Our ref: 24514
Your ref: Yzermyn Underground Coal Mine

16 October 2013

Dear Stakeholder,

PUBLIC AND STATE DEPARTMENT REVIEW OF DRAFT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL AND SOCIAL MANAGEMENT PROGRAMME REPORT FOR THE YZERMYN UNDERGROUND COAL MINE

Atha Africa Ventures (Pty) Ltd (Atha) propose to develop an underground coal mine close to the town of Wakkerstroom in the Mpumalanga Province of South Africa. The proposed project is known as the Yzermyn Underground Coal Mine. Atha obtained the prospecting right to an area of 8,360 hectares and has completed detailed exploration drilling that identified a feasible target area approximately 2,500 hectares in extent.

Atha propose to produce thermal coal for the local and export market through means of underground bord and pillar mining. It is proposed that the Utrecht Coalfield will be mined, which comprises the Karoo Supergroup geological stratigraphic unit. The Alfred and Dundas coal seams, which form part of the Utrecht coalfield, will be mined. The project involves the extraction of the coal, beneficiation/ washing of the coal, stockpiling of product and discard and the transportation of the marketable coal to either the Piet Retief Siding for export through the Richards Bay Coal Terminal, or to Eskom power stations for the generation of electricity.

It is anticipated that the mine will have the potential to produce approximately 2.5 million tons of coal per annum, with an estimated life of mine of approximately 15 – 20 years, with additional resources potentially available adjacent to the target area.

WSP Environmental (Pty) Ltd (WSP) has been appointed by Atha to undertake a comprehensive social and environmental impact assessment (ESIA) for the proposed mine. The ESIA was undertaken in two phases – namely scoping phase and the environmental impact assessment (EIA) phase. This document details the findings of the EIA phase for the project. WSP has undertaken all project phases in accordance with relevant South African legislation (the Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA), National Environmental Management Act (No. 107 of 1998) (NEMA), and associated relevant legislation).

The ESIA will need to be authorised by the Department of Mineral Resources (DMR), Mpumalanga Department of Economic Development, Environment, Tourism and Conservation (MDEDECT), the Department of Environmental Affairs (DEA) and the Department of Water Affairs (DWA).

WSP submitted the final scoping report to the DEA in August 2013 and received an acceptance of the scoping report and plan of study on 9 October 2013. A draft ESIA and environmental and social management programme (ESMP) document has been placed on public review for a period of 60 days as required by the NEMA EIA Regulations of 2010 from 17 October 2013 to 17 December 2013 at the venues detailed on page 2. Please note that the draft ESIA/ ESMP has been updated following the completion of the MPRDA public review period, for which amendments have been indicated on page 3.

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The draft reports have been made available at the following venues:

Venue	Address
Wakkerstroom Public Library	Corner of R543 and Badenhorst Street, Wakkerstroom, 2480
Wakkerstroom Country Inn	124 Badenhorst Street, Wakkerstroom, 2480
Themba Trust Mission House in Dirkiesdorp	27°10'35.29"S; 30°24'13.86"E, off R543 Regional Road in Dirkiesdorp
Vulindela General Dealer	27°04'45.38"S; 30°31'21.20"E, off R543 Regional Road in Vulindela
Piet Retief Public Library	10 Retief Street, Piet Retief, 2380
Volksrust Public Library	Joubert Street, Volksrust, 2470
WSP Environment and Energy's website	www.wspenviornmental.co.za

Comment sheets have been included in the report. All comments are to be addressed to **Brent Holme** and submitted (via fax/ email/ postage) by 17 December 2013.

Please note that the draft reports **are not to be removed** from the public review venues.

WSP would like to thank you for your interest in this project. Should you have any issues or queries regarding the project, please do not hesitate to contact the undersigned.

Regards,

Holme

Brent Holme
Senior Environmental Consultant
Tel: 011 361 1389
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Differences between the MPRDA Draft ESIA/ ESMP and the NEMA Draft ESIA/ ESMP Document:

- Section 4.11: No Go Alternatives, specifically the first paragraph on page 87, Section 4.11.7 and 4.11.8 following the request for inclusion from the DEA;
- Section 6.2: Feasibility Assessment of Remainder Area, following request for information from the DEA;
- Section 7.19.2.6: Health and HIV/ AIDS following the request for information from the DEA;
- Section 8.7: Geohydrological Assessment following a peer review of the study from Atha and reassessment of geohydrological assessment from WSP. Please note that no significant aspects have changed.
- Section 8.8: Biodiversity Assessment following a peer review of the geohydrological study by Atha and reassessment of the geohydrological study by WSP. As the groundwater dewatering has an effect on the surrounding biodiversity, the information from the groundwater assessment needed to be updated in the biodiversity assessment. Findings remain the same however.
- Section 10: Environmental and Social Impact Assessment; references with regards to groundwater and biodiversity was amended for an initial environmental significance (with mitigation) from 25.0 to 21.7 (same weighting of the significance as before).
- Section 11: Environmental and Social Management Programme; inclusion of reference 12.43 and 12.44 following the request for information from the DEA.
- Section 19.2: Recommendations; amended third bullet to include the alternative location of the reduced co-disposal discard dump to the northeast and/ or northwest of the target area (within prospecting right boundary).

Comments and Response Sheet

To ensure that all your comments, issues or queries regarding the proposed Yzermyn Underground Coal Mine are adequately documented and addressed, please forward your comments and contact details with the attached response sheet to:

Brent Holme
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Address: P.O. Box 5384, Rivonia, 2128
Tel: +27 (0)11 361 1389
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Email: Brent.Holme@WSPGroup.co.za

Please insert your personal details below:

Name:	
Organisation & Designation:	
Address:	
Tel:	
Fax:	
E-mail:	

Please list your interest in the project and comments below:

UNITED BY OUR DIFFERENCE WSP

DRAFT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL AND SOCIAL MANAGEMENT PROGRAMME

Yzermyn Underground Coal Mine:
DEA Ref. No. 14/12/16/3/3/3/85
Public Review Document

2013/10/17

Quality Management

Issue/revision	Issue 1			
Remarks	ESIA/ ESMP			
Date	October 2013			
Prepared by	Brent Holme	Jared O'Brien	Ashlea Strong	Kim Allan
Checked by	Kim Allan	Ashlea Strong	Caroline Henderson	
Authorised by	Kim Allan			
Project number	24514			
Report number	Draft ESIA			
File reference	24514/ ESIA			

Draft Environmental and Social Impact Assessment Report and Environmental and Social Management Programme

Yzermyn Underground Coal Mine: DEA Ref. No. 14/12/16/3/3/3/85

2013/10/17

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Abbreviations

Abbreviation	Definition
ADI	Area of direct influence
ADT	Articulated dump truck
AEL	Atmospheric Emissions License
AII	Area of indirect influence
Archaetnos	Archaetnos CC
Atha	Atha-Africa Ventures (Pty) Ltd
AU	Animal unit
BBBEE	Broad Based Black Economic Empowerment
BirdLife SA	BirdLife South Africa
BPG	Best Practice Guidelines
C Plan	Mpumalanga Conservation Plan
CARA	Conservation of Agricultural Resources Act (No. 43 of 1983)
CFBC	Circulating Fluidised Bed Combustion
CI	Conservation importance
CIS	Conservation important species
CM	Continuous miner
CR	Critically endangered
CV	Calorific value
DAFF	Department of Agriculture, Forestry and Fisheries
dBA	Decibels
DEA	Department of Environmental Affairs
DFO	Dust fallout
DMR	Mpumalanga Department of Mineral Resources
DMS	Dense medium separator
DWA	Department of Water Affairs
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EHS	Environmental, health and safety
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan/ Programme
EN	Endangered
ENPAT	Environmental Potential Atlas for South Africa
EPFI	Equator Principles Financial Institutions
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Programme

Abbreviation	Definition
EQ	Equator Principles
FEL	Front end loader
Fencing Act	Fencing Act (No. 31 of 1963)
FULCO	Full calendar operation system
GDP	Gross Domestic Product
GGP	Gross Geographic Product
GNR	Government Notice Regulation
GTIS	Gross tons in situ
ha	Hectare
ha/ AU	Hectare per animal unit
HDPE	High-Density Polyethylene
HSA	Hazardous Substances Act (No. 15 of 1979)
HIV/ AIDS	Human immunodeficiency virus/ acquired immunodeficiency syndrome
IBA	Important Bird Area
ICMM	International Council for Mining and Minerals
IDP	Integrated Development Plan
IEMA	UK Institute for Environmental Management and Assessment
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
IWULA	Integrated water use license application
IWWMP	Integrated waste and water management plan
km	Kilometres
KPE	KwaMandlagampisi Protected Environment
KZN	KwaZulu-Natal
l/ s	Litre per second
LoM	Life of Mine
LoO	Likelihood of occurrence
m	Metre
m^2	Square metres
m^3	Cubic metres
MAP	Mean annual precipitation
masl	Metres above sea level
MDEDECT	Mpumalanga Department of Economic Development, Environment, Conservation and Tourism
mg/ l	Milligrams per litre
Mindset	Mindset Mining Consultants (Pty) Ltd
MJ/ kg	Megajoules per kilogram
MPRDA	Mineral and Petroleum Resources Development Act (No. 28 of 2002)

Abbreviation	Definition
MR	Mining Right
MRA	Mining Right Application
MTPA	Mpumalanga Tourism and Parks Agency
Mtpa	Million tons per annum
MVA	Mega Volt Ampere
NBSAP	National Biodiversity Strategy and Action Plan
NEFPA	National Freshwater Ecosystem Priority Areas
NEMA	National Environmental Management Act (No. 107 of 1998)
NEMAQA	National Environmental Management Air Quality Act (No. 39 of 2004)
NEMBA	National Environmental Management Biodiversity Act (No. 10 of 2004)
NEMPAA	National Environmental Management Protected Areas Act (No. 57 of 2003)
NEMWA	National Environmental Management Waste Act (No. 59 of 2008)
NEPAD	New Partnership of Africa's Development
NFA	National Forests Act (No. 84 of 1998)
NGOs	Non-government Organisations
NHRA	National Heritage Resources Act (No. 25 of 1999)
NOx	Nitrogen oxides
NSBA	National Spatial Biodiversity Assessment
NSS	Natural Scientific Services CC
NT	Near threatened
NWA	National Water Act (No. 36 of 1998)
OECD	Organisation for Economic Co-operation and Development
PCD	Pollution Control Dam
PM	Particulate matter
PPE	Personal protective equipment
R/ ZAR	South African Rand
RBCT	Richards Bay Coal Terminal
RD	Relative density
RDP	Reconstruction and Development Plan
ROM	Run of Mine
SABAP	Southern African Bird Atlas Project
SABS	South African Bureau of Standards
SAMBF	South African Mining and Biodiversity Forum
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SAWIS	South African Weather Services
SDF	Social Development Framework
SLP	Social and Labour Plan

Abbreviation	Definition
SoER	State of the Environment Report
SOx	Sulphur dioxides
TTIS	Total tons in situ
TWQR	Target Water Quality Requirements
UM	Unified model
US$	United State Dollar
VM	Volatile matter
VRA Africa	Visual Resource Management Africa CC
VU	Vulnerable
WML	Waste Management License
WSP	WSP Environmental (Pty) Ltd
WULA	Water Use License Application
WWF-SA	World Wildlife Fund South Africa

Executive Summary

Background and Introduction

Atha-Africa Ventures (Pty) Ltd (Atha) acquired the coal prospecting rights to an area of 8,360 hectares (ha) located some 58 kilometres (km) southwest of Piet Retief in the Mpumalanga Province. The prospecting area comprises 12 privately owned farms; of which Atha does not own any surface rights. Mindset Mining Consultants (Pty) Ltd (Mindset) has been appointed to lead the project planning and submit a Mining Right Application (MRA), including a Mine Works Programme (MWP). Following detailed exploration, a feasible target area was identified which comprises approximately 2,500 hectares. Atha completed the detailed exploration drilling for the target area in 2012.

Atha propose to produce thermal coal for the local and export market through means of underground bord and pillar mining. It is proposed that the Utrecht Coalfield will be mined, which comprises the Karoo Supergroup geological stratigraphic unit. The Alfred and Dundas coal seams, which form part of the Utrecht coal field, will be mined. The project involves the extraction, beneficiation/ washing and stockpiling of coal product and discard as well as the transportation of the saleable coal to the Piet Retief Siding for export through the Richards Bay Coal Terminal, or to Eskom power stations for the generation of electricity.

It is anticipated that the mine will have the potential to produce 2.25 million tons of coal per annum, with an estimated life of mine (LoM) of approximately 15 years, with additional resources potentially available adjacent to the target area.

WSP Environmental (Pty) Ltd (WSP) has been appointed by Atha to undertake a comprehensive social and environmental impact assessment (ESIA) for the proposed Yzermyn Underground Coal Mine. The ESIA was undertaken in two phases – namely the scoping phase and the environmental impact assessment phase (this phase). This document details the findings of the ESIA phase for the project, which includes the environmental and social management programme (ESMP). WSP is undertaking all project phases in accordance with relevant South African legislation.

Legislative Requirements

In terms of Section 24 of the Constitution of the Republic of South Africa (No. 108 of 1996), everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while prompting justifiable economic and social development. The needs of the environment, as well as affected parties, have been integrated into the overall project management in order to fulfil the requirements of Section 24 of the Constitution.

In order to commence with the proposed Yzermyn Underground Coal Mine, Atha is required to obtain approval from a number of South African government departments. A mining right (MR) will need to be authorised by the Mpumalanga Department of Mineral Resources (DMR) in accordance with the Minerals and Petroleum Resources Development Act (No. 28 of 2008) (MPRDA). An environmental authorisation (EA) and waste management license will need to be obtained from the national Department of Environmental Affairs (DEA) in accordance with the National Environmental Management Act (No. 107 of 1998) (NEMA) and the National Environmental Management Waste Act (No. 59 of 2008) (NEMWA). Furthermore, a water use license application (WULA) will need to be submitted and authorised by the KwaZulu Natal Department of Water Affairs (DWA).

To this effect, WSP has compiled this draft ESIA/ ESMP document that describes the process followed, description of the project, stakeholder engagement undertaken as well as findings of specialists appointed to assess various biophysical and socio-economic aspects associated with the proposed Yzermyn Underground Coal Mine. Environmental and socio-economic impacts have been rated according to WSPs rating methodology and mitigation measures developed in order to minimise the significance of negative impacts identified and promote positive impacts.

Environmental Procedure

Stakeholder Engagement

The stakeholder consultation process was conducted from the onset of the project and as part of the overall ESIA process undertaken by WSP in a comprehensive and transparent manner. Although the requirements of the MPRDA and NEMA were taken into consideration, WSP perceives that the requirements of the NEMA, pertaining to stakeholder engagement, are more stringent than the MPRDA. Therefore, WSP followed the NEMA requirements for stakeholder engagement, where prescribed.

The stakeholder consultation process was undertaken in English, Afrikaans and Zulu to ensure the widest range of stakeholders were able to participate in the process. According to Section 56 of the NEMA (EIA) Regulations, WSP must give notice to all potential stakeholders of the project. The statutory requirements were followed in full, comprising:

- Newspaper advertisements;
- Site notices;
- Written notice and distribution of background information documents;
- Public consultation;
- Authorities consultation; and
- Informal stakeholder consultation.

Scoping Report

A scoping report was compiled for the proposed Yzermyn Underground Coal Mine in accordance with all relevant South African environmental legislation. Draft copies of the scoping report were made available to the public for a period of 37 days from 25 March to 7 May 2013 (MPRDA process) and 73 days from 25 March to 10 June 2013 (NEMA process). All stakeholders and commenting state departments were notified of the public review period as well as the locations of the draft scoping reports via fax and email. All comments received were recorded and included in the issues trail.

Environmental and Social Impact Assessment/ Environmental and Social Management Programme

The objectives of the ESIA/ ESMP process are to provide:

- An assessment of the environment likely to be affected by the proposed project;
- An assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural heritage impacts of the proposed project;
- A comparative assessment of the identified land use and development alternatives and their environmental, social and cultural impacts;
- Appropriate mitigation measures for each significant impact of the proposed project;
- Details of the stakeholder engagement process followed and an indication of how the issues raised have been addressed;
- Identification of knowledge gaps and reporting on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information;
- A description of the arrangements for monitoring and management of environmental impacts including planned performance assessment reporting;
- Closure and environmental objectives;
- Financial provision which must include the determination of the quantum of the financial provision and details of the method providing for the financial provision;
- Technical and supporting information as appendices, if available; and
- An undertaking by the applicant.

The above is accomplished by assessing and utilising the comments received from all stakeholders as well as the investigations undertaken by the environmental consultants and specialists to identify all the impacts, which could occur as a result of the proposed Yzermyn Underground Coal Mine.

The potential environmental impacts associated with the proposed Yzermyn Underground Coal Mine have been evaluated according to their significance, which is determined as a result of the consequence and likelihood. The consequence is determined as a function of the severity, duration, and spatial scale, whereas the likelihood of the impact is determined as a function of the frequency of the activity and frequency of the incident/ impact. The consequence multiplied by the likelihood presents the significance of the potential impact. All impacts were assessed without management measures in place. Mitigation measures have been developed in order to minimise the significance of negative impacts identified and promote positive impacts.

WSP is of the opinion that the correct methods prescribed in the NEMA EIA Regulation and MPRDA were complied with. All registered stakeholders will be notified about the location of the draft ESIA/ ESMP documents.

Findings, Recommendation and Summary

Findings

It has been noted that coal production, including the mining of coal, contributes to the provincial economy of Mpumalanga and the Gross Domestic Product (GDP) of the region. In consultation with the local Pixley ka Seme and Khondo municipalities, it has been noted that economic development is needed within the greater area, which can be promoted through agriculture, manufacturing, mining and tourism. However, it is understood and noted by both municipalities, that these economic development initiatives must be undertaken in a systematic approach that balances the needs of the environment with the socio-economic needs of the region.

The proposed Yzermyn Underground Coal Mine is located within known sensitive habitats and environments as well as adjacent to an existing protected environment (KwaMandlagampisi Protected Environment). Furthermore, the proposed area is located within a threatened ecosystem (Wakkerstroom/ Luneburg) which is considered endangered. The site itself comprises a number of farms that are proposed to be included in a separate protected environment (Mabola) and has been earmarked to be included in a ‘no-go’ mining area in terms of Section 49 of the MPRDA, which have not been ruled on.

Recommendations

According to the preferred surface layout design and sensitivities pertaining to the layout, it is WSPs recommendation that this ‘preferred’ layout not be considered for development. However, taking cognisance of the sensitive habitats, environments and biomes assessed as part of this ESIA process, as well as the need for job employment and economic development within the area, WSP recommends reassessing the layout design in order to re-position the proposed infrastructure to determine whether both environmental and socio-economic aspects can be accommodated.

Prior to providing an opinion in terms of an independent environmental impact statement, WSP has the following recommendations which Atha should consider:

- Relocating the surface infrastructure to the northeast in order to reduce the impact over two wetland catchment areas (i.e. locate the surface layout in order to potentially impact on one wetland area) (*see appendix H)*;
- Minimise the area in extent required to construct and install the surface infrastructure;
- Relocate and reduce the size of the co-disposal discard dump, to the northeast and/ or northwest of the target area (within prospecting right boundary), which is approximately 1 km from the surface infrastructure area which requires an additional conveyor system as recommended by the technical consultant. It is anticipated that the potential for wetland occurrence is less (to be confirmed by relevant specialist);
- Design the co-disposal discard dump with a clay underliner as well as a High-Density Polyethylene (HDPE) liner to reduce potential leachate entering the environment;

- Reuse/ beneficiate the discard material in order to reduce the footprint size and produce additional product for Eskom use;
- Reassess the hydrogeology in close proximity to the proposed new surface layout area;
- Undertake a wetland delineation within the proposed new surface layout area;
- Develop a stormwater management plan that will eliminate runoff of contaminated water and retain rainwater harvesting for mine use (i.e. potable water, make-up wash water, etc.);
- Assessment of a shorter access road alternative;
- Undertake the following additional specialist studies in order to further identify the site sensitivities:
  - Biodiversity assessment (alternative location and route);
  - Air quality assessment (alternative location and route);
  - Noise assessment (alternative route);
  - Archaeological, cultural and heritage (alternative location);
  - Groundwater assessment (alternative location);
  - Stormwater management plan (alternative location and route); and
  - Traffic impact assessment (alternative route).

