local rainfall patterns and erosion processes;
- Recognition that unconsolidated materials from disturbed land will require greater protective measures to minimize erosion;
- Large overburden depositories normally require a drainage density higher than existed prior to mining to compensate for the increase in the gradient of slopes and drainage channels. As a rule where run-off in concentrated into drains or diversion channels, individual catchment area of 2 hectares are required;

- Unless already naturally vegetated, slopes will be designed to reduce the velocity of run-off and long straight ridges and slope angles will be avoided. Slope angles will be less than 20 degrees, except for slopes constructed of non-erosive rock;
- Only where limitations prevent the construction of stable slopes will contour benches or similar erosion control measures be considered;
- The drainage pattern for the overall site will be planned as part of the overall land-scaping, with drainage patterns and densities of monitored during the operational phase on, and near site providing a guide to site requirements;
- The entry of water runoff to the site will be limited through diversion channels and holding structures such as small dams;
- Where possible, rainfall infiltration will be encouraged, except on materials that have acid generating potential; and
- Final site drainage will be directed internally via the as far as possible to the final void. Drainage that is unlikely to be affected by residual impacts of mining will be directed to the surrounding area.

Given the pre-mining ecology and drainage patterns, the final landform design will focus on re-creating a series of dams and wetlands laid out to accommodate anticipated post-mining drainage patterns along the major drainage lines which will be located in the valleys opening towards the west and northwest.

Rehabilitation is designed to establish an adequate cover of non-erodible materials or vegetation so as to stabilize the site and prevent and control erosion to natural levels. As the majority of the land disturbed by opencast mining at Paardeplaats will already have been backfilled, contoured and seeded as per the requirements of the Paardeplaats Soil Management Guide, the majority of the disturbed land can at the cessation of mining and the initiation of closure work be assumed to be covered in at least the initial pioneer vegetation seeded as part of the concurrent rehabilitation of the operational phase. Wherever vegetation has already established a cover of a density and diversity comparable to the surrounding landscape, no further re-vegetation or erosion control will be implemented. Beyond this the rehabilitation and re-vegetation of areas other than the open pit, final void and box cut area will be rehabilitated and re-vegetated as follows:

- All areas where topsoil or vegetation has been removed and/or where soils have been compacted or covered as a result of haulage roads or temporary structures will be ripped or ploughed to a depth of 500mm;
- All areas otherwise disturbed or impacted will be ripped or ploughed to a depth of 500 mm;

- Existing culverts and storm water control infrastructure will be upgraded (using mainly gabions) to ensure its long-term effectiveness and its ability to handle a 1:100 year flood event;
- Existing pollution control dams will be maintained where they can be integrated into the long term pollution control infrastructure ; and
- Depending upon the results of the on-site wetland restoration projects conducted during the operational phase, existing or impacted wetlands will be re-established or expanded to contain potentially polluted run-off and seepage

Once all water management infrastructures has been put in place and all disturbed areas have been prepared and shaped, the establishment of vegetation can proceed on these areas and integrated with that of the vegetation established on the backfilled Paardeplaats final void.

While seeding and transplanting of nursery-raised seedlings (see below) are the preferred re-vegetation method, use can also be made of rescued plants from impacted areas, transplanting from areas not impacted as well as propagation of plants from soil biota.

The species selected for the re-vegetation of each specific area will be informed by the species composition as determined by fauna and flora studies which form part of this document, in non-impacted, comparable areas on site. To ensure a steady supply of suitable specimens and to avoid denuding the surrounding countryside of indigenous seeds, Paardeplaats should, as part of its CSI or SLP initiatives establish a nursery operation with which to ensure a sustainable source of indigenous seeds and young plants to vegetate the areas marked for re-vegetation (including for concurrent rehabilitation during the operational phase). This nursery could also serve as the source of young trees for those areas where the re-establishment of pre-mining eco-systems has been determined as not feasible or desirable (due to stakeholder input) and where low-intensity agriculture, grazing or forestry land uses are eventually agreed upon. Re-vegetation can only take place during suitable seasons (end of winter, spring).

Concurrent with re-vegetation the removal of all remaining exotic vegetation left on the property is recommended. The plant material thus collected should be chipped and used as organic additive to particularly impacted soils or in areas where the re-establishment of wetlands is planned. The addition of this material increases the ability of rehabilitated soils to retain soil moisture and works against soil crust formation which can affect rainfall run-on/off.