<u>Summary</u>

The Pixley ka Seme and Khondo municipalities recognise the importance of mining as a key economic sector within these two municipalities. However, both IDP's also recognise the significant challenges they face in balancing the needs of environmental protection with the economic and developmental needs of the region. This proposed project is not immune to these challenges. This ESIA has therefore attempted to describe both the benefits of the proposed Yzermyn Underground Coal Mine as well as the associated environmental and social sensitivities. Where impacts are identified, detailed mitigation measures to reduce the significance of these impacts are described; in the case of positive impacts, measures to enhance such positive impacts are provided.

Atha recognise these sensitivities, and have provided a written undertaking to implement the measures prescribed in this ESIA (as provided in the Letter of Undertaking) as a demonstration of their commitment in implementing all such mitigation measures. Alternatively, it is recommended that an additional site layout be identified prior to making a decision and assess whether the proposed mine can coexist within the area.

Furthermore, WSP recommends that the Mpumalanga DMR, the DEA, the DWA and the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) consider both the benefits and the sensitivities associated with the proposed Yzermyn Underground Coal Mine, preferably following the completion of the assessment of the newly recommended site layout, so that an informed decision be made in this regard.

1 Introduction

1.1 Project Background

Atha-Africa Ventures (Pty) Ltd (Atha) acquired the coal prospecting rights[1] to an area of 8,360 hectares (ha) located some 58 kilometres (km) southwest of Piet Retief in the Mpumalanga Province (**Figure 1-1**). The prospecting area comprises 12 privately owned farms; of which Atha does not own any surface rights. Mindset Mining Consultants (Pty) Ltd (Mindset) has been appointed to lead the project planning and submit a Mining Right Application (MRA), including a Mine Works Programme (MWP). Mindset completed the phase one exploration activities (infill drilling) in order to adequately identify the proposed coal resource for the proposed Yzermyn Underground Coal Mine. Second phase exploration drilling is currently underway, to be completed around end-September 2013.

WSP Environmental (Pty) Ltd (WSP) has been appointed by Atha to undertake a comprehensive social and environmental impact assessment (ESIA) for the proposed Yzermyn Underground Coal Mine. The ESIA was undertaken in two phases – namely the scoping phase and the environmental impact assessment phase (this phase). This document details the findings of the ESIA phase for the project. WSP is undertaking all project phases in accordance with relevant South African legislation, detailed in **Section 3**.

Following detailed exploration activities, a feasible target area has been identified within the prospecting right boundary. The target area covers an area of approximately 2,500 ha and comprises three farms (Farms Kromhoek 93, Goedgevonden 95, and Yzermyn 96 Portion 1) and a portion of an additional farm (i.e. portion of the Farm Zoetfontein 94). It has been noted that the Yzermyn Underground Coal Mine will utilise underground conservative drill and blast, bord and pillar mining methods with a portal/ adit being sunk within the northern section (27°13'14.05"S; 30°18'39.25"E) of the target area. Atha has applied for a MRA for the target area only, of which this ESIA report has reference. The MRA was submitted to the Mpumalanga Department of Mineral Resources (DMR) on 19 March 2013 and accepted on 25 April 2013.

For the purpose of this report, the following definitions are used:

- **Prospecting area/ boundary/ right:** The area of 8,360 ha that comprises a total of 12 privately owned farms, of which Atha is legally permitted to prospect (intentionally searching for any mineral by means of any method).
- **Target area:** The area of approximately 2,500 ha that comprises of three farms and a portion of a fourth farm for which Atha has submitted an MRA. Exploration drilling (prospecting) has yielded a feasible coal reserve of good quality. Please note that the ESIA process is being undertaken for this area only. Within the target area, a surface infrastructure layout of approximately 80 ha will be required.
- **Remainder area**: The area of further exploration within the prospecting boundary earmarked for future mining. At present, the coal reserve has not been defined; however, if exploration drilling identifies feasible reserves, these areas may extend the current life of mine. Atha will be required to undertake a separate ESIA process prior to mining in this area in accordance with the relevant South African environmental legislative requirements. The remainder area is explained in more detail in **Section 6**.

Figure 1-2 illustrates the prospecting right boundary, the target area as well as the remainder area for clarification.

[1] The prospecting rights were previously held by BHP Billiton, Ingwe Colliery and transferred to Bunengi Mining in 2011. Subsequent to this, Atha bought the shares from Bunengi Mining thereby becoming the primary holder of the prospecting right.

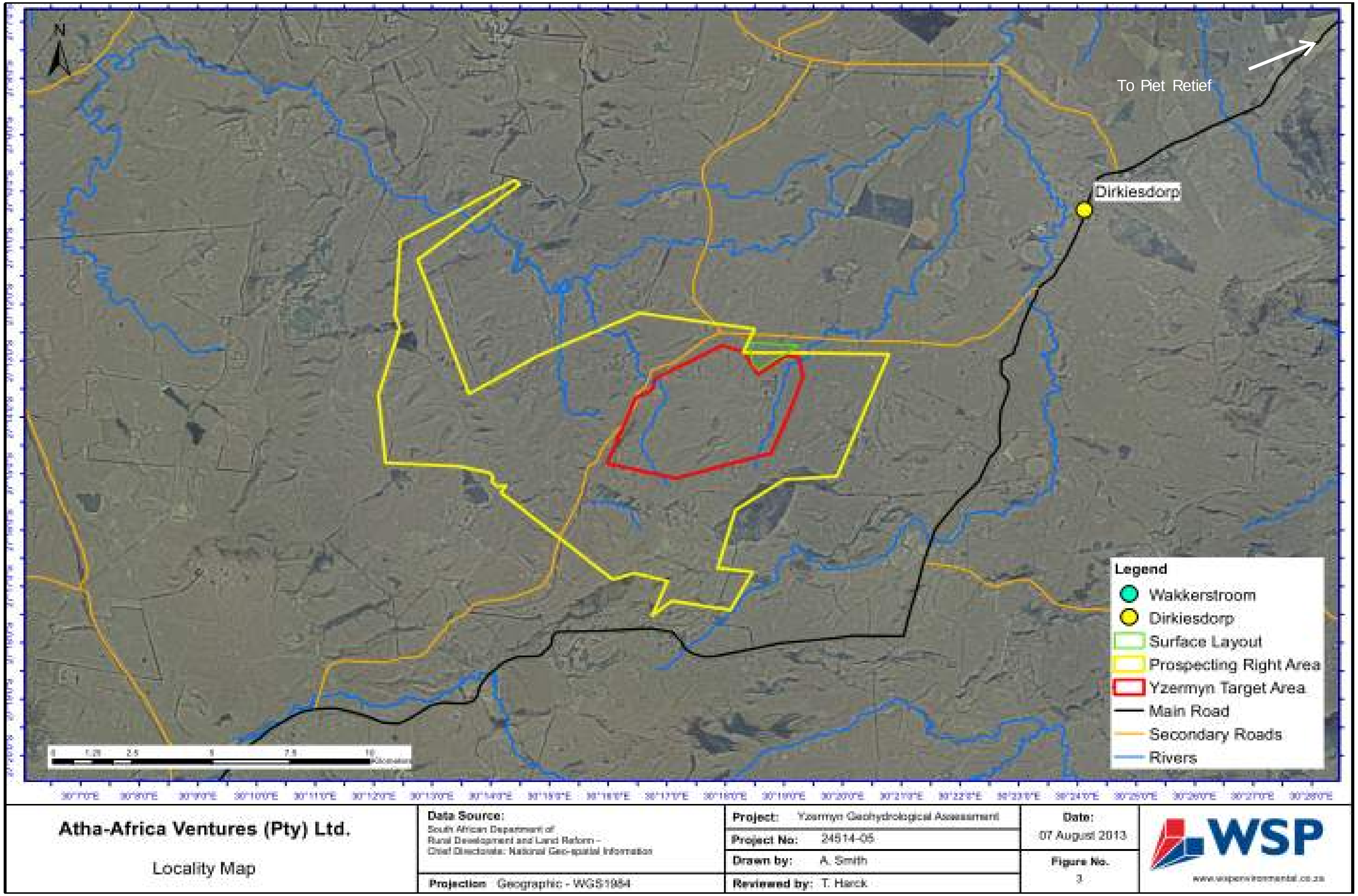

Figure 1-1: Locality Map of Project Area

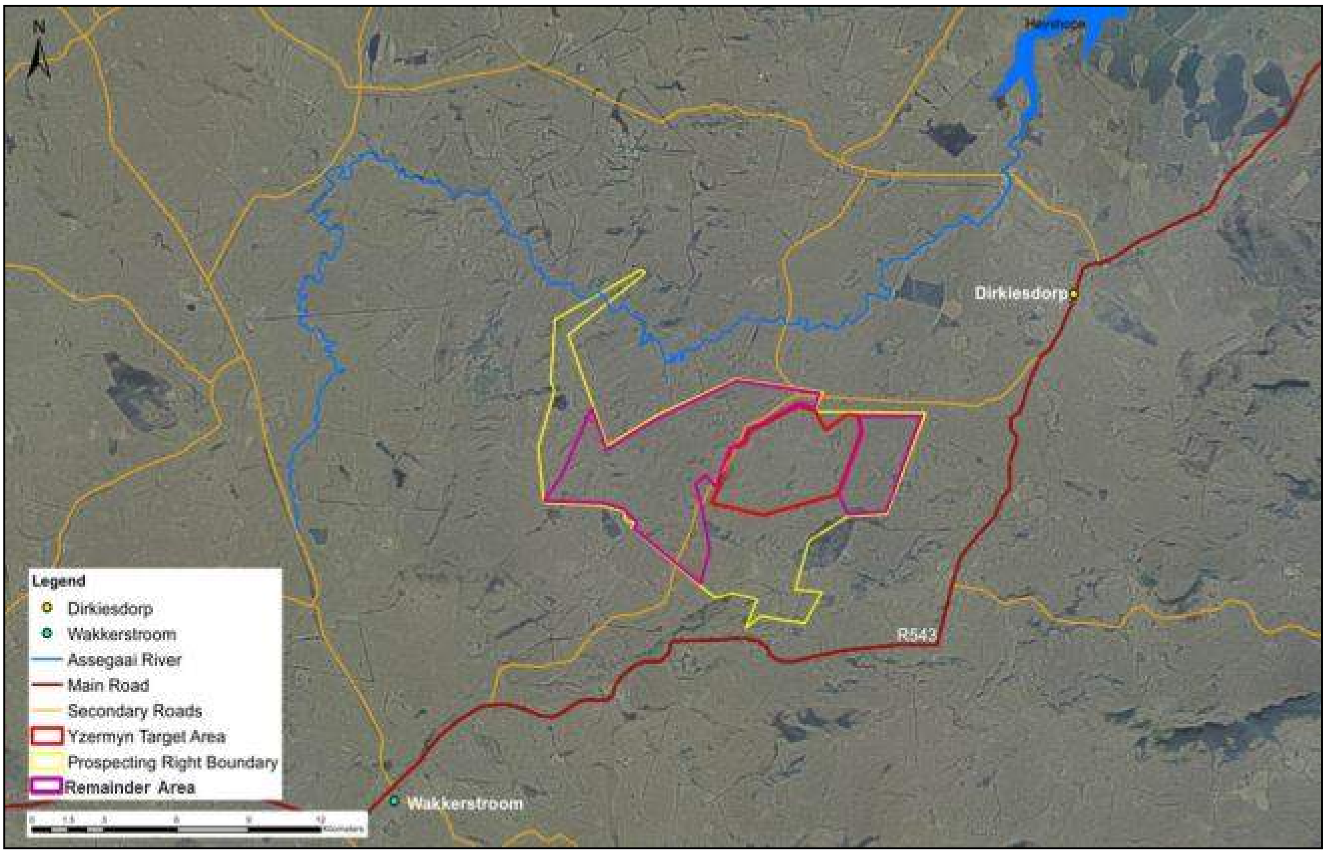

Figure 1-2: Aerial Image Illustrating Prospecting Right Boundary, Target Area and Remainder Area

1.2 Project Motivation

1.2.1 Need

Coal is considered one of the most valued minerals in the world and is the largest source of energy, providing 27% of the global primary energy needs and generating 41% of the world's electricity (World Coal Association, 2011). South Africa possesses Africa's only significant coal reserves; over 70% of Africa's coal reserves are found in South Africa (Snyman and Botha, 1993), with coal reserves of 30,408 million tons at the end of 2009, which represents 3.68% of the world's total coal production. Coal production in South Africa was valued at approximately ZAR 59.9 billion in 2009 (BP Statistical Energy Survey, 2010).

South Africa is a significant coal consuming country, with a coal consumption of 99.43 million tons in 2009, representing 3.3% of the world's total (Mbeni Information Services, 2011). In 2008, South Africa used coal for 93% of its electricity generation needs, and was the most dependent coal to electricity country in the world (World Coal Association, 2011). Apart from its domestic needs, South Africa is still the world's fifth largest coal exporting country, resulting in an excess of 60 million tons of coal exported during 2009 (World Coal Association, 2011).

Coal plays a crucial role in the South African energy-economy and fuels local industry. The consumption of coal in South African coal-fired power stations is anticipated to continue into the future. Increased demand in Eastern countries (driven by rapid economic growth rates) will continue to result in a demand for South African coal exports, and exports are expected to increase to 105 million tonnes per annum by the year 2020. Until alternative sources of energy are successfully implemented, coal will remain the primary source in South Africa and in developing countries across the world (Eberhard, 2010).

Both local and international markets are highly dependent on South Africa being a main provider of coal. The identification and exploitation of new coal reserves in South Africa is therefore a prerequisite in meeting this demand. According to the Statistics SA (2007), the mining sector provides over 20% of the gross domestic product (GDP) and approximately 6% employment in the province. According to the Gert Sibande District Municipality Integrated Development Plan (IDP) of 2013/14, sectoral contribution to the regional economy from mining was calculated at 28.8% in 2009.

Although it is noted that activities such as mining are important to enhance Mpumalanga's local economic development, the local municipalities in which the proposed Yzermyn Underground Coal Mine is located recognise the challenges associated with balancing the needs of environmental protection with the economic and development needs of the region (Khondo and Pixley ka Seme IDPs, 2011 and 2012).

1.2.2 Desirability

Coal will have a major role in meeting the future energy needs. Demand for coal and its vital role in the world's energy system is set to continue. Over the next 30 years, it is estimated that global energy demand will increase by almost 60%. Two thirds of the increase will come from third world countries, and by 2030 they would account for almost half of the total energy demand (www.bp.com).

The changes in the global market are placing Eskom under increasing risk in terms of securing future supplies from the local market, in which the production capacity has not kept pace with increases in both local and international demand. It is critical that local production be facilitated to ensure long-term security of supply for electricity production. Additional power stations and major power lines are being built to meet rising electricity demand in South Africa (Eskom Annual Report, 2008). Until alternative sources of energy are successfully implemented, coal will remain the primary source in South Africa.

The proposed Yzermyn Underground Coal Mine has a gross *in situ* resource of 80.32 Mt (before losses) that will be exported via Richards Bay Coal Terminal or transported to supply Eskom power stations. According to the MWP, it is anticipated that 32.6% of the saleable coal will be transported to power stations (597,840 tons) and the remaining 67.4% saleable coal product may be exported (1,234,032 tons). The planned life of mine (LOM) is 15 years, although this may be extended with the potential identification of additional feasible reserves within the prospecting right boundary. Additional prospecting drilling is required to adequately quantify this potential resource.

It has further been conveyed that Atha may beneficiate (briquette plant) the discard coal into a saleable product that will be transported to Eskom power stations. This will further reduce the footprint of the co-disposal discard dump and produce an additional product which can be sold and used by the South African market. However, further information will be required on this aspect, and as such, has not been included in this ESIA process.

1.3 Project Location

Atha has obtained a prospecting right for an area of 8,360 ha located in the Pixley ka Seme Local Municipality within the Mpumalanga Province. The prospecting right was granted in 2011 in terms of Section 17(1) of the Minerals and Petroleum Resources Development Act (No. 28 of 2008) (MPRDA). The area is some 21 km northeast of Wakkerstroom, 58 km southwest of Piet Retief and 13 km southwest of Dirkiesdorp. **Figure 1-3** illustrates the prospecting area and target area in detail (excluding the remainder area, which is not being applied for as part of this process). **Figure 1-4** provides a detailed illustration of the target area.

The predominant land uses within and surrounding the prospecting area include agriculture, conservation, grassland area, cultivated land, forestry areas, vacant areas, rivers and wetlands; with only a small portion of the target area having been transformed by recent anthropogenic activities. The study area lies within the high altitude grassland biome, which is the second richest biome in terms of biodiversity in southern Africa. The target area is located within the Wakkerstroom/ Luneburg Grassland Threatened Ecosystem.

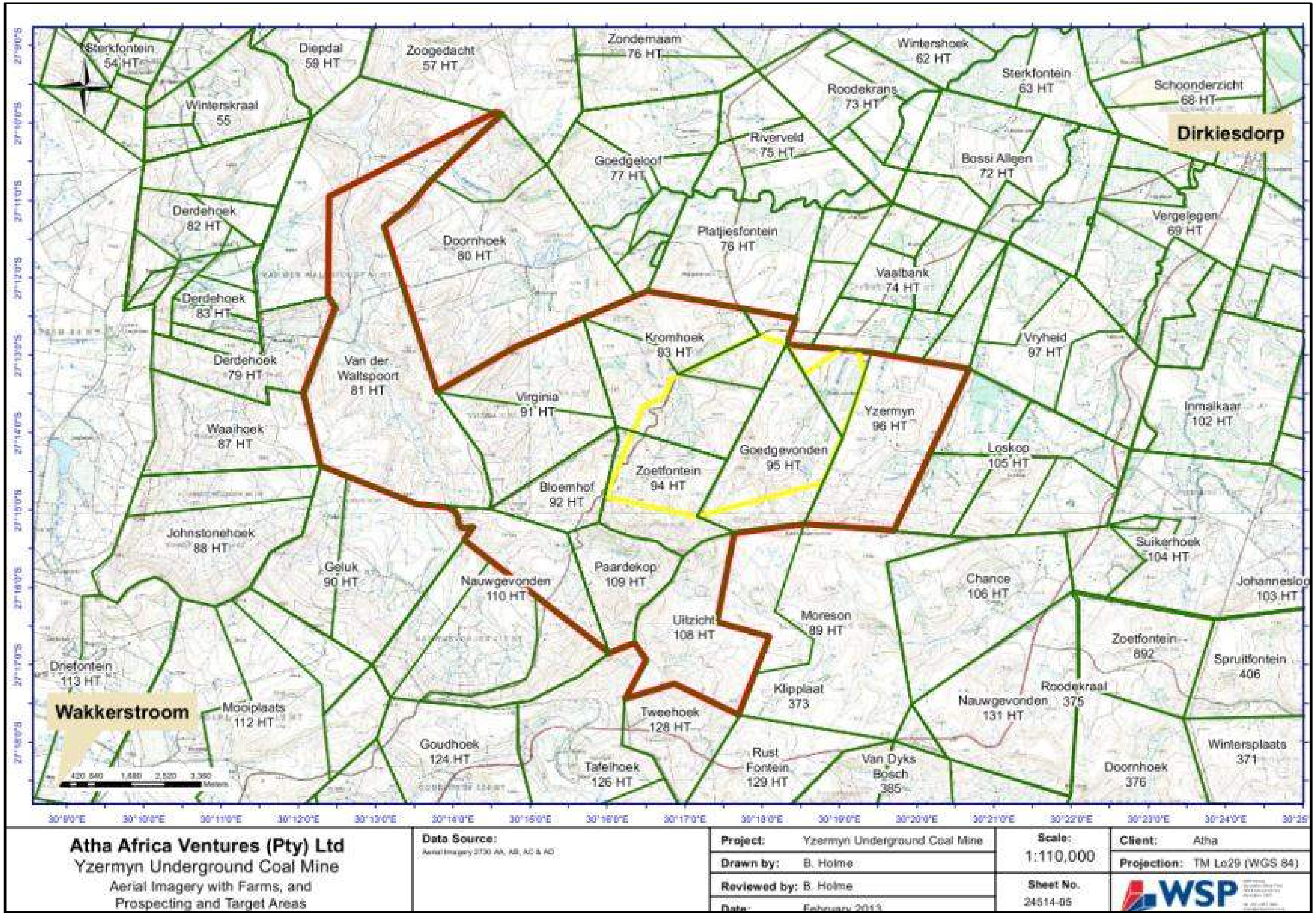

Figure 1-3: Locality Map Detailing Prospecting Right, Target Area and Farm Names

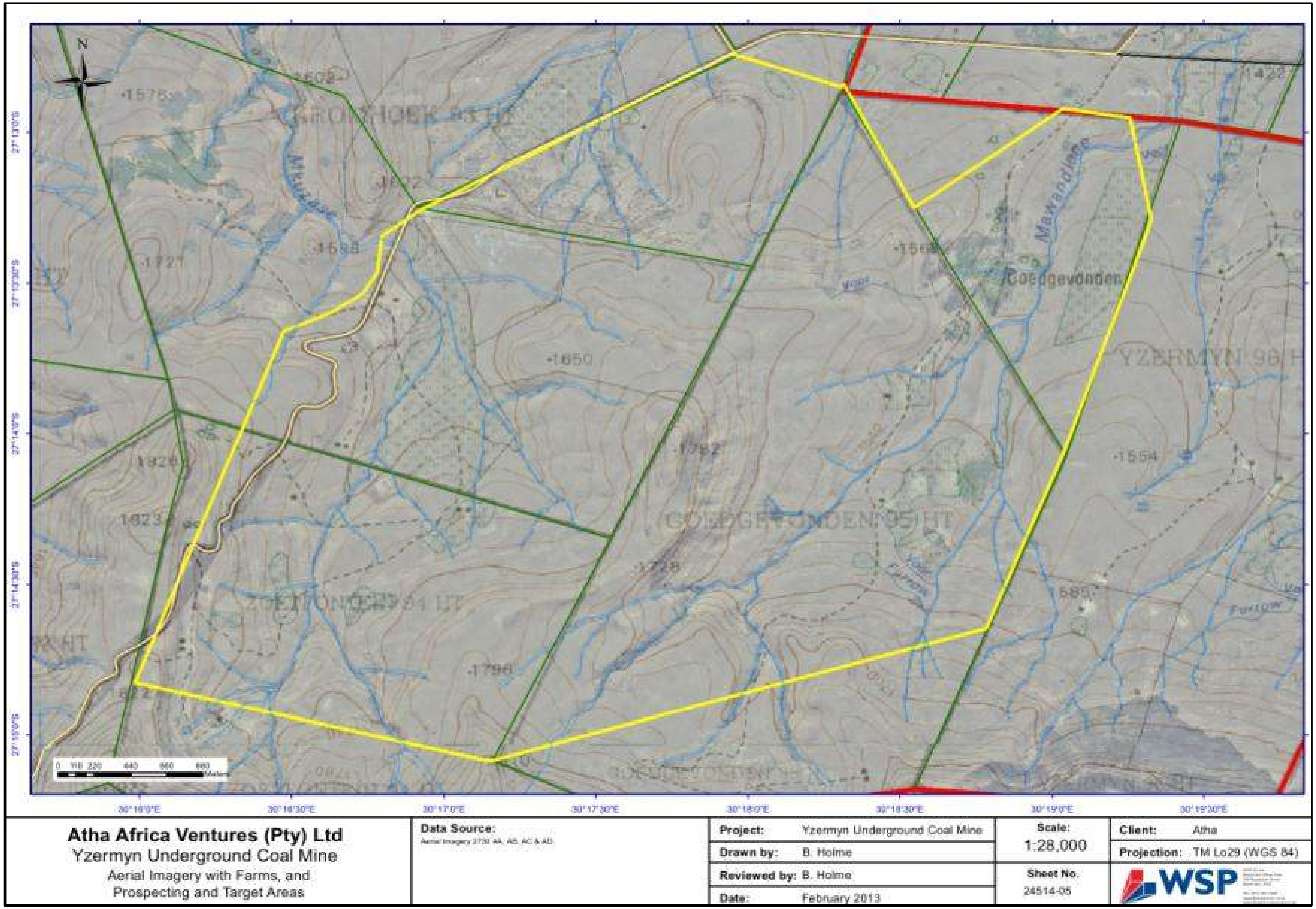

Figure 1-4: Locality Map Detailing the Target Area

1.3.1 Land Ownership

Table 1-1 details the farms comprising the prospecting right area, the target area as well as the proposed remainder area.

Table 1-1: List of Farms associated with the proposed Yzermyn Underground Coal Mine

Farm	Portion	Reg Div	Province	Extent (ha)
Farms Comprising the Prospecting Right Area				
Bloemhof 92	The Farm	HT	Mpumalanga	329.09
Goedgevonden 95	The Farm	HT	Mpumalanga	739.45
Kromhoek 93	The Farm	HT	Mpumalanga	1184.73
Nauwgevonden 110	Portion 1	HT	Mpumalanga	428.27
Paardekop 109	The Farm	HT	Mpumalanga	400.05
Uitzicht 108	The Farm	HT	Mpumalanga	691.31
Van Der Waltspoort 81	Portion 2	HT	Mpumalanga	1064.45
Van Der Waltspoort 81	Remaining Extent	HT	Mpumalanga	1022.98
Virginia 91	The Farm	HT	Mpumalanga	925.40
Yzermyn 96	Portion 1	HT	Mpumalanga	193.83
Yzermyn 96	Remaining Extent	HT	Mpumalanga	826.16
Zoetfonetin 94	The Farm	HT	Mpumalanga	553.81
Farms Comprising the Target Area				
Kromhoek 93	The Farm	HT	Mpumalanga	1184.73
Portion of Farm Zoetfonetin 94	The Farm	HT	Mpumalanga	553.81
Goedgevonden 95	The Farm	HT	Mpumalanga	739.45
Yzermyn 96 Portion 1	Portion 1	HT	Mpumalanga	193.83
Farms Comprising the Remainder Area				
Bloemhof 92	The Farm	HT	Mpumalanga	329.09
Goedgevonden 95	The Farm	HT	Mpumalanga	739.45
Kromhoek 93	The Farm	HT	Mpumalanga	1184.73
Paardekop 109 (only a portion of the Farm)	The Farm	HT	Mpumalanga	400.05
Virginia 91	The Farm	HT	Mpumalanga	925.40
Nauwgevonden 110	Portion 1	HT	Mpumalanga	428.27
Yzermyn 96	Remaining Extent	HT	Mpumalanga	826.16
Zoetfonetin 94	The Farm	HT	Mpumalanga	553.81

After completing the initial exploration and extrapolating recent and historical data, Atha has identified that a portion of the prospecting right area is considered unfeasible to mine due to erosion, thinning of the seam and depth issues. The farms, where mining is considered unfeasible, include the entire area of Uitzicht 108 and major portions of Paardekop 109 and Van Der Waltspoort 81.

As required by South African environmental legislation, landowner information of the adjacent farms is detailed in **Table 1-2**.

Table 1-2: Landowner details of the farms adjacent to the proposed Yzermyn Underground Coal Mine Prospecting Right Area

Farm	Portion	Landowner
Landowners Adjacent to Prospecting Right		
Diepdal 59 HT	0	B. P. Greyling
Winterskraal 55 HT	0	B. P. Greyling (kerneels Greyling trust)
	1	Benjamin Jacobus Joubert
	2, 4, 5	Naauwpoort Trust
	3	Andries Lodewiekus Hattingh
Derdehoek 82 HT	0, 4	Magdalena Johanna Lundie
	1	O. J. Klingenberg (Carl Klingenberg Family Trust)
	3	Interactive Trading 798CC
	5	Theunis Christoffel de Bruin
	6	Jonathan Jacobs Lundie
Derdehoek 83 HT	0, 7	Jonathan Jacobs Lundie
	3	Derdehoek Anthracite Mine Pty Ltd.
	4, 5	Michael Christian Moller
Derdehoek 79 HT	0	Hendrik Christoffel Marthinus Botha
Waaihoek 87 HT		Langfontein trust
Johnstonshoek 88 HT	0	National Government of the Republic of South Africa
	1	Langfontein trust
Geluk 90 HT	0	Imfuyo Pty Ltd
	1	PKS Local Municipality
Mooiplaats 112 HT	1, 2	Doktor Jan Consultante CC
	3	Imfuyo Pty Ltd
	4	Danie Zietsman Familie Trust
	5	Wetlands Country Retreat
	6	B. P. Greyling (Jan Christoffel Greyling)
	7	B. P. Greyling
	11	Julian Geoffrey Hilder
Goudhoek 124 HT	0	Danie Zietsman Familie Trust
Tafelhoek 126 HT	0	John George Pringle
Tweehoek 128 HT	0	O. J. Klingenberg
Rustfontein 129 HT	0	O. J. Klingenberg
Moreson 89 HT	0	Danria PTY Ltd.
Loskop 105 HT	0	O. Malan, Daniel Cornelius Malan
Loskop 105 HT	1	Karl Friedbert Schroder

Farm	Portion	Landowner
Vryheid 97 HT	0	B. P. Greyling
Vaalbank 74 HT	0, 8	J. Uys
Vaalbank 74 HT	1, 3, 4	Sobumbana Farming Project CC
Vaalbank 74 HT	2	A. Du Plessis
Vaalbank 74 HT	5	B. P. Greyling
Vaalbank 74 HT	6, 7	Department of Land Affairs
Platjiesfontein 76 HT	0	J. Uys
Goedgeloof 77 HT	0	Greykor Pty Ltd
Zoogedacht 57 HT	0	B. P. Greyling

1.4 Overview of Project

Although feasible coal reserves exist within the target area, a number of geological structures and faults have been identified at several stratigraphic levels, which have influence the stratigraphy and coal qualities of the coal seams. Faults present in the area have an impact on the coal seams deposition, presenting potential operating issues as the dolerite structures comprise hard rock, which needs to be mined through in order to reach the coalface.

Please note that no opencast mining will be considered as part of the project. Two incline shafts will be developed in order to access the coal reserves of the Alfred and Dundas coal seams. Coal will be mined from underground bord and pillar mining methods (drill and blast and continuous miner operations). The coal will be removed via conveyor systems to a Run-of-Mine (ROM) raw coal stockpile at the surface prior to being conveyed to a wash plant.

In order to minimise the discard quantity, it is proposed to wash coal in two-stage washing plant that would help in maximising the recovery of saleable product from ROM stockpile. According to calculations, it is anticipated that 81% of the coal mined will be saleable with the remaining 19% being transported to the discard dump for co-disposal. Discard from wash plant will be deposited on a discard dump and the washed coal will be conveyed to two separate stockpiles; primary product for export quality (1,234,032 tons per annum) and a secondary product (597,840 tons per annum) that will be railed for use in Eskom power stations.

Existing infrastructure and services in the area are limited, and services such as access roads, power and water supply will need to be established. Infrastructure that will need to be constructed includes, but is not limited to, administration offices, change houses (including ablution facilities), workshops, conveyor systems, wash plant/ beneficiation plant, pollution control dams and water separation systems (clean and dirty water separation), sewage treatment plant and water treatment plant. Furthermore, a co-disposal discard dump will need to be developed to store discard that is unfeasible to utilise due to its calorific value, ash content and concentration of volatiles.

It is anticipated that the coal will be transported by road to an existing coal siding (operated by Jindal) at the Piet Retief Siding near Piet Retief for dispatch to the Richards Bay Coal Terminal on the east coast or to other destinations for supply of coal (i.e. Eskom) as appropriate. It is anticipated that the haul route will take the existing unpaved road through the village of Dirkiesdorp, which is situated about 13 km from the proposed mine site, and onto the tarred R543 to the Piet Retief Siding, located approximately 60 km away.

1.5 Terms of Reference

In terms of Section 22 (4a) of the MPRDA, the proposed Yzermyn Underground Coal Mine requires a mining right from the DMR and is required to conduct an environmental impact assessment (EIA) and submit and environmental management programme report (EMPR) for approval in terms of Section 39 of the MPRDA.

In addition, activities need to be authorised in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA), with specific reference to the 2010 EIA Regulations, the National Environmental Management Waste Act (No. 59 of 2008) (NEMWA) with specific reference to GNR.718 of 2009 and the National Water Act (No. 36 of 1998) (NWA).

To this affect, WSP was appointed to undertake a comprehensive ESIA (including an environmental and social management programme (ESMP)) for the proposed Yzermyn Underground Coal Mine and to facilitate the MRA (according to MPRDA), environmental authorisation[2] (in terms of NEMA), waste management license (WML) (required by NEMWA) and water use license applications (WULAs) (in line with the NWA).

WSP has compiled the ESIA/ ESMP document (this report) in support of the abovementioned requirements. Please note that the purpose of the ESIA/ ESMP document is to assess the environmental and social impacts associated with the proposed Yzermyn Underground Coal Mine and were compiled in accordance with relevant South African environmental legislation.

1.6 Details of the Decision-making Authorities

The proposed Yzermyn Underground Coal Mine will require authorisation from a number of government departments prior to commencement. A mining right will need to be authorised by the DMR in accordance with the MPRDA. Although an application for environmental authorisation was submitted to the Mpumalanga Department of Economic Development, Environment, Conservation and Tourism (MDEDECT), the national Department of Environmental Affairs (DEA) has been identified as the overarching competent authority, and therefore the DEA will be responsible for granting environmental authorisation (according to the NEMA) and a WML (according to the NEMWA). It must be noted that MDEDECT will remain as a commenting authority, and will be required to comment on the ESIA/ ESMP document. Furthermore, to ensure compliance with all relevant South African environmental legislation, an integrated WUL will need to be obtained from the Department of Water Affairs (DWA) in accordance with the NWA. This is illustrated in **Figure 1-5** below. Contact details of the decision-making authorities are included in **Table 1-3** to **Table 1-6**.

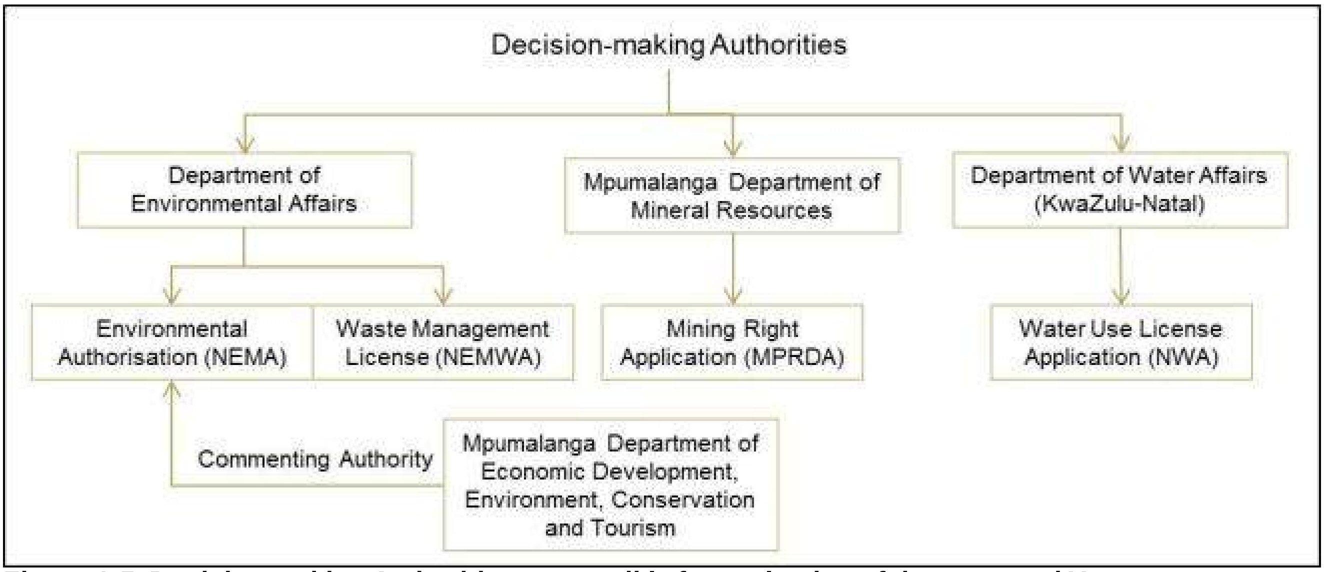

Figure 1-5: Decision-making Authorities responsible for evaluation of the proposed Yzermyn Underground Coal Mine project

[2] Please note that according to the EIA Regulations of 2010, a project will not receive a 'record of decision', but rather an 'environmental authorisation'.

Table 1-3: Details for the Department of Environmental Affairs

Department of Environmental Affairs	
Combined Environmental Authorisation and Waste Management License Applications	
Case Officer	Mmatlala Rabothata
Address	315 Pretorius Street Fedsure Building Pretoria 0001
Contact Information	Tel: +27 12 395 1768 Fax: +27 12 320 7539 Email: mrabothata@environment.gov.za
Reference Number	14/12/16/3/3/3/85

Table 1-4: Details for the Mpumalanga Department of Economic Development, Environment, Conservation and Tourism

Mpumalanga Department of Economic Development, Environment, Conservation and Tourism	
Application for Environmental Authorisation	
Case Officer	Nelisiwe Mlangeni
Address	13 De Jager Street Ermelo 2350
Contact Information	Tel: +27 17 811 4830/ 3944 Fax: +27 17 811 4830 Email: Mlangeninm@mpg.gov.za
Reference Number	17/2/3 GS-131

Table 1-5: Details for the Department of Mineral Resources

Mpumalanga Department of Mineral Resources	
Mining Right Application	
Case Officer	J du Plessis
Address	Province Building Cnr. Botha Avenue and Paul Kruger Street Witbank 1035
Contact Information	Tel: +27 13 653 0500 Fax: +27 13 690 3288
Reference Number	MP 30/5/1/2/2/10069MR

Table 1-6: Details for the Department of Water Affairs

KwaZulu-Natal Department of Water Affairs	
Water Use License Application	
Case Officer	Ntombethu Makwabasa
Address	718 Southern Life Building 88 Joe Slovo Street Durban 4000
Contact Information	Tel: +27 31 336 8810 Fax: +27 86 612 8124 Email: MakwabasaN@dwa.gov.za
Reference Number	16/2/7/W512/K/3

1.7 Details of the Project Proponent

The Atha Group (www.athagroup.in) was conceived as an iron ore mining business almost six decades back. Over the last decade, the Group has diversified into a coal mining, renewable power (wind and solar photovoltaic), sponge iron and steel production, CPC production, logistics, merchant iron ore exports, international trading and other international initiatives. With its experience and thorough knowledge, the Group has managed to carve a niche for itself and reached valuation of USD$ 800 for manganese. The Atha Group brand is visible in commodity and energy market in the Asian continent and is now making ambitious forays into Africa, Australia and Latin America. Atha is a subsidiary of the Atha Group headquartered in India and is a registered entity in South Africa with Registration number 2004/020746/07.

The Group has spread its footprint in South Africa, has successfully acquired the prospecting right and has applied for a MRA for the proposed Yzermyn Underground Coal Mine in close proximity to Piet Retief, Mpumalanga. The Group is also looking to expand its presence by acquiring or developing more projects in Southern Africa. The Atha Group has invested significantly into the Yzermyn acquisition and the subsequent development of the coal resources in this project since 2011 to date, and has been A-Rated by Nedbank, a major South African Bank.

The applicant for the proposed Yzermyn Underground Coal Mine is Atha. The relevant details are as follows:

Table 1-7: Project Proponent Details

Project Proponent	**Atha Africa Ventures (Pty) Ltd**
Company Registration/ Identity number for individuals:	2004/020746/07
Contact Person:	Morgam Munsamy
Postal Address:	8th Floor, Sinosteel Plaza 159 Rivonia Road Morning Side Santon 2144
Telephone:	+27 11 784 1885
Fax:	+27 11 784 7467
E-mail:	Morgam.Munsamy@athagroup.in

1.8 Details of the Environmental Assessment Practitioner

According to the requirements of the NEMA, EIA Regulations of 2010 (Government Notice Regulation (GNR) 543 of 2010), Section 17: "*An environmental assessment practitioner (EAP) appointed in terms of regulation 16(1) must be independent, have expertise in conducting environmental impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity*".