26.1.3 PHASE 3: MONITORING, MAINTENANCE AND RELINQUISHMENT

Once the final landform design has been established and stabilized the mine will provide for a period of monitoring to verify the success or otherwise of the rehabilitation program. The length of the monitoring period will be determined in consultation with the appropriate regulators and would take the form of periodic inspections by contracted specialists, but is generally assumed to last for at least 3 years for issues other than ground water and possibly more than a decade for ground water. The parameters that may be monitored after rehabilitation should, subject to agreement with the regulator, include the following:

- The continued safety of the site;
- The establishment and growth of plants including the return of species not planted as part of re-vegetation;
- The percentage of ground cover and species composition;
- The return of native fauna (where eco-system restoration is intended);
- Soil fertility, pH and salinity;
- Evidence of land erosion or land degradation;
- The presence of vertebrate and invertebrate species identified in the EIA/EMP as indicator species;
- Surface and ground water quality; and
- Conditions of downstream ecosystems.

Maintenance that may be required in addition to rehabilitating any areas where initial vegetation establishment failed includes:

- Fencing to control access by grazing animals onto rehabilitated areas, especially the re-constituted wetlands and the areas surrounding any re-established dams;
- Pest and weed control; and
- Liming to control pH or heavy metals.

Where reworking becomes necessary as a result of re-vegetation not performing adequately, this work will be scoped in consultation with the regulators. Sufficient funds will be allowed for this as part of the post-closure monitoring budget. Long-term ground water management will be necessary due to the fact that the neighbouring Glisa mine working the same seam which Paardeplaats plans to mine has already created a water sink (a low point void to which ground water migrates). The experience of Glisa and the findings of the geo-hydrological section of this report, demonstrate that under almost any situation, the post-mining situation will be one in which acid generation takes places within the groundwater as it passes through the backfilled areas of Paardeplaats.

The challenge for Paardeplaats is that the while disturbed, backfilled soils are not likely to lead to a change in pre-mining groundwater flow directions, it is likely that groundwater movement will alter in vertical terms, i.e. passing through a much larger vertical strata than in the pre-mining environment. As the coal stream does not end at the mining lease boundary, this means that post-mining ground water management will need to intercept ground water across a much deeper range of strata than would presently be the case. Two options for the long term management of this ground water pollution challenge will be considered during the operational phase of Paardeplaats:

- The placement of additional dolomitic, acid-neutralising material into the backfilled strata; and
- The establishment of a series of abstraction wells, powered by windmills along the western boundary of the Paardeplaats mining lease, from which the potentially polluted water will be pumped to the treatment plant located on NBC Glisa property.

Both options will require long-term maintenance and monitoring for effectiveness. The costs associated with either option will vary depending upon the size of the disturbed area and have been provided in the financial quantum. Components of the success criteria will need to be formally negotiated with regulators and stakeholders but would include:

- Physical (stability, resistance to erosion, re-establishment of drainage);
- Biological (species richness, plant diversity, canopy cover, seed production, fauna return);
- Water quality; and
- Public safety issues.

From an ecological perspective, eco-systems are deemed sustainable when the site can be managed for its designated land-use without any greater management inputs than for other comparable land in the area being used for a similar purpose.

27 FINANCIAL PROVISION

The calculations for the financial provision for closure were calculated in line with the master rates provided by the DMR and adjusted for 2012 CPI as referenced in the Mine Closure Quantum Guideline document. As two operating project alternatives were assessed, two closure cost calculations have been undertaken for Alternative 2 Maximum Mine Production and Alternative 3 Sensitivity Planning Approach. The full closure costing assessment is provided in Appendix Q.

27.1 ANNUAL FORECASTED FINANCIAL PROVISION

27.1.1 ALTERNATIVE 2 MAXIMUM MINE PRODUCTION

The determination of the closure cost liability for Alternative 2 is based on the following criteria:

- Final Void including Box Cut – ca. 30 hectares@ R 155 766/ha;
- Access and haulage roads – ca. 8km or 80 000 square meters (8 hectares) @ R 265 800/ha;
- Pipelines- ca. 5 km or at 2 meters width, 10 000 square meters @ R 148.57 sq.m;
- Compacted land beyond other infrastructure – 0.5 hectares @ R 82 262/ha;
- Temporary general waste collection and storage site – 0.2 hectares @ R 297.15 sq.m;
- Land utilised for temporary overburden and topsoil storage – 15 hectares @ R 103 844/ha;
- Return water and storage dams – 2.5 hectares @ R129 335.96/ ha;
- Storm water control infrastructure – 3.5 hectares (will be largely retained);
- Otherwise disturbed land (provision) – 20 hectares @ R 82 262/ha;
- Water management – for approximately 100% of surface area @ R 31 278/ha; and
- Post-closure monitoring and maintenance for entire site – 1167.6 ha @ R 10 947

Based on the criteria above the Clean Closure Liability and Total Closure Liability Costs are presented below:

- Clean Closure Liability Cost: R 59 440 341.00
- Total Closure Liability (including preliminary & general and VAT): R 73 230 500.00

27.1.2 ALTERNATIVE 3 SENSITIVITY PLANNING APPROACH (PREFERRED ALTERNATIVE)

The determination of the closure cost liability for Alternative 3 (Preferred Alternative) is based on the following criteria:

- Final Void, including Box Cut – ca. 30 hectares@ R 155 766/ha;
- Access and haulage roads – ca. 6km or 60 000 square meters (6 hectares) @ R 265 800/ha;
- Pipelines- ca. 3 km or at 2 meters width, 6000 square meters @ R 148.57 sq.m;

- Compacted land beyond other infrastructure – 0.5 hectares @ R 82 262/ha;
- Temporary general waste collection and storage site – 0.2 hectares @ R 297.15 sq.m;
- Land utilised for temporary overburden and topsoil storage – 15 hectares @ R 103 844/ha;
- Return water and storage dams – 2.25 hectares @ R129 335.96/ ha;
- Storm water control infrastructure – 2.5 hectares (will be largely retained);
- Otherwise disturbed land (provision) – 10 hectares @R 82 262/ha;
- Water management – for entire site (225 ha) @ R 31 278/ha; and
- Post-closure monitoring and maintenance for entire site – 225 ha @ R 10 947

Based on the criteria above the Clean Closure Liability and Total Closure Liability Costs are presented below:

- Clean Closure Liability Cost: R 19 075 122;
- Total Mine Closure Liability Cost (including preliminary & general and VAT): R 26 790 627.00

27.2 CONFIRMATION OF AMOUNT TO BE PROVIDED

The amount to be provided is dependent on the project alternative approved. The calculation of the financial provision for both operating project alternatives is provided above. The closure cost has been calculated using the DMR guideline for the calculation of closure and is hereby confirmed as adequate.

Mine closure planning however is an integrated process that is required to take into account the biophysical as well as socio-economic conditions of land adjacent to the proposed Paardeplaats mining area. The decision to operate Paardeplaats Coal Mine as an extension of NBC Glisa means that the Total Closure Costs associated with the proposed project are potentially incomplete and require further assessment.

It is suggested that if the project is approved that NBC Glisa’s closure costs be updated accordingly. The update is required as a result of the potential liability of the use of existing infrastructure on NBC Glisa by the proposed Paardeplaats Coal Mine. Furthermore, it is anticipated that both the Paardeplaats Coal Mine and NBC Glisa will share a post-mining water treatment plant. The plant will be located on NBC Glisa and be used to treat contaminated water stemming from both operations. It is strongly suggested that the closure costs of both operations be incorporated in a single closure costing as it is likely that it will become progressively more difficult to separate impacts stemming from either operation.

The closure cost calculation will be reviewed and updated annually to ensure that that annual contributions are in line with costs and adequate for decommissioning, rehabilitation and closure of the proposed Paardeplaats Coal Mine.

27.3 METHOD OF PROVIDING FINANCIAL PROVISION

In terms of Regulation 53(1) of the MPRDA, the Applicant must lodge a guarantee in the form of a bank guarantee from a registered South African Bank in order to provide security against a closure funding shortfall as is the case for unexpected premature closure. As such, the method of providing the financial provision will be in line with the approved DMR’s funding methods.

28 TECHNICAL SUPPORTING INFORMATION

The following appendices are included:

Closure, rehabilitation and Final Land Use (Appendix J); and

Financial Provision (Appendix Q).

29 CAPACITY TO MANAGE AND REHABILITATE THE ENVIRONMENT

29.1 AMOUNT REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT

The proposed Paardeplaats Coal Mine will manage environmental impacts throughout the value chain of Exxaro Coal Mpumalanga (Pty) Ltd. The proposed mine will put in place mitigation measures to achieve the objectives and goals of impact management and rehabilitation as identified in this report. The direct operational budget for the financial year following approval will be determined in consultation with the DMR and a capital budget for the project provided for.

29.2 AMOUNT PROVIDED FOR

The amount provided for to manage and rehabilitate the environment will be provided by the direct operational budget for the proposed mine and in consultation with the DMR.

30 UNDERTAKING SIGNED BY APPLICANT

I ……………………………………………..……………., the undersigned and duly authorised thereto by the Applicant , have studied and understand the contents of this document and duly undertake to adhere to the conditions as set out therein, unless specifically or otherwise agreed to in writing.

Signed at ……………………………..… on this ……………... day of …………………………. 2002

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Name:

I ……………………………………………………..….., the undersigned and duly authorised hereto by the Department of Mineral Resources, have studied and approved the contents of this document.

Signed at ……………………………..… on this ……………... day of ………..……………… 2002

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Name:

31 ENVIRONMENTAL IMPACT STATEMENT & CONCLUSION

The proposed Paardeplaats Coal Mine, if approved, is likely to have several significant environmental impacts. If approved it is the recommendation of the EAP that Alternative 3 - Sensitivity Planning Approach be approved due to the limited temporal and spatial scales of environmental impacts and the fact that established land users such as Hadeco will be allowed to continue their operations on adjacent properties.

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