WSP Group Africa has recently merged with an international engineering company; Genivar. Together WSP and Genivar represent one of the worlds' leading professional services firms. WSP works throughout the public and private sectors globally providing integrated and innovative solutions across a broad range of disciplines to ensure the sustainable transformation of built and natural environment. Our expertise ranges from environmental remediation to urban planning, from engineering iconic infrastructure to advising cities on climate adaptation, and from developing the energy sources of the future to enabling new ways of extracting natural resources. We have 14,500 employees, including engineers, scientists, planners, project managers, technicians, environmental experts and other specialists, based in more than 300 offices, across 35 countries.

WSP Environmental (Pty) Ltd. is a leading South African environmental consultancy with a broad range of expertise and over 20 years' experience in the regional environmental market. While we form part of WSP Group, a global engineering and environmental multi-consultancy, we are also committed to transformation in our operational region, with 26% Broad Based Black Economic Empowerment (BBBEE) ownership and having achieved Level 3 BBBEE in South Africa. As part of a global business, we provide the regional marketplace with a dynamic blend of local and global expertise.

WSP was appointed by Atha to fulfil the role of the EAP to facilitate the environmental authorisation process in an independent manner. **Table 1-8** details the relevant contact details of the EAP.

Table 1-8: Details of the Environmental Assessment Practitioner

Environmental Assessment Practitioner (EAP)	WSP Environmental (Pty) Ltd
Company Registration/ Identity number for individuals:	1995/08790/07
Contact Person:	Brent Holme
Postal Address:	PO Box 5384 Rivonia 2128
Telephone:	+27 11 361 1389
Fax:	+27 86 532 8685
E-mail:	Brent.Holme@wspgroup.co.za

We pride ourselves on our reputation for delivery and technical excellence and provide a broad range of environmental and energy related services across a range of economic areas including the industrial, mining, financial, tourism and public sectors. Refer to **Appendix A** for a copy of WSPs Capability Statement and **Appendix B** for the EAPs curriculum vitae.

Please note: neither WSP nor its employees has, had or will have any financial or other interest in the proposed Yzermyn Underground Coal Mine, or Atha (or its parent company), other than the payment of our normal consulting fees as agreed with the proponent, prior to commencement of this project. Payment of WSP's consulting fees is not dependent on the receipt of any authorisation (positive or negative) from the DEA, the DMR, or the DWA or any other government agency involved in this project.

1.9 Report Structure

This document fulfils the requirements of Section 39 and Section 41 of the MPRDA, Section 50 and Section 51 of the MPRDA Regulations of 2004 as well as Section 31 and Section 33 of the NEMA EIA Regulations of 2010.

This ESIA/ ESMP document has been compiled in a diligent, comprehensive and independent manner, and includes the following:

- Letter of Undertaking;
- Introduction, including an introduction to the proposed Yzermyn Underground Coal Mine, project motivation, terms of reference, project proponent and the details of the EAP, details of the decision-making authorities and the report structure (**Section 1**);
- Approach and methodology applied to the ESIA process (**Section 2**);
- Discussion of the relevant governance framework applicable to the proposed Yzermyn Underground Coal Mine, including provincial ordinances, municipal by-laws and guidelines (**Section 3**);
- Assessment of project alternatives considered as part of the ESIA process (**Section 4**);
- Detailed project description including activities associated with the proposed Yzermyn Underground Coal Mine (**Section 5**);
- Discussion on the remainder area (**Section 6**);
- Description of the baseline biophysical and socio-economic characteristics of the proposed Yzermyn Underground Coal Mine (**Section 7**);
- Summary and findings of the specialist studies appointed for the project (**Section 8**);
- Detailed stakeholder engagement process undertaken during the ESIA process (**Section 9**);
- Assessment of the predicted biophysical and socio-economic impacts resulting from the proposed Yzermyn Underground Coal Mine, including cumulative impacts and mitigation measures (**Section 10**);
- Environmental and social management programme to mitigate significant impacts identified during the ESIA process, including anticipated costs to implement the mitigation measures (**Section 11**);
- Environmental and social monitoring management programme (**Section 12**);
- Environmental, social and cultural goals and objectives (**Section 13**);
- Environmental awareness plan (**Section 14**);
- Environmental emergency response plan (**Section 15**);
- Closure and rehabilitation plan and objectives (**Section 16**);
- Financial provision (**Section 17**);
- Assumptions and limitations associated with the proposed Yzermyn Underground Coal Mine project (**Section 18**); and
- Conclusion, recommendations and environmental statement (**Section 19**).

2 Approach and Methodology

In order for the project to commence, environmental authorisation through a full ESIA process is required, as the project triggers specific listed activities outlined in the MPRDA, NEMA, NEM:WA, NWA. Atha requested WSP to undertake the necessary environmental authorisation in accordance with national environmental legislation, but to ensure too that it would also comply with international financial institutions' guidelines for social and environmental appraisal.

Refer to **Figure 2-1** below for an illustration of the environmental authorisation process to-date.

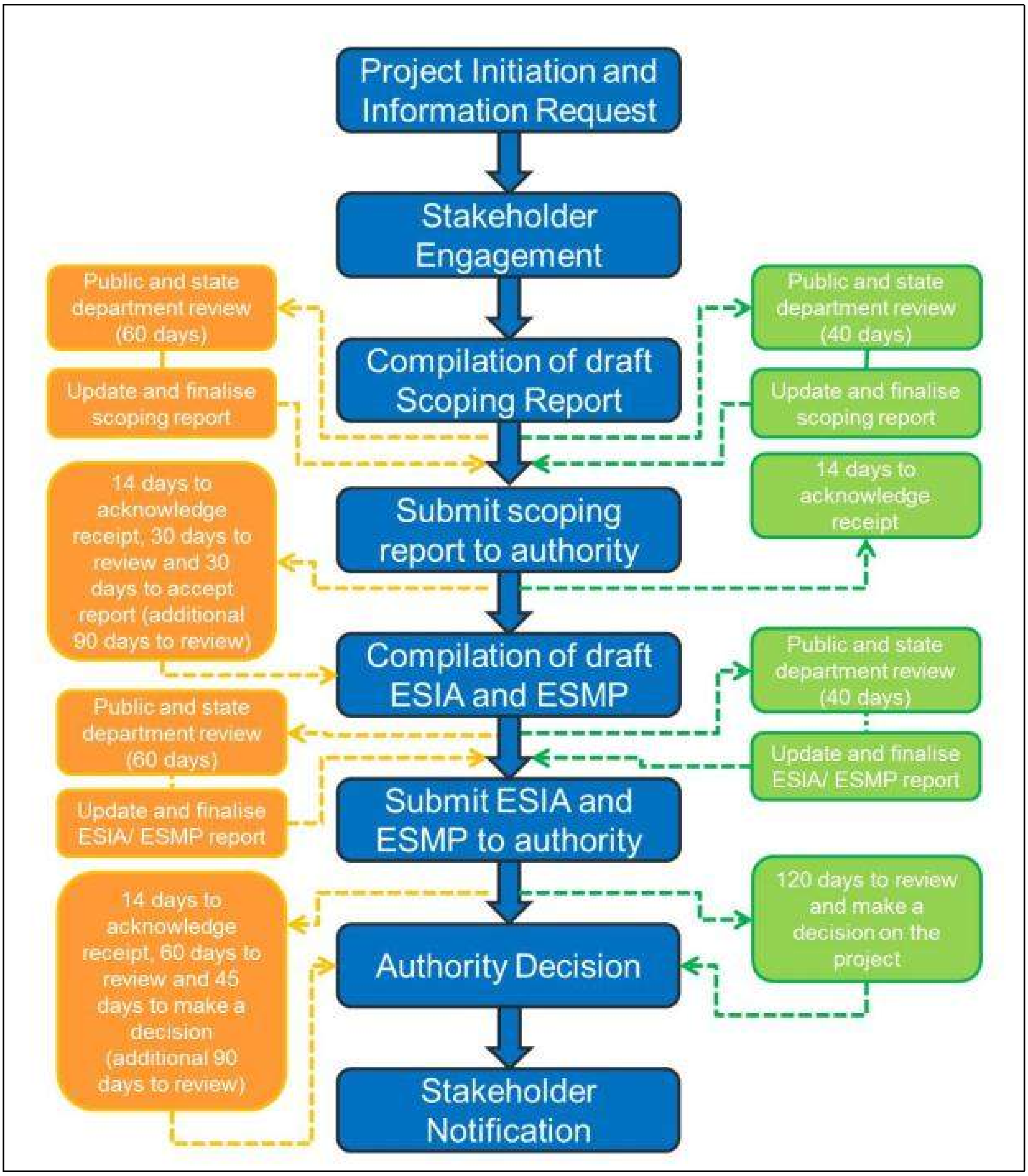

Figure 2-1: Diagram Illustrating ESIA Process

2.1 Approach to the Environmental and Social Impact Assessment

The scoping phase of the environmental authorisation process was completed in May 2013. The 30 days' timeframe for DMR to comment on the scoping report has lapsed, and therefore, WSP can assume no comments were raised by the DMR. WSP is awaiting acceptance of the scoping report from DEA and as a result, this draft ESIA/ ESMP document is placed on public review in order to appease the MPRDA process. Once the letter of acceptance has been received from DEA, WSP will place the NEMA draft ESIA/ ESMP on public review for 60 days.

This report details the ESIA phase, and represents the ESIA/ ESMP for the proposed Yzermyn Underground Coal Mine project.

2.1.1 Objectives of the Environmental and Social Impact Assessment Process

The objectives of the ESIA process are to provide:

- An assessment of the environment likely to be affected by the proposed project (**Section 7**);
- An assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed project (**Section 10**);
- A comparative assessment of the identified land use and development alternatives and their environmental, social and cultural impacts (**Section 4**);
- Appropriate mitigation measures for each significant impact of the proposed project (**Section 11**);
- Details of the stakeholder engagement process followed and an indication of how the issues raised have been addressed (**Section 9**);
- Identification of knowledge gaps and reporting on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information (**Section 18**);
- A description of the arrangements for monitoring and management of environmental impacts (**Section 12**); and
- Inclusion of technical and supporting information as appendices, if available (**Appendix C**).

2.1.2 Approach and Methodology for the Environmental and Social Impact Assessment

The ESIA process has been undertaken in accordance with the requirements of legislation detailed in **Section 3** of this document to ensure compliance with South African statutes and best practise. The compilation of the scoping report, and subsequent ESIA/ ESMP (this document), has taken cognisance of the requirements of the NEMA and the MPRDA (including the relevant regulations).

The methodology applied for conducting the ESIA consisted of the following processes:

- The environmental scoping report was submitted to the DMR on the 17 May 2013 and the DEA on the 20 June 2013;
- All comments received from the decision-making authorities, (including relevant authorities) and stakeholders will be addressed in the final report;
- Please note that the final scoping report acceptance letter was received by the DEA on 9 October 2013. In order to meet the MPRDA timeframes and submit the final ESIA/ ESMP document to the DMR within the requested period, WSP made the draft ESIA/ ESMP document available to the public from 10 September to 11 October 2013. To ensure compliance with the NEMA, the ESIA/ ESMP document has been placed on public review for a period of 60 days from 17 October 2013 until 17 December 2013;
- The environments likely to be affected by the project were assessed without management measures in place, including cumulative impacts;

- The identified potential environmental, social, cultural and cumulative impacts were identified and assessed with management measures in place;
- An ESMP (**Section 10**) was compiled detailing the proposed management commitments as described in the ESIA (**Section 9**);
- The ESIA/ ESMP (combined report) will be submitted to the relevant departments following a public review period of (1) 30 days for the MPRDA process, from 10 September to 11 October 2013, and (2) 60 days for the NEMA process, from 17 October to 17 December 2013. Comments received from both public review periods will be incorporated in the final ESIA/ ESMP documents before being submitted to DMR and the DEA for review and decision-making. WSP will make the final ESIA/ ESMP document available for public review for 21 days as required by NEMA following finalisation;
- The stakeholders will be informed of the availability of the draft ESIA/ ESMP report by means of personal communications, either by email, fax or telephonically;
- All comments received from the stakeholders will be addressed in the Final ESIA/ ESMP;
- This report will be submitted to the DMR and DEA, as well as other relevant government departments, including: the DMR, DEA, DWA, SAHRA, MTPA, WWF-SA, BirdLife SA, MDEDECT, Pixley ka Seme Local Municipality and the Khono Local Municipality for consideration; and
- All stakeholders will be informed of the Departments' decision on the proposed Yzermyn Underground Coal Mine project.

Note: Although similar methodology has been applied for the compilation of the ESIA/ ESMP document, timeframes associated with public and government review and respective authorisation periods differ. According to the MPRDA, an environmental (and social) impact report has to be submitted to the DMR within 180 days following the acceptance of the MRA. Due to this constraint, WSP will be placing the draft ESIA/ ESMP for public review for a period of 30 days (to meet the public review requirements contemplated in the MPRDA). Comments obtained from the draft document will be updated into a final ESIA/ ESMP and submitted to the DMR. However, to ensure compliance with the NEMA EIA Regulations of 2010, WSP will ensure that the draft document remains on public review for an additional period of 30 days (total of 60 days as required for WML applications) before being removed from public review. All comments will be recorded and responded to and a final document will be made available to registered stakeholders prior to being submitted to the DEA for review. WSP will also send an updated issues trail to the DMR in order to ensure transparency and compliance with relevant South African legislation.

2.1.3 Specialist Studies

To ensure a comprehensive environmental authorisation process, technical studies were undertaken for potential impacts associated with the proposed project. Summarise of all the studies are included in **Section 8** and all technical reports are available in **Appendix C**. The studies undertaken and the entity and consultant responsible for each are listed in **Table 2-1**.

According to the NEMA EIA Regulations of 2010 (GNR 543 Section 32), all specialist studies and reports must be undertaken and compiled by a person who is suitable qualified to undertake the required investigations. In addition, all specialists must declare that they:

- Act as the independent specialist in this application;
- Will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- Declare that there are no circumstances that may compromise my objectivity in performing such work;
- Have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- Will comply with the Act, Regulations and all other applicable legislation;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with

respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

- Have furnished the department with true and correct particulars in terms contact details and qualifications; and
- Realise that a false declaration is an offence in terms of regulation 71 and is punishable in terms of section 24F of the Act.

Signed declaration of interest forms of all the specialists involved in this ESIA/ ESMP are available on request.

Table 2-1: Specialist Team Details

Name	Organisation	Project Component	Contact Details
Bradley Keiser Kirsten Collett	WSP	Air Quality	Tel: 011 361 1377 Fax: 086 532 8685
Bradley Keiser Kirsten Collett	WSP	Noise	Tel: 011 361 1377 Fax: 086 532 8685
Caroline Lotter	Natural Scientific Services (NSS)	Biodiversity	Tel: 011 787 7400 Fax: 011 784 5799
Anton van Vollenhoven	Archaetnos CC	Cultural, Heritage and Archaeological	Tel: 012 343 0509
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2.1.4 Environmental Impact Rating Methodology

The potential environmental impacts were evaluated according to their severity, duration, extent and significance of the impact. Furthermore, cumulative impacts were also taken into consideration. WSPs risk assessment methodology was used for the rating of the impacts.

This system derives environmental significance based on the consequence of the impact on the environment and the likelihood of the impact occurring. Consequence is calculated as the average of the sum of the ratings of severity, duration and extent of the environmental impact. Likelihood considers the frequency of the activity together with the probability of an environmental impact occurring.

The following tables (**Table 2-2** to **Table 2-9**) describe the process in detail:

Table 2-2: Assessment and Rating Sensitivity

Rating	Description
1	Negligible/ non-harmful/ minimal deterioration (0 – 20%)
2	Minor/ potentially harmful/ measurable deterioration (20 – 40%)
3	Moderate/ harmful/ moderate deterioration (40 – 60%)
4	Significant/ very harmful/ substantial deterioration (60 – 80%)
5	Irreversible/ permanent/ death (80 – 100%)

Table 2-3: Assessment and Rating of Duration

Rating	Description
1	Less than 1 month/ quickly reversible
2	Less than 1 year/ quickly reversible
3	More than 1 year/ reversible over time
4	More than 10 years/ reversible over time/ life of project or facility
5	Beyond life of project of facility/ permanent

Table 2-4: Assessment and Rating of Extent

Rating	Description
1	Within immediate area of activity
2	Surrounding area within project boundary
3	Beyond project boundary
4	Regional/ provincial
5	National/ international

Consequence is calculated as the average of the sum of the ratings of severity, duration and extent of the environmental impact.

Table 2-5: Determination of Consequence

Determination of Consequence (C) =	(Severity + Duration + Extent) / 3

Likelihood considers the frequency of the activity together with the probability of the environmental impact associated with that activity occurring.

Table 2-6: Assessment and Rating of Frequency

Rating	Description
1	Less than once a year
2	Once in a year
3	Quarterly
4	Weekly
5	Daily

Table 2-7: Assessment and Rating of Probability

Rating	Description
1	Almost impossible
2	Unlikely
3	Probable
4	Highly likely
5	Definite

Table 2-8: Determination of Likelihood

Determination of Likelihood (L) =	(Frequency + Probability) / 2

Impact significance is the product of the consequence and likelihood values.

Table 2-9: Determination of Environmental Significance

Environmental Significance (Impact) = C × L	Description
L (1 – 4.9)	Low environmental significance
LM (5 – 9.9)	Low to medium environmental significance
M (10 – 14.99)	Medium environmental significance
MH (15 – 19.9)	Medium to high environmental significance
H (20 – 25)	High environmental significance. Likely to be a fatal flaw.

1.1.1 Environmental and Social Management Programme

The ESMP (**Section 10**) provides the actions for the management of identified environmental impacts emanating from the proposed project as well as an outline of the implementation programme to minimise and/ or eliminate significant environmental impacts. The ESMP addresses the roles and responsibilities of environmental management personnel on-site and establishes a framework for environmental compliance and monitoring.

The ESMP includes the following for the construction, operational and closure phases for the proposed project:

- Details and expertise of the person who prepared the ESMP;
- Information on any proposed management or mitigation measures that will be taken to address the environmental impacts that have been identified in the ESIA. This will include environmental impacts or objectives in respect of planning and design, pre-construction and construction activities, operation or undertaking of the activities and rehabilitation of the environment and closure where relevant;
- A detailed description of the aspects of the activity that are covered by the ESMP;
- An identification of the persons who will be responsible for the implementation of the measures; and
- Proposed mechanisms for monitoring compliance with the ESMP and reporting thereof.

Please note that a full cost calculation will be employed during the ESIA phase of the project in order to calculate the cost of each mitigation measure that will be developed in order to minimise the anticipated risks/ impacts of the proposed project.

2.2 Stakeholder Engagement

The stakeholder consultation process was conducted from the onset of the project. The NEMA EIA Regulations of 2010 (GNR 543, Sections 54 – 57) require that an inclusive, transparent process of engagement be undertaken that allows participation by any and all persons and entities who may be affected by and/ or have an interest in a proposed project. Procedures for informing stakeholders about a project and engaging their participation have become standard practice. In the case of this project, WSP undertook a social scan and informal engagement as an additional step prior to the scoping phase of the project.

The stakeholder consultation process was undertaken in English, Afrikaans and Zulu to ensure the widest range of stakeholders were able to participate in the process.

Full details of the stakeholder engagement process are provided in **Section 9**.

3 Governance Framework

3.1 South African Legal Requirements

Relevant South African legislation requires various authorisations prior to the commencement of the proposed mining activities. Although cognisance of all applicable legislation is being taken, the following table details the relevant environmental authorisations, which are required:

Table 3-1: Authorisation Required for the Proposed Project

Authorisation	Responsible Department	Relevant Act
Mining Right	DMR	MPRDA
Environmental Authorisation	DEA	NEMA
Water Use License	DWA	NWA
Waste Management License	DEA	NEMWA

As part of the scoping phase, and to ensure all relevant South African legislation was taken into consideration, the following legislation was considered relevant as part of the overall ESIA process to ensure legal compliance and best practice.

- The Constitution of the Republic of South Africa (No. 108 of 1996)
- Mineral and Petroleum Resources Development Act (No. 28 of 2002)
- National Environmental Management Act (No. 107 of 1998)
- National Water Act (No. 36 of 1998)
- National Environmental Management Biodiversity Act (No. 10 of 2004)
- National Environmental Management Protected Areas Act (No. 57 of 2003)
- National Environmental Management Air Quality Act (No. 39 of 2004)
- National Environmental Management Waste Act (No. 59 of 2008)
- National Heritage Resources Act (No. 25 of 1999)
- Conservation of Agricultural Resources Act (No. 43 of 1983)
- National Forests Act (No. 84 of 1998)
- Fencing Act (No. 31 of 1963)
- Hazardous Substances Act (No. 15 of 1979)
- Occupational Health and Safety Act (No. 85 of 1993)
- Mine Health and Safety Act (No. 29 of 1996)
- Subdivision of Agricultural Land Act (No. 70 of 1970
- Promotion of Access to Information Act (No. 2 of 2000)
- Promotion of Administrative Justice Act (No. 3 of 2000)
- Provincial Ordinances and Municipal By-laws
  - Mpumalanga Parks Board Act (No. 6 of 1995)
  - Mpumalanga Nature Conservation Act (No 10 of 1998)
  - Mpumalanga Tourism and Parks Agency Act (No. 5 of 2005)
- Guidelines

- Department of Water Affairs: Best Practice Guideline Series
- Action Plan of the Environmental Initiative of the New Partnership of Africa's Development
- The Mining and Biodiversity Forum of South Africa
- Mining and Biodiversity Guideline
- National Spatial Biodiversity Assessment
- South Africa's National Biodiversity Strategy and Action Plan
- Threatened, Protected, Alien and Invasive Species Regulation
- National Aquatic Ecosystem Health Monitoring Programme and River Health Programme
- Mpumalanga Tourism and Parks Agency Guidelines for Biodiversity Assessment
- Mpumalanga Biodiversity Sector Plan
- Mpumalanga Conservation Plan
- Environmental Management Framework for the Wakkerstroom Area
- KwaMandlagampisi Protected Environment Declaration

3.1.1 Constitution of the Republic of South Africa (No. 108 of 1996)

Since 1994 South African legislation, including environmental legislation, has undergone a large transformation and various new laws and policies was promulgated with a strong emphasis on environmental concerns and the need for sustainable development. The Constitution of the Republic of South Africa (No. 108 of 1996) (the Constitution), the supreme law in South Africa, contains far reaching clauses relevant to the environment including the environmental right, the administrative justice clause, the access to information right as well as the liberalisation of *locus standi* rule. In terms of Section 24, a positive obligation is placed on the State to give effect to the environmental right. The environmental right states that:

"*Everyone has the right -*

- *To an environment that is not harmful to their health or well-being; and*
- *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:*
  - *Prevent pollution and ecological degradation;*
  - *Promote conservation; and*
  - *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

The purpose of the ESIA study is to identify activities that may cause environmental and socio-economic damage from the associated impacts occurring because of the proposed Yzermyn Underground Coal Mine. The impacts will be assessed, evaluated and mitigation measures developed to minimise the negative impacts and promote positive impacts associated with the project, thereby ensuring that the project is undertaken in a sustainable manner. This also ensures that Atha does not contravene Section 24 of the Constitution.

The Constitution cannot manage environmental resources as a stand-alone piece of legislation hence additional legislation has been promulgated in order to manage the various spheres of both the social and natural environment. Each promulgated Act and associated Regulations are designed to focus on various industries or components of the environment to ensure that the objectives of the Constitution are effectively implemented and upheld on an on-going basis throughout the Country. In terms of Section 7, a positive obligation is placed on the State to give effect to the environmental rights.

3.1.2 Mineral and Petroleum Resources Development Act (No. 28 of 2002)

The primary aim of the MPRDA is to recognise the sovereignty of the State over all the mineral and petroleum resources in South Africa and to promote equitable access to the Country's resources. The MPRDA has a number of objectives, including to:

- Promote equitable access to the nation's mineral and petroleum resources to all the people of South Africa;
- Substantially and meaningfully expand opportunities for historically disadvantaged persons, including women, to enter the mineral and petroleum industries and to benefit from the exploitation of the nation's mineral and petroleum resources;
- Promote economic growth and mineral and petroleum resources development in the country;
- Provide for security of tenure in respect of prospecting, exploration, mining and production operations;
- Give effect to Section 24 of the Constitution of South Africa by ensuring that the nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development; and
- Ensure that holders of mining and production rights contribute towards the socio-economic development of the areas in which they are operating.

The MPRDA concerns equitable access to, and sustainable development of, South Africa's mineral and petroleum resources. The MPRDA makes provision for sustainable mining and requires:

- That every person who has applied for a mining right must conduct an EIA, determine the environmental baseline, and submit an EMP to the DMR;
- That every holder of a mining reconnaissance permit, prospecting right, mining right, mining permit or retention permit must assess and communicate the impacts of the activity on the environment;
- The need to rehabilitate the environment affected by prospecting or mining operations to its natural or predetermined state; and
- That the directors of the mining company are liable for unacceptable impacts on the environment.

In accordance with Section 22 of the MPRDA, Atha is required to conduct an EIA and submit an EMP (in terms of Section 39) for approval to the Mpumalanga DMR. A Social and Labour Plan and Financial Provision for the proposed mine has been developed and submitted to the DMR. WSP has compiled the ESIA and ESMP report in accordance with the MPRDA.

3.1.3 National Environmental Management Act (No. 107 of 1998)

The NEMA is South Africa's overarching environmental statute concerned with integrated environmental management (IEM) and the underlying principles by which environmental management must be undertaken. Its primary objective is to provide for co-operative governance, thus binding all organs of State by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance, and procedures for co-ordinating environmental functions exercised by organs of State and to provide for matters connected therewith (Government Gazette, 1998).

The NEMA provides for the Constitutional right to an environment that is not harmful to the health and well-being of South African citizens, the equitable distribution of natural resources, sustainable development, environmental protection, and the formulation of environmental management frameworks (Government Gazette, 1998). Section 2 of NEMA sets out principles for sustainable integrated environmental governance; the principles are further detailed in subsequent sections of NEMA.

Section 24(5), 24M and 44 of the NEMA enables the Minister to publish regulations pertaining to environmental impact assessments. The current Environmental Impact Assessment Regulations, GNR.543 (EIA Regulations), were published on 18 June 2010. Sections 24(2) and 24D of the NEMA make provision for the Minister to publish listed activities that would require environmental authorisation prior to commencement of that activity. The Minister published the following three Regulations in terms of Sections 24(2) and 24D of the NEMA on 18 June 2010:

- Regulation GNR.544 of 2010 which sets out a list of identified activities which may not commence without environmental authorisation from the competent authority and which must follow the Basic Assessment (BA) procedure as provided for in Regulations 21 to 25 of the EIA Regulations;
- Regulation GNR.545 of 2010 which sets out a list of identified activities which may not commence without environmental authorisation from the competent authority and which must follow the scoping and EIA procedure as provided for in Regulations 26 to 35 of the EIA Regulations; and

- Regulation GNR.546 of 2010, which sets out a list of identified activities per geographical area, which may not commence without environmental authorisation from the competent authority and which must follow the BA procedure as, provided for in Regulations 21 to 25 of the EIA Regulations.

Furthermore, according to Section 2(r) in NEMA, sensitive, vulnerable, highly dynamic or stressed ecosystems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure. Grasslands and wetlands in Mpumalanga are a strong case in point.

In terms of Section 24(2) and 24(D) of the NEMA, authorisation is required for the following listed activities identified in terms of:

EIA Regulation GNR.544 of 2010:

Activity 9:	The construction of facilities or infrastructure exceeding 1,000 m in length for the bulk transportation of water, sewage or stormwater (i) with an internal diameter of 0.36 m or more; or (ii) with a peak throughput of 120 litres per second or more.
Activity 10:	The construction of facilities or infrastructure for the transmission and distribution of electricity (i) outside urban areas or industrial complexes with a capacity more than 33 but less than 275 kilovolts.
Activity 11:	The construction of canals, channels, dams, weirs, bulk stormwater outlet structures, buildings exceeding 50 m^2 or structures covering more than 50 m^2 – where such a construction occurs within 32m of a watercourse.
Activity 12:	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50,000 m^3 or more, unless the storage falls within the ambit of GNR.545, Activity 19.
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 m^3.
Activity 22:	The construction of a road, outside urban areas, (i) where the road reserve is wider than 13.5 m, or (ii) where no road exists where the road is wider than 8m.
Activity 23:	The transformation of undeveloped land to industrial use, outside an urban area – where the total area to be transformed is greater than 5 ha but less than 20 ha.
Activity 24:	The transformation of land bigger than 1,000 m^2 to industrial use, where the land use was zoned as open space, conservation or had equivalent zoning.
Activity 26:	Any process or activity identified in terms of Section 53(1) of the NEMBA.

EIA Regulations GNR.545 of 2010:

Activity 5:	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.
Activity 6:	The construction of facilities or infrastructure for the bulk transportation of dangerous goods in solid form, outside of an industrial complex, using conveyors with a throughput capacity of more than 50 tons per day.
Activity 15:	Physical alteration of undeveloped land for industrial use where the total area to be transformed in greater than 20 ha.
Activity 18:	The route determination and design of associated physical infrastructure, including (i) national roads as defined in Section 40 of the South African National Roads Agency Limited and National Roads Act (No. 7 of 1998), (ii) roads administered by provincial authorities, (iii) road reserve is greater than 30 m, or (iv) the road will cater for more than one lane of traffic in both directions.
Activity 20:	Any activity which requires a mining right contemplated in Section 22 of the MPRDA[3].

[3] Although this activity has yet to be promulgated, it is considered applicable to the proposed Yzermyn Underground Coal Mine.

EIA Regulations GNR.546 of 2010:

The following activities are triggered due to the specific geographical locality of the proposed project. Authorisation will be required in Mpumalanga for protected areas identified in terms of NEMPAA, National Protected Area Expansion Strategy Focus area, Sensitive areas as identified in an environmental framework as contemplated in chapter 5 of the NEMA, critical biodiversity areas, core areas in biodiversity reserves, and areas within 10 km of national parks or 5 km from any protected environment.

Activity 2: The construction of reservoirs for bulk water supply with a capacity of more than 250 m^3.

Activity 4: The construction of a road wider than 4m with a road reserve less than 13.5 m.

Activity 12: The clearance of an area of 300 m^2 or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.

Activity 16: The construction of buildings with a footprint exceeding 10 m^2 in size; or infrastructure covering 10 m^2 or more.

An environmental authorisation application form has been submitted to the MDEDECT for which a reference number has been received (**17/2/3GS131**). Furthermore, a combined application form environmental authorisation and WML has been compiled and submitted to the DEA for which a reference number has been received (**14/12/16/3/3/85**). Refer to **Appendix D** for a copy of the acknowledgement of receipt from MDEDECT and DEA.

3.1.4 National Environmental Management Biodiversity Act (No. 10 of 2004)

In line with the Convention on Biological Diversity, the National Environmental Management Biodiversity Act (No. 10 of 2004) (NEMBA) aims to legally provide for biodiversity conservation, sustainable use and equitable access and benefit sharing. The Act establishes the South African National Biodiversity Institute (SANBI). The NEMBA creates a basic legal framework for the formation of a national biodiversity strategy and action plan and the identification of biodiversity hotspots and bio-regions which will then be given legal recognition. It imposes obligations on landowners (state or private) governing alien invasive species as well as regulates the introduction of genetically modified organisms. Furthermore, the Act serves to regulate bio-prospecting, making provision for communities to share the profits of any exploitation of natural materials involving indigenous knowledge.

A restricted activity is defined by the NEMBA as, *inter alia*:

- In relation to a specimen of a listed threatened or protected species:
  - Hunting, catching, capturing or killing any living specimen of a listed threatened or protected species by any means, method or device whatsoever, including searching, pursuing, driving, lying in wait, luring, alluring, discharging a missile or injuring with intent to hunt, catch, capture or kill any such specimen;
  - Gathering, collecting or plucking any specimen of a listed threatened or protected species;
  - Picking parts of, or cutting, chopping off, uprooting, damaging or destroying, any specimen of a listed threatened or protected species;
  - Having in possession or exercising physical control over any specimen of a listed threatened or protected species; and
  - Conveying, moving or otherwise translocating any specimen of a listed threatened or protected species.
- In relation to a specimen of an alien species or listed invasive species:
  - Importing into the Republic, including introducing from the sea, any specimen of an alien or listed invasive species;
  - Having in possession or exercising physical control over any specimen of an alien or listed invasive species;
  - Growing, breeding or in any other way propagating any specimen of an alien or listed invasive species, or causing it to multiply; and
  - Conveying, moving or otherwise translocating any specimen of an alien or listed invasive species.

Sections 52(1)(a) and 56(1) of the NEMBA state that the Minister may publish national lists of species and ecosystems, respectively, that are threatened or are in need of protection. A list of species that are threatened or are in need of protection was published in 2007 in GNR.151, with GNR.152 detailing the regulations relating to such species. These regulations are imposed where restricted activities involve specimens of listed threatened or protected species. GNR.152 defines the requirements of permitting and the process related thereto.

GNR.1002, published in 2011, contains the first national list of threatened terrestrial ecosystems and provides supporting information to accompany the list, including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed terrestrial ecosystems. It also includes individual maps and detailed information for each listed ecosystem.

One of the objectives of this Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and to ensure the sustainable use of indigenous biological resources. In addition to regulations on Threatened, Protected, Alien and Invasive Species in South Africa, the National Biodiversity Strategies and Action Plans (NBSAP) was formulated under the National Spatial Biodiversity Assessment (NSBA) and was used to identify Terrestrial and Aquatic Priority Areas and Threatened Ecosystems for biodiversity conservation.

Chapter 4, Part 2 (Threatened and Protected Species Regulations) of NEMBA provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival. In February 2007, this was achieved as the Minister of DEA published a list of Critically Endangered, Endangered, Vulnerable and Protected Species, according to Section 56(1) of the Act.

Natural Scientific Services (Pty) Ltd (NSS) has been appointed to undertake comprehensive fauna, flora and wetland assessments of the target area. Impacts of the proposed Yzermyn Underground Coal Mine have been assessed, and mitigation measures developed in order to attempt to ensure that the mine is constructed, operated and rehabilitated in a responsible manner, taking into consideration biological resources.

3.1.5 National Environmental Management Protected Areas Act (No. 57 of 2003)

The National Environmental Management Protected Areas Act (No. 57 of 2003) (NEMPAA) concerns the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes, and includes *inter alia*:

- The establishment of a national register of all national, provincial and local protected areas;
- The management of those areas in accordance with national standards; and
- Inter-governmental co-operation and public consultation in matters concerning protected areas.

The project will take cognisance of the NEMPAA in order to ensure compliance with South African legislation.

The NEMPAA defines various kinds of protected areas, namely: special nature reserves, national parks, nature reserves (including wilderness areas) and protected environments, world heritage sites, marine protected areas, specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act (No. 84 of 1998), and mountain catchment areas declared in terms of the Mountain Catchment Areas Act (No. 63 of 1970).

Part 4 of Chapter 4 of the NEMPAA (Sections 48 to 53) lists restrictions of activities that may not be conducted in a protected area (as described above). Activities that are restricted include:

- Prospecting and mining activities;
  - Activities that are restricted by:
    - Regulations made by the Minister;
    - Regulations made by the MEC, in the case of provincial and local protected areas;
    - By-laws of the relevant municipality, in the case of local protected areas; and
    - Internal rules made by the managing authority of the area;

- Commercial and community activities where the survival of any species is negatively affected or the integrity of an ecosystem is significantly disrupted; and
- Any development or other activity that is inappropriate for the area given the purpose for which the area was declared.

The existing KwaMandlagampisi Protected Environment is located adjacent (east) to the existing prospecting right. Furthermore, the MEC of MDEDECT, along with the Mpumalanga Tourism and Parks Agency (MTPA), has submitted intent to declare the Mabola Protected Environment, which was gazetted in May 2013. This ESIA has taken cognisance of the existing, as well as the proposed Protected Environments and has assessed the need to retain the natural environment against the potential social-economic upliftment associated with the proposed project.

3.1.6 National Environmental Management Air Quality Act (No. 39 of 2004)

The National Environmental Management Air Quality Act (No. 39 of 2004) (NEMAQA) allows for national, provincial and local air quality standards to be established as well as the declaration of priority areas. In addition, the NEMAQA requires that Air Quality Management Plans (AQMP) form part of the environmental implementation plan or environmental management plans to be prepared by national departments or the Province as required by Chapter 3 of the NEMA. Furthermore the NEMAQA requires municipalities to include an AQMP into its integrated development plan (IDP).

The NEMAQA requires the Minister of the DEA to publish a list of activities which results in atmospheric emissions which may have a detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions, ecological conditions or cultural heritage. The NEMAQA requires that an atmospheric emissions licence (AEL) be obtained for such listed activities. Such a list of activities was published in GNR.248 of 2010.

Although it was anticipated that an AEL may have been required in the scoping phase for the storage of more than 100,000 tons of coal outside of a mine lease area, it has been confirmed that this activity will not occur. However, dust fallout will need to be monitored to ensure that this does not impact on the surrounding environment. The NEMAQA has drafted threshold limits for the generation of dust, although this has yet to be promulgated. It has been noted that SANS 10929 will be utilised for assessing dust fallout concentrations.

3.1.7 National Environmental Management Waste Act (No. 59 of 2008)

The National Environmental Management Waste Act (No. 59 of 2008) (NEMWA) serves to reform the law regulating waste management in order to protect human health and the environment. This is managed by providing reasonable measures for the prevention of pollution and ecological degradation. The Act aims to secure ecologically sustainable development while promoting justifiable economic and social development. The Act provides national norms and standards for regulating the management of waste by all spheres of government, for specific waste management measures and for matters incidental thereto.

In terms of the NEMWA, the Minister of the DEA may publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment. Furthermore, the NEMWA prohibits any person to commence, undertake or conduct a waste management activity except in accordance with the requirements or standards determined in terms of the NEMWA for that activity or where a WML has been issued in respect of that activity.

A list of waste management activities that require a WML was published in GNR.718 of 2009. GNR.718 details two categories of activities: Category A activities, which require a BA process in terms of GNR.543 to be undertaken, and Category B activities, which require a scoping and EIA process in terms of GNR.543 to be undertaken. The following activities are considered applicable to the proposed Yzermyn Underground Coal Mine:

GNR.718 0f 2009, Category A:

Activity 1: The storage, including the temporary storage, of general waste at a facility that has the capacity to store in excess of 100 m^3 of general waste at any one time, excluding the storage of waste in lagoons.

Activity 2:	The storage, including the temporary storage, of hazardous waste at a facility that has the capacity to store in excess of 35 m^3 of hazardous waste at any one time, excluding the storage of hazardous waste in lagoons.
Activity 18:	The construction of facilities for activities listed in Category A of GNR.718.
GNR.718 of 2009, Category B:	
Activity 7:	The treatment of effluent, waste water or sewage with an annual throughput capacity of 15,000 m^3 or more.
Activity 11:	The construction of facilities for activities listed in Category B of GNR.718.

As the waste management activities involve the storing, handing and management of hazardous waste, the DEA will be responsible for authorising a WML for the relevant activities. A combined environmental application and WML application has been drafted and submitted to the DEA (reference **14/12/16/3/3/85**). A copy of the combined application form is available in **Appendix D**.

To ensure best practice, WSP has included requirements from the draft norms and standards which have yet to be promulgated. These include the Draft Norms and Standards for the Temporary Storage of Waste (GNR. 436 of 2011), and the Draft Norms and Standards of Waste Classification and Management (GNR.614 of 2012).

3.1.8 National Water Act (No. 36 of 1998)

The NWA provides for fundamental reformation of legislation relating to water resources and use. The preamble to the Act recognises that the ultimate aim of water resource management is to achieve sustainable use of water for the benefit of all users and that the protection of the quality of water resources is necessary to ensure sustainability of the nation's water resources in the interests of all water users. The purpose of the Act is stated, in Section 2 as, *inter alia*:

- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources; and
- Meeting international obligations.

The NWA presents strategies to facilitate sound management of water resources, provides for the protection of water resources, and regulates use of water by means of Catchment Management Agencies, Water User Associations, Advisory Committees and International Water Management.

As this Act is founded on the principle that the government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, an industry (including mines) is only entitled to use water if the use is permissible under the NWA.

Section 21 of the NWA provides a list of water uses which require a WULA prior to commencement, unless listed in Schedule 1 (of the NWA) as an existing lawful use. Applying for a WULA triggers NEMA listed activities as contemplated in terms of GNR.544 and GNR.545 of 2010.

Water use includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. A water use must be licensed unless it is listed in Schedule 1 (of the NWA), is an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a license.

In terms of the NWA, a watercourse is defined as follows:

- *A river or spring;*
- *A natural channel in which water flows regularly or intermittently;*
- *A wetland, lake of dam into which the Minister may, by notice in the Gazette, declare to be a watercourse, and reference to a watercourse, which includes, where relevant, its beds and banks.*

Furthermore in terms of the NWA, a wetland is defined as follows:

- *Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.*

As required by Section 39 of the NWA, the following water uses will require a WULA in terms of Section 21 the NWA, of which the KZN DWA will be responsible for granting. It is understood that no aspects of the project may commence prior to receipt of the relevant WULAs: Section 21(a): Taking of water from a water resource; Section 21(b): Storing water; Section 21(c): Impeding or diverting the flow of water in a water course; Section 21(d): Engaging in a stream flow reduction activity contemplated in Section 36 of the NWA; Section 21(e): Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1); Section 21(f): Discharging waste or water containing waste into a water resource through pipe, canal, sewer, sea outfall or other conduit; Section 21(g): Disposing of water in a manner which may detrimentally impact on a water resource; Section 21(i): Altering the bed, bank, course or characteristics of a watercourse; 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. WSP is in the process of submitting a WULA to the Department.

3.1.9 Government Notice Regulation 704 of 1999

GNR.704 of 1999 under the NWA provides regulations on the use of water for mining and related activities aimed at the protection of water resources (requirements for clean and dirty water separation). GNR.704 requires *inter alia* the following:

- Separation of clean (unpolluted) water from dirty water;
- Collection and confinement of the water arising within any dirty area into a dirty water system;
- Design, construction, maintenance and operation of the clean water and dirty water management systems so that it is not likely for either system to spill into the other more than once in 50 years;
- Design, construction, maintenance and operation of any dam that forms part of a dirty water system to have a minimum freeboard of 0.8m above full supply level, unless otherwise specified in terms of Chapter 12 of the Act; and
- Design, construction, and maintenance of all water systems in such a manner as to guarantee the serviceability of such conveyances for flows up to and including those arising as a result of the maximum flood with an average period of recurrence of once in 50 years.

GNR.704 also stipulates that no person in control of a mine or activity may-

- Locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood line or within a horizontal distance of 100 m from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked;
- Place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation; or
- Use any area or locate any sanitary convenience, fuel depots, reservoir or depots for any substance which causes or is likely to cause pollution of a water resource within the 1:50 year flood line of any watercourse or estuary.

Cognisance has also been taken with regards to Regulation 4, Regulation 6 and Regulation 7 of GNR.704. A stormwater management plan has been developed by WSP and identifies 'dirty' and 'clean' areas within the site. All 'dirty' areas will be constructed within a cut-off trench and routed to a pollution control dam (PCD). The water within the PCD will be utilised for the wash plant, potable water and dust suppression.

3.1.10 National Water Services Act (No. 108 of 1997)

The Act provides for, among other things, the:

- Setting of national water standards, and norms and standards for water tariffs;
- Monitoring of water services and intervention by the Minister or by the relevant Province;
- Gathering of information in a national information system and the distribution of that information; and
- Promotion of effective water resource management and conservation.

Subject to subsection 3 of the Act, no person may dispose of industrial effluent in any manner other than that approved by the water services provider nominated by the water services authority having jurisdiction in the area in question. No approval given by a water services authority under this section relieves anyone from complying with any other law relating to the use and conservation of water and water resource, or the disposal of effluent.

3.1.11 National Heritage Resources Act (No. 25 of 1999)

The National Heritage Resources Act (No. 25 of 1999) (NHRA) established the South African Heritage Resources Agency (SAHRA) in 1999. SAHRA is tasked with protecting heritage resources of national significance. With regard to heritage sites, sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, dolomitic land and ridges, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure. A heritage site means a place declared to be a national heritage site by SAHRA or a place declared to be a provincial heritage site by a provincial heritage resources authority.

Section 34 and 38 of the NHRA details specific activities that require a heritage impact assessment that will need to be approved by SAHRA. The following activities require a heritage impact assessment to be undertaken for the proposed Yzermyn Underground Coal Mine. Please note that WSP has appointed Archeatnos CC (Archaetnos) to undertake a phase 1 heritage impact assessment of the target area.

Section 34(1): Structures older than 60 years may not be altered or demolished prior to permission from SAHRA;

Section 38(1a): The construction of a road, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;

Section 38(1c): Any development or other activity which will change the character of a site (i) exceeding 5,000 m^2 in extent, or (ii) involving three or more erven or subdivisions; and

Section 38(1d): The rezoning of a site exceeding 10,000 m^2 in extent.

Furthermore, section 48(2) requires a permit from a heritage resources authority to perform such actions at such time and subject to such terms, conditions and restrictions or directions as may be specified in the permit. This would include any development of the site where "development" means any physical intervention, excavation, or actions, other than those caused by natural forces, which results in a change to the nature, appearance or physical nature of a place, or influences its stability and future well-being, including:

- Construction, alteration, demolition, removal or change of use of a place or a structure at a place;
- Carrying out any works on or over or under a place;
- Any change to the natural or existing condition or topography of land; and
- Any removal or destruction of trees, or removal of vegetation or topsoil.

Archeatnos has assisted WSP in determining the requirements for a permit relating to the NHRA. Findings of the specialist's study is summarised in **Section 8** of this report. It should be noted that it is unlikely that any identified archaeological, cultural or heritage aspect will be destroyed as a result of this project. However, should any heritage resources be identified on the proposed site, a permit needs to be acquired from the SAHRA, before the resource can be removed, reallocated and/ or destroyed.

3.1.12 Conservation of Agricultural Resources Act (No. 43 of 1983)

The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) includes the use and protection of land, soil, wetlands and vegetation and the control of weeds and invader plants. This is the only legislation that is directly aimed at conservation of wetlands in agriculture. The Act aims to prevent agricultural practices that contribute to the degradation of the environment.

3.1.12.1 Applicability of the CARA

CARA aims to protect the prevailing natural agricultural resources of South Africa from change of land use away from agriculture. This is especially important where high potential soils are present. It is an unfortunate fact that the majority of the coal resources of South Africa occur beneath moderate to high potential arable soils, and every time some of these soils are removed from agricultural production, the local, regional and national food security situation may be affected.

With regards to soil erosion, the primary legislation applicable to erosion of soil is the CARA. The objectives of this Act are to provide for the conservation of the natural agricultural resources of South Africa through maintaining the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants.

In 1984, regulations were passed in terms of the CARA regulations declaring about 50 species “weeds” or “invader plants”. On 30 March 2001 the Minister of Agriculture promulgated an amendment to these regulations. This amendment now contains a comprehensive list of species that are declared weeds and invader plants dividing them into three categories. These categories are as follows:

- Category 1: Declared weeds that are prohibited on any land or water surface in South Africa. These species must be controlled, or eradicated where possible.
- Category 2: Declared invader species that are only allowed in demarcated areas under controlled conditions and prohibited within 30 m of the 1:50 year floodline of any watercourse or wetland.
- Category 3: Declared invader species that may remain, but must be prevented from spreading. No further planting of these species is allowed.

In terms of the amendments to the regulations under the CARA, landowners are legally responsible for the control of alien species on their properties. Various Acts administered by the DEA and DWA, as well as other laws (including local by-laws), spell out the fines, terms of imprisonment and other penalties for contravening the law. Although no fines have yet been placed against landowners who do not remove invasive species, the authorities may clear their land of invasive alien plants and other alien species entirely at the landowners cost and risk.

During the biodiversity assessment undertaken by NSS, a number of alien and invasive plants were identified and recorded in the vicinity of the study area which will need to be removed in terms of the CARA regulations.

3.1.13 National Forest Act (No. 84 of 1998)

The purpose of the NFA is as follows:

- Promotion of the sustainable management and development of forests for the benefit of all;
- Creation of the conditions necessary to restructure forestry in the State’s forests;
- Provision of special measures for the protection of certain forests and trees;
- Promotion of the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes;

- Promotion of community forestry; and
- Promotion of greater participation in all aspects of forestry and the forest products industry by persons disadvantaged by unfair discrimination.

One of the objectives of this Act is to provide special measures for the protection of certain forests and tree species and to promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes. Section 15(1) – No protected tree may be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold; except under license granted by the DWA/ DEA (or a delegated authority). GNR.767 of 2005 and GNR. 716 of 2012 comprise lists of protected tree species under the National Forests Act (No. 84 Of 1998). The criteria used to select tree species for inclusion in the protected tree list are:

- Red List Status (rare or threatened species);
- Keystone Species Value (whether species play a dominant role in an ecosystem's functioning);
- Sustainability of Use (whether a species is threatened by heavy use of its products such as timber, bark etc.);
- Cultural or Spiritual Importance (outstanding landscape value or spiritual meaning attached to certain tree species); and
- Other legislation (whether a species is already adequately protected by other legislation).

One of the objectives of this Act is to provide special measures for the protection of certain forests and tree species and to promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes. In terms of Section 15(1) of the National Forests Act (no.84 of 1998), protected tree species may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold – except under license granted by the relevant authority.

A number of protected species (both fauna and flora) have been identified onsite by NSS.

3.1.14 Fencing Act (No. 31 of 1963)

The aim of the Fencing Act (No. 31 of 1963) is to consolidate the laws relating to fences and the fencing of farms and other holdings. When a landowner erects a fence in a designated area, he/ she may insist that the adjacent owner contribute towards the erection or maintenance costs. In areas where contributions are not mandatory / have not been published in the Government Gazette, a contribution can be claimed from the adjacent owner if the fence offers beneficial use for such a person. The Act also makes provision for a mechanism to deal with disputes between adjacent owners regarding a contribution towards erecting or repairing a fence.

Of specific importance, section 17 requires that any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 metres on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to the protection of flora.

3.1.15 Hazardous Substances Act (No. 15 of 1979)

The object of the Act is *inter alia* to 'provide for the control of substances which may cause injury or ill health to, or death of, human beings by reason of their toxic, corrosive, irritant, strongly sensitising or flammable nature or the generation of pressure thereby in certain circumstances; for the control of electronic products; for the division of such substances or products into groups in relation to the degree of danger; for the prohibition and control of such substances.'

In terms of the Act, substances are divided into schedules, based on their relative degree of toxicity, and the Act provides for the control of importation, manufacture, sale, use, operation, application, modification, disposal and dumping of substances in each schedule.

Dangerous substances contained on-site during the construction phase of the proposed Yzermyn Underground Coal Mine will need to be management in accordance with the Act and material safety data sheets (MSDS) will need to accompany all dangerous goods (hydrocarbons, cleaning chemicals, paints, etc.).

3.1.16 Mine Health and Safety Act (No. 29 of 1996)

The Mine Health and Safety Act (No. 29 of 1996) (MHSA) aims to protect and promote the health and safety of employees and persons that may be affected by the activities at a mine and outlines both the rights and responsibilities of an employer, as well as the obligations of employees working thereat.

The MHSA was developed “to provide for protection of the health and safety of employees and other persons at mines”. That said the Act also provides and/ or promotes the following:

- A culture of health and safety;
- The enforcement of health and safety measures;
- For appropriate systems of employee, employer and State participation in health and safety matters;
- The establishment of representative tripartite institutions to review legislation, promote health and enhance properly targeted research;
- For effective monitoring systems and inspections, investigations and inquiries to improve health and safety;
- Promotion of training and human resources development;
- Regulation of employers' and employees' duties to identify hazards and eliminate, control and minimise the risk to health and safety;
- Entrenchment of the right to refuse to work in dangerous conditions;
- To give effect to the public international law obligations of the Republic relating to mining health and safety; and
- To provide for matters connected therewith.

The following principles are considered applicable to the proposed Yzermyn Underground Coal Mine and are detailed below:

- The primary responsibility for ensuring a health and safe working environment in the mining site is placed on the mine owner. The Act sets out in detail the steps that employers must take to identify, assess records and control health and safety hazards in the mine;
- The right of workers to participate in health and safety decisions, the right to receive health and safety information, the right to training and the right to withdraw from the workplace in face of danger;
- The Act requires the establishment of institutions to promote a culture of health and safety and develop policy, legislation and regulations; and
- The responsibility for enforcing MHSA lies with the Mine Health and Safety Inspectorate. The Inspectorate's powers are recast and include the power to impose administrative fines upon employers who contravene the MHSA. The Act also contains innovative approaches to the investigation of accidents, diseases and other occurrences that threaten health and safety.

Atha will be required to comply with all obligations contained in the MSHA.

3.1.17 Occupational Health and Safety Act (No. 85 of 1993)

The Occupational Health and Safety Act (No. 85 of 1993) (OHSA) provides a legislative framework for the provision of reasonably healthy and safe conditions in the workplace. It also places extensive legal duties on employees and users of machinery and makes major inroads on employers' and employees' common law rights.

OHSA contains provisions that impose general obligations with regard to health and safety. More detailed and specific obligations can be found in the regulations published in terms of OHSA. These include environmental, general safety, electrical machinery, driven machinery, electrical installation, construction, asbestos, hazardous chemicals substances and noise.

The OHSA addresses, amongst others:

- Safety requirements for the operation of plant machinery;

- Protection of persons other than persons at work against hazards to health and safety, arising out of, or in connection with, the activities of persons at work;
- Establishment of an advisory council for occupational health and safety; and
- Provisions for matters connected herewith.

The OHSA is applicable and states that any person involved with construction, upgrades or developments for use at work or on any premises shall ensure as far as reasonably practicable that nothing about the manner in which it is installed, erected or constructed makes it unsafe or creates a risk to health when properly used.

3.1.18 Subdivision of Agricultural Land Act (No. 70 of 1970)

This Act regulates the subdivision of agricultural land and its use for purposes other than agriculture. The Directorate of Resource Conservation is responsible for the enforcement thereof. Investigations are done by the Provincial Department in support of the execution of the Act. The Act also deals with aspects associated with rezoning land.

If agricultural land, that is productive in terms of food and/ or fibre production, becomes subdivided in some way as to make the reduced land parcel(s) uneconomic or unsustainable, then agricultural production is diminished. Such actions should be resisted wherever possible, especially where the prevailing agricultural potential is high.

Agricultural land is defined in the Act as *"land situated in the area of jurisdiction of a municipal council, city council, town council, village council, village management board, village management council, local board, health board or health committee, and land forming part of … in the province of the Transvaal, an area in respect of which a local area committee has been established under section 21 (1) of the Transvaal Board for the Development of Peri-Urban Areas Ordinance (Ordinance No. 20 of 1943 of the Transvaal), but excluding any such land declared by the Minister after consultation with the executive committee concerned and by notice in the Gazette to be agricultural land for the purposes of this Act."*

It can be concluded that although the land has not be zoned as 'Agricultural Land', the inherent definition of the land on which the proposed Yzermyn Underground Coal Mine is located is considered agricultural land.

According to Section 21 of the Town Planning and Township Ordinance Act (No. 15 of 1986) and above mentioned legislation, rezoning of the land is not required.

3.1.19 Promotion of Access to Information Act (No. 2 of 2000)

The Promotion of Access to Information Act (No. 2 of 2000) (PAIA) recognises that everyone has a right of access to any information held by the state and by another person when that information is required to exercise or protect any right. The purpose of the Act is to promote transparency and accountability in public and private bodies and to promote a society in which people have access to information that enables them to exercise and protect their right.

3.1.20 Promotion of Administrative Justice Act (No. 3 of 2000)

The purpose of the Promotion of Administrative Justice Act (No. 3 of 2000) (PAJA) is to govern the actions of the administration and to ensure good administrative practice, by laying down the minimum procedural requirements related to decision-making. As such, PAJA applies to all actions of the administrators, in particular environmental administrators.

Section 1 of PAJA deals with procedures to be followed in the granting, suspending or revoking of permissions (licences, grants, permits). Sections 3 and 4 of PAJA deal with fair procedure, which requires the administrator to act in a fair manner when making a decision. Section 5 of PAJA governs the provision of reasons by the administrator and determines that an administrator provide reasons after a decision has been made (or whilst taking it), in order to justify the decision.

3.1.21 Provincial Ordinances and Municipal By-laws

In addition to national legislation, some of South Africa's nine provinces have their own provincial biodiversity legislation, as nature conservation is a concurrent function of national and provincial government in terms of the Constitution of South Africa.

3.1.21.1 Mpumalanga Parks Board Act (No. 6 of 1995)

The Mpumalanga Parks Board was established in terms of the Mpumalanga Parks Board Act (No.6 of 1995) as amended. The objectives of this Act include *inter alia:*

- To provide effective conservation management of natural resources of the Mpumalanga Province;
- To promote the creation of economic and employment opportunities in pursuit of nature conservation and biodiversity;
- To ensure that natural systems, biodiversity and ecological functions and processes in the Mpumalanga Province are maintained;
- To determine and enforce limits to sustainable utilization of natural resources;
- To contribute to the advancement of scientific knowledge, and facilitate technology transfer in respect of conservation; and
- Provide information and extension services to the public on conservation management, problem species, legal aspects of conservation and other conservation matters.

This Act makes provisions for the appointment of the Board of Directors to be responsible for the administration of the Mpumalanga nature conservation and biodiversity.

3.1.21.2 Mpumalanga Nature Conservation Act (No. 10 of 1998)

To consolidate and amend the laws relating to nature conservation within the Province and to provide for matters connected therewith. Aspects included in the Act include, but are not limited to, administration of wild animals, administration of fisheries, administration of indigenous plants, endangered and rare species of fauna and flora (including protected ecosystems, plants and unique communities).

3.1.21.3 Mpumalanga Tourism and Parks Agency Act (No. 5 of 2005)

This Act provides for the establishment of the Mpumalanga Tourism and Parks Agency and for the management thereof by a Board; to provide for the sustainable development and improvement of the tourism industry in Mpumalanga; to provide for conservation management of the natural resources of Mpumalanga; to confer powers and functions upon the Agency; to provide for the registration of certain persons and entities directly involved in tourism; to provide for transitional arrangements; and to provide for matters incidental thereto.

3.1.22 Applicable Guidelines and Forums

Relevant guidelines have been developed in order to assist in sustainable development within South Africa. The following guidelines are considered applicable to the Yzermyn Underground Coal Mine project.

3.1.22.1 Department of Water Affairs: Best Practise Guideline Series

DWA developed a number of best practice guidelines for water resource protection in the South African mining industry. The best practice guidelines include international principles and approaches towards sustainability. A number of best practice guidelines have been developed that include:

- A water management hierarchy;
- General water management strategies, techniques and tools; and
- Guidelines for mining related activities and aspects.

The guidelines therefore define and document best practices for water and waste management associated with underground mining.

3.1.22.2 Action Plan of the Environmental Initiative of the New Partnership of Africa's Development

This initiative encourages sustainable development and associated conservation and wise use of biodiversity in Africa and was established in 2003. It has been recognised that a healthy and productive environment is a prerequisite for the success of New Partnership of Africa's Development (NEPAD), together with the need to systematically address and sustain ecosystems, biodiversity and wildlife. Six areas have been identified:

- Combating land degradation, drought and desertification;
- Conserving Africa's wetlands;
- Preventing and controlling invasive alien species;
- Conservation and sustainable use of coastal and marine resources;
- Combating climate change in Africa; and
- Cross-border conservation and management of natural resources.

3.1.22.3 The Mining and Biodiversity Forum of South Africa

The South African Mining and Biodiversity Forum (SAMBF) was established in 2005 to provide a platform for cross-sectoral interaction and co-operation in order to improve biodiversity conservation and management in the mining sector. A review of the status of biodiversity management in the mining industry in South Africa was recently published (Kuntonen-van't Riet, 2007). A need for the establishment of biodiversity guidelines was identified.

The good practice guidance on mining and biodiversity, published by the International Council for Mining and Minerals (ICMM), in consultation with the International Union for the Conservation of Nature (IUCN), was prepared for an international audience, and was therefore generic in nature, whilst the need for a guideline document specific to South Africa was identified by the South African mines. This guideline document (currently a draft document) was therefore compiled to incorporate local biodiversity information and best practice guidelines, specific to South Africa.

3.1.22.4 Mining and Biodiversity Guideline

The mining industry plays a vital role in South Africa's growth and development. But if mining is not strategically planned and carefully implemented, it has significant negative impacts on biodiversity and ecosystems, in particular, catchments, rivers and wetlands that support water-related services. The Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector (DEA *et al*. 2013), interprets the best available biodiversity knowledge and science in terms of the implications and risks for mining in a practical and user-friendly guideline for integrating relevant biodiversity information into decision making. The development of this guideline was initiated by the Chamber of Mines and the South African Mining and Biodiversity Forum (SAMBF), in partnership with the DEA, the DMR, and with technical input and co-ordination by the SANBI Grasslands Programme.

3.1.22.5 National Spatial Biodiversity Assessment

The National Spatial Biodiversity Assessment (NSBA) was completed in 2004 and its main focus was to make links between biodiversity and socio – economic development. It is the first ever-comprehensive spatial assessment of biodiversity throughout the country and has four components, dealing with the terrestrial, freshwater, estuarine and marine environments.

There are several possible approaches to biodiversity planning. The approach used most often in South Africa, including in the NSBA, is systematic biodiversity planning. It is based on three key principles:

- The need to conserve a representative sample of biodiversity pattern, such as species and habitats (the principle of representation);
- The need to conserve the ecological and evolutionary processes that allow biodiversity to persist over time (the principle of persistence); and
- The need to set quantitative biodiversity targets that tell us how much of each biodiversity feature should be conserved in order to maintain functioning landscapes and seascapes.

3.1.22.6 South Africa's National Biodiversity Strategy and Action Plan

According to the Minister of DEA in 2005, the National Biodiversity Strategy and Action Plan (NBSAP) is based on the recognition that South Africa is extremely rich in terms of biodiversity, but is also a developing country where the majority of the population resides in poverty. The NBSAP recognises that biodiversity should be managed in the context of ensuring equitable benefits to people – both current and future generations. The NBSAP highlights five strategic objectives with a number of outcomes linked to five-year targets, indicators, and activities to achieve the outcomes.

Through the NSBA, it is recognized that biodiversity cannot be conserved through protected area networks only. All stakeholders, from private landowners and communities to business and industry must get involved in biodiversity management. NBSAP further identified mining as one of the activities that causes habitat transformation and degradation, and seriously threatens aquatic and terrestrial biodiversity. The strategy therefore promotes the inclusion of biodiversity considerations in mining regulations, guidelines and best practice codes to mitigate negative impacts and encourage sustainable mining practices through partnerships.

The NBSAP highlights, in particular, that South Africa's rivers are poorly protected and that the present status of many of these freshwater ecosystems is disturbing. To ensure further protection and sustainability of South Africa's wetlands, the DWA (formerly the Department of Water Affairs and Forestry) initiated the National Aquatic Ecosystem Health Monitoring Program (NAEHMP) and River Health Program (RHP).

3.1.22.7 Threatened, Protected, Alien and Invasive Species Regulations

Chapter 4, Part 2 of NEMBA provides for listing of species that are threatened or in need of protection to ensure their survival in the wild while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival. According to Section 56(1) of NEMBA, in February 2007 the Minister of Environmental Affairs and Tourism published a list of Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and Protected Species (PS).

The Draft Alien and Invasive Species Regulations (2007) under Section 70 of NEMBA list all declared weeds and invasive plant species in South Africa. These include 47 invasive plant species in addition to those listed in CARA. The Regulations have not yet been promulgated but are already widely used. Their purpose is to:

- Prevent the unauthorised introduction and spread of alien species to ecosystems and habitats where they do not naturally occur;
- Manage and control invasive species to prevent or minimise harm to the environment and to biological diversity in particular; and
- Where possible and appropriate, eradicate invasive species that may cause such harm.

3.1.22.8 National Aquatic Ecosystem Health Monitoring Programme and River Health Programme

The National Aquatic Ecosystem Health Monitoring Programme (NAEHMP) is a national programme managed by DWA's Resource Quality Services with support from the Water Research Commission (WRC), the Council for Scientific and Industrial Research (CSIR) and various regional and provincial authorities. The overall purpose of the NAEHMP is to provide ecological information for South African rivers and the broader aquatic ecosystems required to support the rational management of these systems. The best-known component of the NAEHMP is the River Health Programme (RHP).

The RHP was initiated in 1994 by the DWA. It provides information on the overall ecological status of river ecosystems in South Africa, and primarily makes use of in-stream and riparian biological communities (e.g. fish, invertebrates, vegetation) to characterize the response of the aquatic environment to multiple disturbances. The rationale is that the integrity or health of the biota inhabiting the river ecosystems provides a direct and integrated measure of the health of the river as a whole. To date, the implementation of the RHP has been largely voluntary and, therefore, the DWA initiated the "National Coverage Phase" to establish the RHP as a national programme that is aligned with the requirements of the NWA.

3.1.22.9 Mpumalanga Tourism and Parks Agency Guidelines for Biodiversity Management

To promote national uniform standards in EMPs the Mpumalanga Tourism and Parks Agency (MTPA) has set minimum standards that need to be conformed to in terms of biodiversity assessments for development applications. These guidelines cover flora, fauna, aquatic and wetland systems.

3.1.22.10 Mpumalanga Biodiversity Sector Plan

The biodiversity of Mpumalanga has been recorded and catalogued by the Province's conservation biologists for more than 21 years. This data were analysed to produce a spatial plan for biodiversity conservation called the Mpumalanga Biodiversity Conservation Plan (MBCP), which was jointly developed by the MTPA and the Department of Agriculture and Land Administration (DALA) to guide conservation and land-use decisions in support of sustainable development in the province (Ferrar & Lötter 2007). The MBCP has recently been updated and replaced with the Mpumalanga Biodiversity Sector Plan (MBSP; MTPA 2013), which recognises Ecological Support Areas (ESAs), and Critical Biodiversity Areas (CBAs) containing irreplaceable, optimal and protected areas for biodiversity.

3.1.22.11 Mpumalanga Conservation Plan

Mpumalanga's Conservation Plan Version 2 (C-Plan 2) database (MPB, 2006), is intended to guide conservation and land-use decisions in support of sustainable development at a strategic level, have been identified. The C-Plan 2 maps the distribution of the provinces known biodiversity into categories according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature.

3.1.22.12 Environmental Management Framework for Wakkerstroom

The purpose of the Environmental Management Framework (EMF) is to serve as a management and decision-making tool that provides authorities with information about the 'state of the environment' and the associated planning parameters. It identifies and spatially represents areas of potential conflict between sensitive environments and development proposals thus assisting in integrating social, economic and environmental factors into planning.

3.1.22.13 KwaMandlagampisi Protected Environment Declaration

The declaration of the KwaMandlagampisi Protected Environment (KPE) GNR.254 of 2010 details farms that have been proclaimed a protected environment in terms of the NEMPA. The KPE includes approximately 23,600 hectares of privately-owned farmland, extending from Wakkerstroom to Luneburg, and consists of high altitude grasslands, wetlands and indigenous mist-belt forests. The area is also home to a number of threatened and endemic plant species. The KPE forms part of a critical water catchment area which includes the headwaters of the Pongola and Assegai Rivers that feed the Heyshope Dam. The KPE is located adjacent to the south-eastern farm boundaries of the prospecting right, specifically Farm Paardekop 109 HT, Uitzicht 108 HT. Goedgevonden 95 HT and Yzermyn 96 HT. The target area is located approximately 800 m from the KPE and approximately 3.5 km from the proposed adit entrance.

3.1.23 Principles of Sustainability

According to the DMR (formerly known as the Department of Minerals and Energy) (Swart, 2007), the mining sector in South Africa aims to promote its vision of 'sustainable development' by enabling South Africans to make balanced and informed decisions regarding the extraction and utilisation of mineral resource, by measuring and assessing progress towards sustainable development objectives and by minimising negative impacts and optimising environmental management in the mining sector.

The most widely accepted definition of sustainable development is provided in the World Commission of Environment and Development in its landmark report Our Common Future (the Brundtland Report) *'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'* A core principle in sustainable development is the 'precautionary principle' which implies that where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

According to the Australian Centre for Sustainable Mining Practices (2011), sustainable development in the mining sector suggests that investments in mining projects should be financially profitable, technically appropriate, environmentally sound and socially responsible (i.e. balance economic, environmental and social aspects and guarantee the advantage for humanity at present and in the future).

Businesses involved in extracting non-renewable resources should embrace the concept of sustainability into strategic decision-making processes and operations. In addition, responsible corporations can theoretically move towards sustainability by developing a range of appropriate socio-economic initiatives. Economic development, environmental impact and social responsibilities should be well managed, and productive relationships should exist between governments, industry and stakeholders.

It is understood that the definition of sustainability may not necessarily encompass the underlying factor that a non-renewable resource will be extracted. However, principles of sustainability should be incorporated into Atha's corporate philosophy, including: aspects such as economy (e.g. coal export, energy production, etc.), social (e.g. long-term job employment, skills development, implementation of the Social and Labour Plan, etc.) and environmental programmes (e.g. adequate implementation of mitigation measures, environmental offsets, etc.) in order to benefit future generations whilst meeting the needs of present citizens.

3.2 International Principles and Standards

In order for the mine to obtain financial contribution from international banks, the reports that are compiled for the environmental authorisation process of the project will need to conform to the following principles and standards:

- Equator Principles
- International Finance Corporation Standards

3.2.1 Equator Principles

The Equator Principles are the financial industry benchmark for assessing and managing social and environmental risk in project financing. The principles establish a code of conduct for lenders with respect to environmental and social issues. For technical detail the relevant Principles, defer to the World Bank Group's guidelines and standards and, in particular, to the International Finance Corporation's environmental and social performance standards.

The Equator Principles apply to all new projects, across all industry sectors, with a total project capital cost of US$10 million or more. They also apply to project financings covering expansion or upgrade of an existing facility where changes in scale or scope may create significant environmental and/or social impacts, or significantly change the nature or degree of an existing impact. Loans are only provided to projects that conform to the Principles listed below; additional detail was included in the scoping report:

- Principle 1: Review and Categorisation;
- Principle 2: Social and Environmental Assessment;
- Principle 3: Applicable Social and Environmental Standards;
- Principle 4: Action Plan and Management System;
- Principle 5: Consultation and Disclosure;
- Principle 6: Grievance Mechanisms;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting; and
- Principle 10: Equator Principles Financial Institutions Reporting.

3.2.2 International Finance Corporation Standards

The aim of these international standards is to ensure the environmental and social risks associated with major infrastructure development projects are considered and managed by proponents, in line with international best practice. Although the proposed project is not currently seeking external debt financing, and is therefore not formally required to meet the standards, their application as far as is practicable can serve as a useful risk and performance management tool.

The IFC, a division of the World Bank Group that lends to private investors, has recently released a Sustainability Policy and set of Performance Standards on Social and Environmental Sustainability (January 2012). These Standards replace the prior IFC safeguard policies and are used to evaluate any project seeking funding through the IFC. The relevant Standards are summarised below:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Resources; and
- Performance Standard 8: Cultural Heritage.

The Performance Standards underscore the importance of managing environmental, social and health issues throughout the life of a project. They identify the need for an effective social and environmental management system that is dynamic and continuous '*involving communication between the client, its workers, and the local communities directly affected by the Project*'. They require '*a thorough assessment of potential social and environmental impacts and risks from the early stages of project development and provides order and consistency for mitigating and managing these on an on-going basis*' (IFC document, 2006).

4 Assessment of Project Alternatives

A key challenge of the environmental impact assessment process is the consideration of alternatives. Most guidelines use terms such as 'reasonable', 'practicable', 'feasible' or 'viable' to define the range of alternatives that should be considered. Essentially there are two types of alternatives:

- Incrementally different (modifications) alternatives to the project; and
- Fundamentally (totally) different alternatives to the project.

Fundamentally different alternatives are usually assessed at a strategic level, and EAPs recognise the limitations of project-specific EIAs to address fundamentally different alternatives.

An alternative assessment is required for all proposed projects according to the NEMA and the MPRDA. Location alternatives, as well as technological alternatives have been assessed and detailed below.

4.1 Target Area

4.1.1 Alternatives Considered

Three mining areas have been identified within the prospecting right area, with a high probability of coal (Anthracite, Lean and Bituminous) resources potentially available. The economically significant seams within these areas are the Alfred and Dundas seams. The three areas, or blocks, are detailed in **Table 4-1** below and illustrated in the **Figure 4-1**.

Table 4-1: Mining Area Alternatives

Block	Name	Coal Type
1	YNBLK001	Lean, bituminous coal
2	YCBLK001	Anthracite coal with <8 volatiles
3	YSBLK001	Lean, bituminous coal

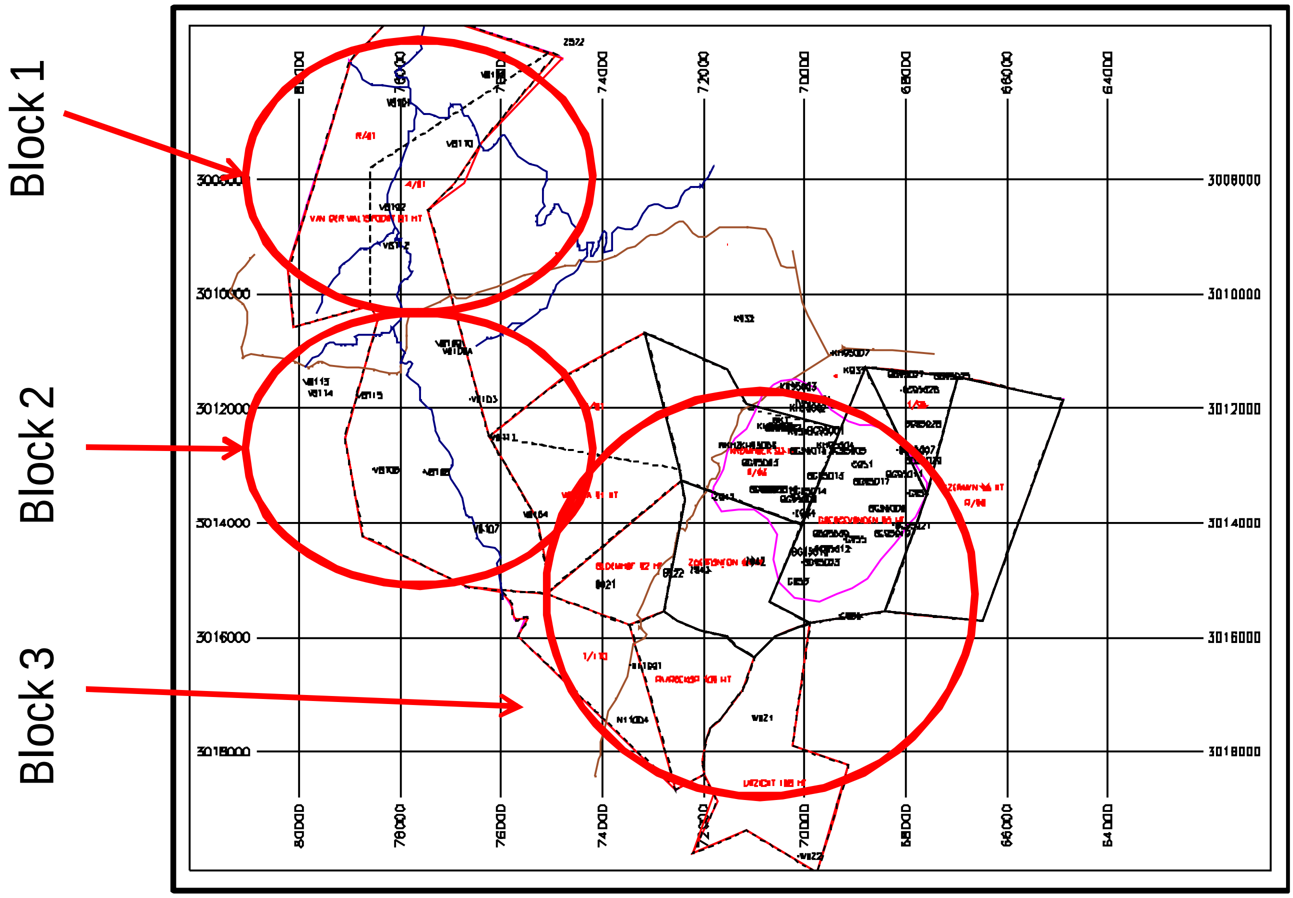


Figure 4-1: Image Indicating Mining Blocks within Prospecting Right (Source: Mindset, 2012)

Based on the historical exploration data, Atha identified the potential coal area in consultation with Mindset where a detailed exploration programme has been carried out and this area is thus designated as the target area. Due to erosion, thinning of the coal seams, depth issues and proximity to the ecological corridor, Block 1 was not considered viable and is therefore not included within the mining right application.

4.1.2 Preferred Alternative

After completing the detailed exploration and extrapolation, a 'feasible' coal resource was identified in Block 3 and as such the target area was redefined.

4.2 Adit Location

4.2.1 Alternatives Considered

Initially, two adit entrance locations were identified and assessed. As indicated previously, a number of dolerite intrusions (dykes and sills) intersect the target area at several stratigraphic levels, which has influenced the location of the adit entrance. Furthermore, due to the environmental sensitivities, a third adit location was identified and considered which is located in the eastern section of the target area (preferred alternative). This was considered as part of this ESIA process. **Figure 4.2** below illustrates three adit locations considered as part of this project which are justified in **Table 4.1**

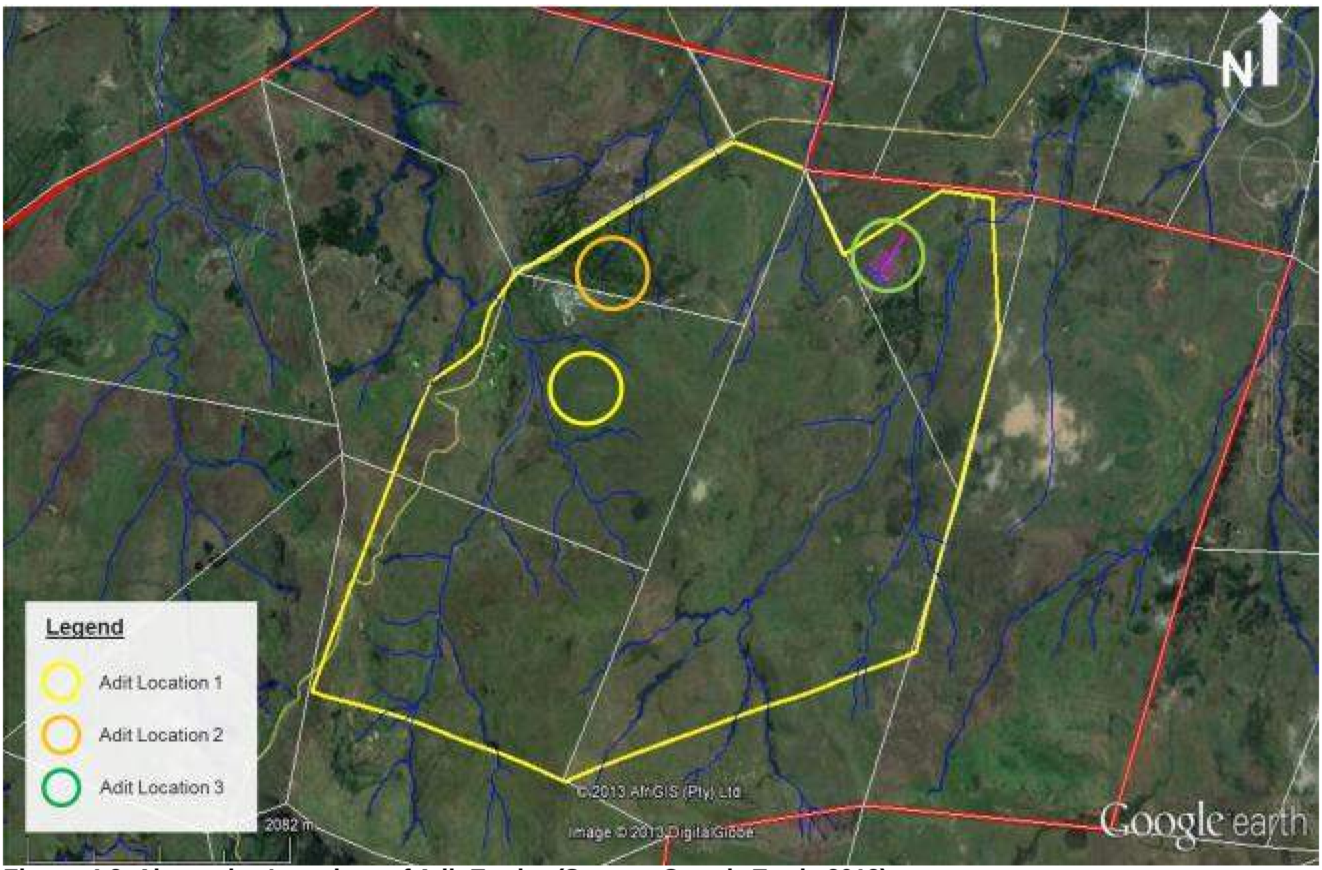


Figure 4-2: Alternative Locations of Adit Entries (Source: Google Earth, 2013)

Table 4-2: Assessment of Adit Locations

Adit	Positives	Negatives
Adit Location 1	■ Minor visual impact	■ Located in close proximity to water courses and potential wetlands ■ Numerous dolerite intrusions yielded mining unfeasible ■ Located in the 'grassland threatened ecosystem'
Adit Location 2	■ Close proximity to historical coal mining ■ Located in valley, minor visual impact ■ Minimal box-cut operations required to access coal seams	■ Located in close proximity to sites of archaeological, cultural or historic significance ■ Located in a thicket biome ■ May impact on wetlands and water courses above the adit entrance ■ Numerous dolerite intrusions yielded mining unfeasible
Adit Location 3	■ Located more than 400 m of a surface watercourse ■ Limited dolerite intrusions in area ■ No sites of archaeological, cultural or historic significance within 100 m of site ■ Limited groundwater near adit location (more than 60 m)	■ Greater visual impact ■ Inclines will be mined through rock before reaching coal face

4.2.2 Preferred Alternative

The preferred adit location (Adit Location 3) was identified due to the complex geology underlying the area. The numerous faults present in the target area have an impact on mining as no coal will be mined when faults are encountered. This is due to the fact that the mine will need to 'mine' through the fault, which comprises durable dolerite. The resultant waste rock that will be generated will need to be transported to the surface and disposed of on the discard dump or crushed and used as aggregate within the mining area. This results in a decrease in coal that can be mined within a month, resulting in a decline in the volume of saleable coal produced.

Although the preferred adit location is located more than 400 m from a watercourse, and no sites of archaeological, cultural and historic significance are present, the location will have an impact on wetlands in the immediate area, which is considered unfavourable. This is considered a risk to the proposed project and, should the project go ahead, various licences, permits and agreements between government authorities, and landowners will need to be obtained.

4.3 Surface Layout

4.3.1 Alternatives Considered

The surface layout of the associated infrastructure required for the proposed Yzermyn Underground Coal Mine was limited to an area that is in close proximity to the preferred adit location in order to minimise expenses related to logistics and transporting the ROM coal via conveyors. Additional technical criteria considered with regards to the placement of the surface infrastructure included the following:

- The length of conveyors and distance from the adit entrance in order to reduce the potential of soil and water contamination associated with potential spillages; and
- Onsite mine vehicle transportation.

Furthermore, the location of the surface infrastructure was limited to uniform areas within the mountainous landscape. The location alternatives considered also took cognisance of environmental sensitive areas such as on top of ridges (to avoid visual and aesthetic risks), water courses and sites identified during the heritage impact assessment. **Figure 4.3** represents the alternative surface layout location that was considered not-preferred.

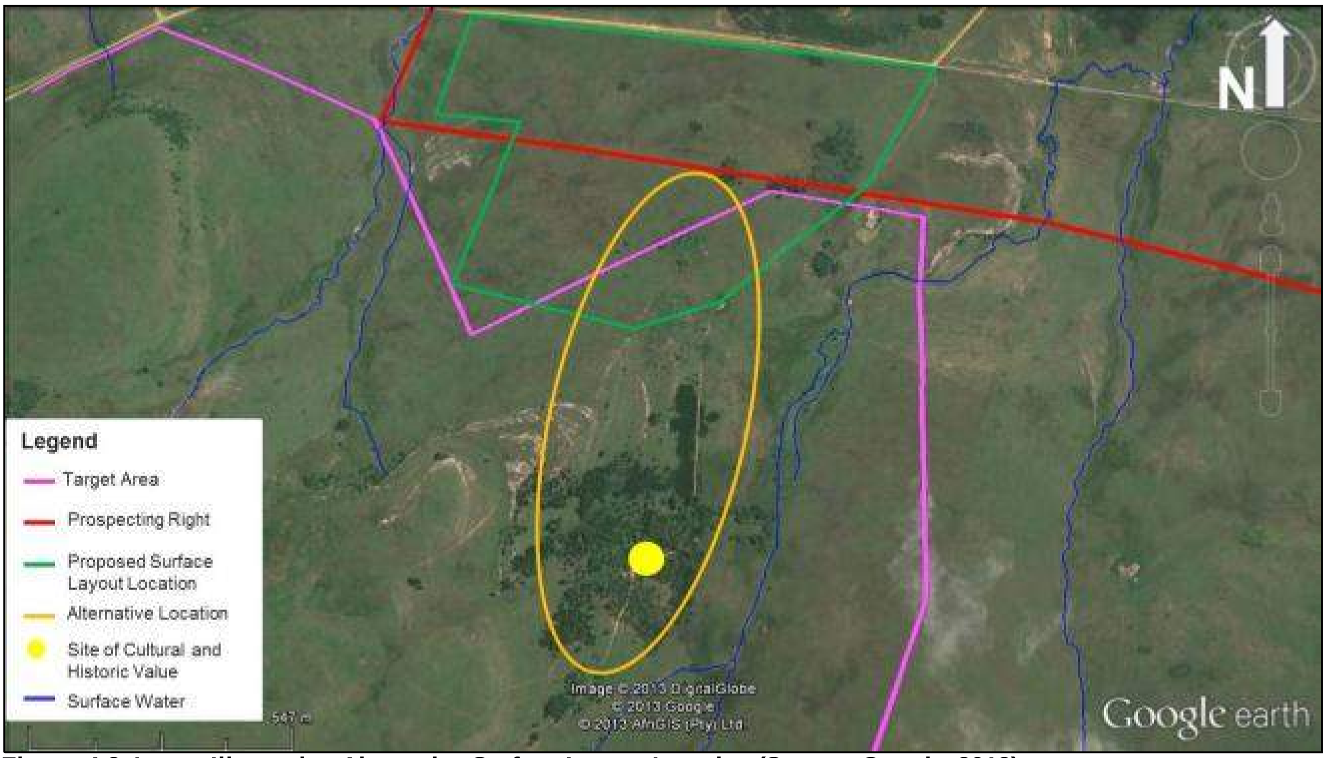


Figure 4-3: Image Illustrating Alternative Surface Layout Location (Source: Google, 2013)

This alternative was not considered feasible due to the following:

- Steep contours to the west, requiring a large volume of subsoil to be removed to create a uniform foundation;
- Close proximity to the tributary of the Mawandlane River;
- Occurrence of an old structure which may have cultural and historic significance, of which a permit from SAHRA may be required;
- Distance from the adit entrance to the area that may be earmarked for the wash plant and potential issues associated with contamination from the length in transportation route; and
- Presents of 'channelled valley bottom wetlands associated with rivers'.

Due to this rational, the surface layout was confined to a 'preferred' area covering an estimated 30 ha.

4.3.2 Preferred Alternative

The preferred alternative is proposed to a uniform area adjacent (west) of the adit location. The preferred area covers an area that was previously utilised for agricultural cultivation of (presumably) maize as is illustrated in **Figure 4.4**. It is anticipated that this area was previously disturbed as a result of agricultural activities, however, has reverted to a natural state.

Figure 4-4: Image Illustrating Evidence of Previous Cultivation Activities (Source: Google, 2013)

It is further noted that the area on which the preferred surface layout is proposed is dominated by wetlands, which have been delineated by NSS and detailed in **Section 8**. Two types of wetlands were defined within the study area, namely:

- 'Seep wetlands' which are understood to be fed predominantly by surface water seepages and, to a lesser degree, by the shallow aquifer underlying the region; and
- 'Channelled valley bottom systems associated with rivers' - it is understood that these wetlands are fed from surface water seeps, the shallow weathered aquifer as well as the deeper fractured aquifer which daylights at locations due to the geology of the area.

It is understood that the 'seep' wetlands will be impacted on by the surface layout which may result in the preferred location being rejected due to the sensitivities of the wetlands and impact on the Assagaai River located downstream. This is considered a risk to the proposed project and, should the project go ahead, various licences, permits and agreements between government authorities and landowners will need to be obtained. WSP recommends that an additional location be assessed. This recommendation is discussed in detail in **Section 18**.

Figure 4.3 illustrates the preferred site layout in relation to the wetlands delineated by NSS.

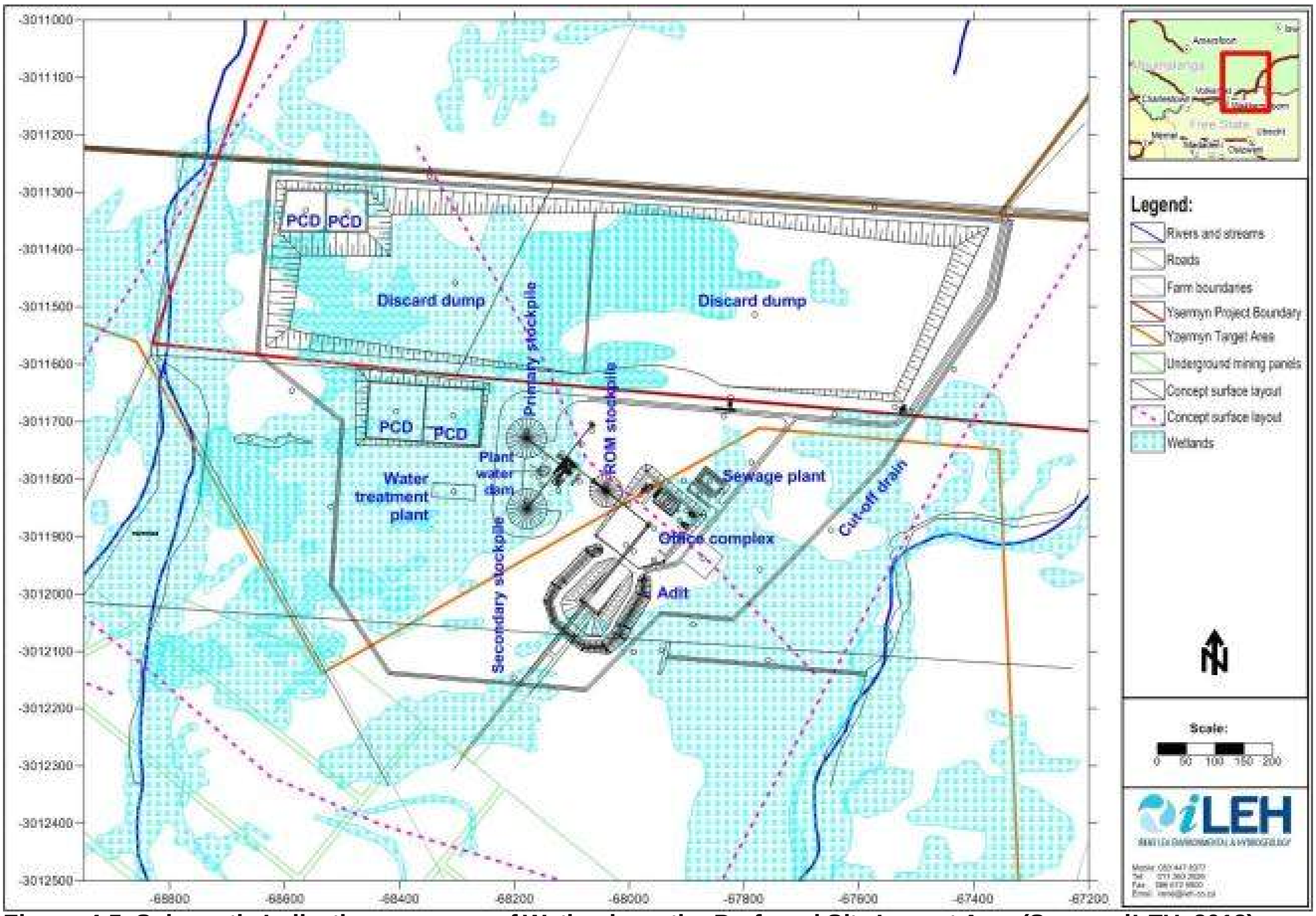


Figure 4-5: Schematic Indicating presence of Wetlands on the Preferred Site Layout Area (Source: iLEH, 2013)

4.4 Mining Method

4.4.1 Alternatives Considered

It is understood that no opencast mining will be undertaken for the proposed Yzermyn Underground Coal Mine, and as a result, this method was not assessed. The underground mining methods to be assessed and decided include:

- Drill and blasting, bord and pillar;
- Low seam continuous mining (CM); and
- Longwall mining or shortwall mining.

Additional characteristics that may affect the mining methods include:

- Ventilation requirements;
- Structural composition of the underlying geology;
- Hardness and cut-ability of the coal seams;
- Flexibility of mining method and equipment;
- Standardisation of mining equipment;
- Expected roof and floor conditions;
- Water ingress and water table;

- Presence of methane gas;
- Potential for acid-mine drainage; and
- Requirement for stone development, air crossings, belt chambers, and traveling and belt road height.

4.4.1.1 Low Seam Continuous Miner

Continuous mining method utilise CM machine which is a large machine with a rotating steel drum equipped with tungsten carbide teeth that scrape ore from the coal seam. The CM are utilised for bord and pillar type mining and produces a constant flow of ore from the working facing of the mine. The CM rotates the oscillating steel drum to cut away designated sections of the coal bed. When the coal is extracted, a conveyor system is utilised to transport and load the coal from the seam.

4.4.1.2 Longwall and Shortwall Mining

Longwall mining is used most efficiently in uniform coal seams of medium height (1.0 – 1.6 m). As in the bord and pillar method, longwall mining starts with sets of entries cut into the ore face. The longwall *panel* (the block of coal that is being mined) is typically 3 – 4 km long and 250 – 400 m wide. The longwall machine shears or coal from the ore face, transports the fallen coal by an advancing conveyor to a secondary haulage conveyor, reverses direction at the end of a cut, and supports the roof in the area of the face by a self-advancing system of hydraulic jacks. Over 80% of the entire coal face can be removed with this method. The roof is allowed to cave behind the advancing work areas; the roof is occasionally blasted to ensure a controlled cave-in rate and to reduce overburden pressure on the coal bed being mined. Longwall mining can produce approximately between 200 000 – 250 000 tons per section per month.

The shortwall method of mining coal is similar to longwall mining with two exceptions. The blocks of panels are smaller, usually ranging from 30 – 45 m wide and 100 m long and the coal is cut with a CM and is loaded into shuttle cars. Shortwall mining can produce approximately between 100 000 – 150 000 tons per section per month.

It has been noted that this type of mining is not advised, due to the complex geology of the Utrecht Coalfield associated with the proposed Yzermyn Underground Coal Mine (Mindset Scoping Report, 2011).

4.4.2 Preferred Alternatives

The proposed Yzermyn Underground Coal Mine will utilise bord and pillar mining to extract the coal reserve. Bord and pillar mining is commonly used for flat or gently dipping bedded ores or coal seams.

Once the coal seam has been accessed, the ore is mined utilising a regular grid of mining tunnels and involves progressively excavating panels into the coal seam whilst leaving behind pillars of coal to support the mine. The coal is then removed in a regular pattern while the rooms are mined out through the tunnels by drill and blast methods or a CM and deposited onto a conveyor. According to Mindset (2011), approximately 40% of the coal reserve may not be mined as this coal will remain as pillars. **Figure 4-6** illustrates a typical bord and pillar method.

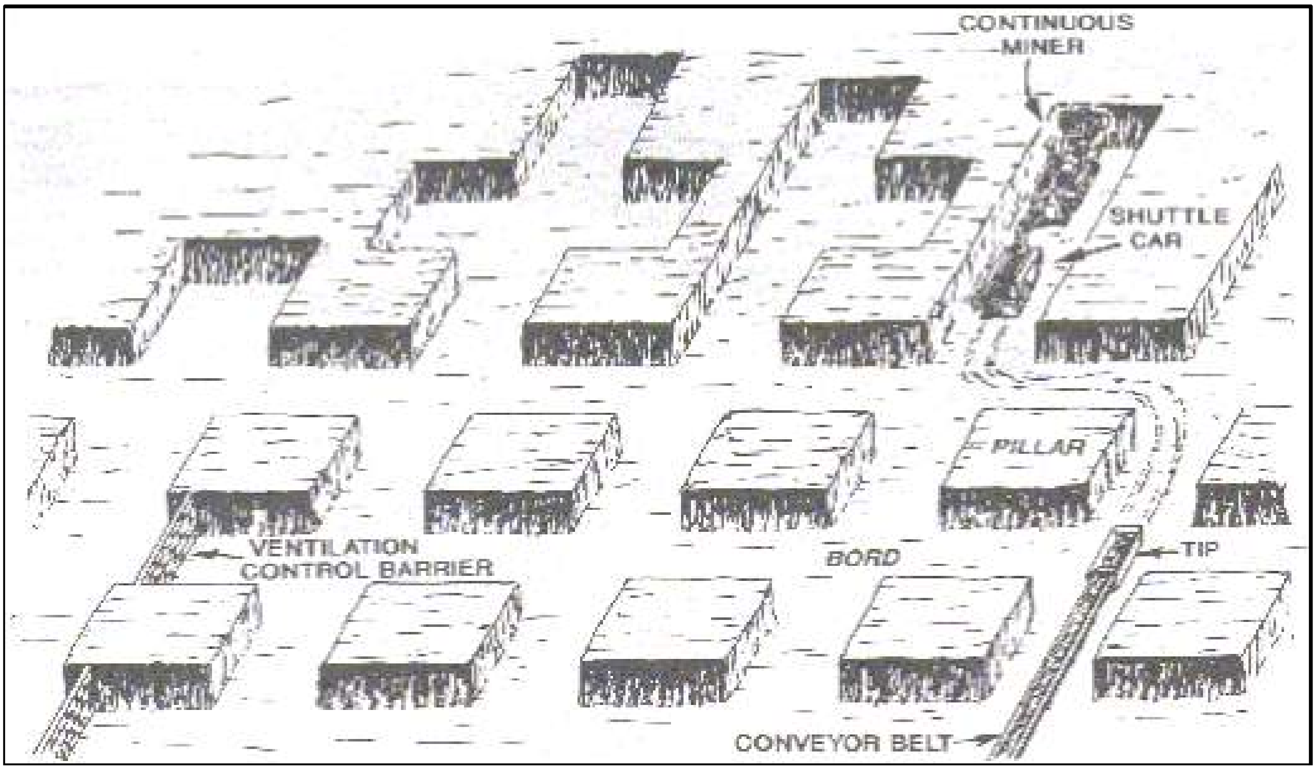


Figure 4-6: Typical Bord and pillar Layout (Source: Wells *et al,* 1992)

Two possible mining methods are considered as part of this project for the bord and pillar technique, which is discussed below. It must be noted that both of these mining methods will be employed for the proposed Yzermyn Underground Coal Mine.

- Drill and Blasting

  Drilling and blasting is required in order to excavate the opening of the adit and access way to the proposed underground mining area. The conventional drill and blast excavation method is the most widely used technique in mining hard rock. During excavation by conventional drill and blast method, the work face of the rock is perforated to 380 mm Augur drill holes. Standard shot-holes will then be drilled around the auger holes. These holes are then filled with explosive and detonated, causing the rock face to collapse, and the new tunnel surface is reinforced (using shotcrete, rock bolts, spilling and lattice girders). The blasted rock is collected by battery driven scoops and transported to the feeder breaker for discharge onto a conveyor system to the wash plant for beneficiation. This method provides better flexibility when handling potential weakness zones, although is more labour intensive and has a higher operating cost than CM operations. **Figure 4.7** illustrates a schematic illustration of a drill and blast operation.

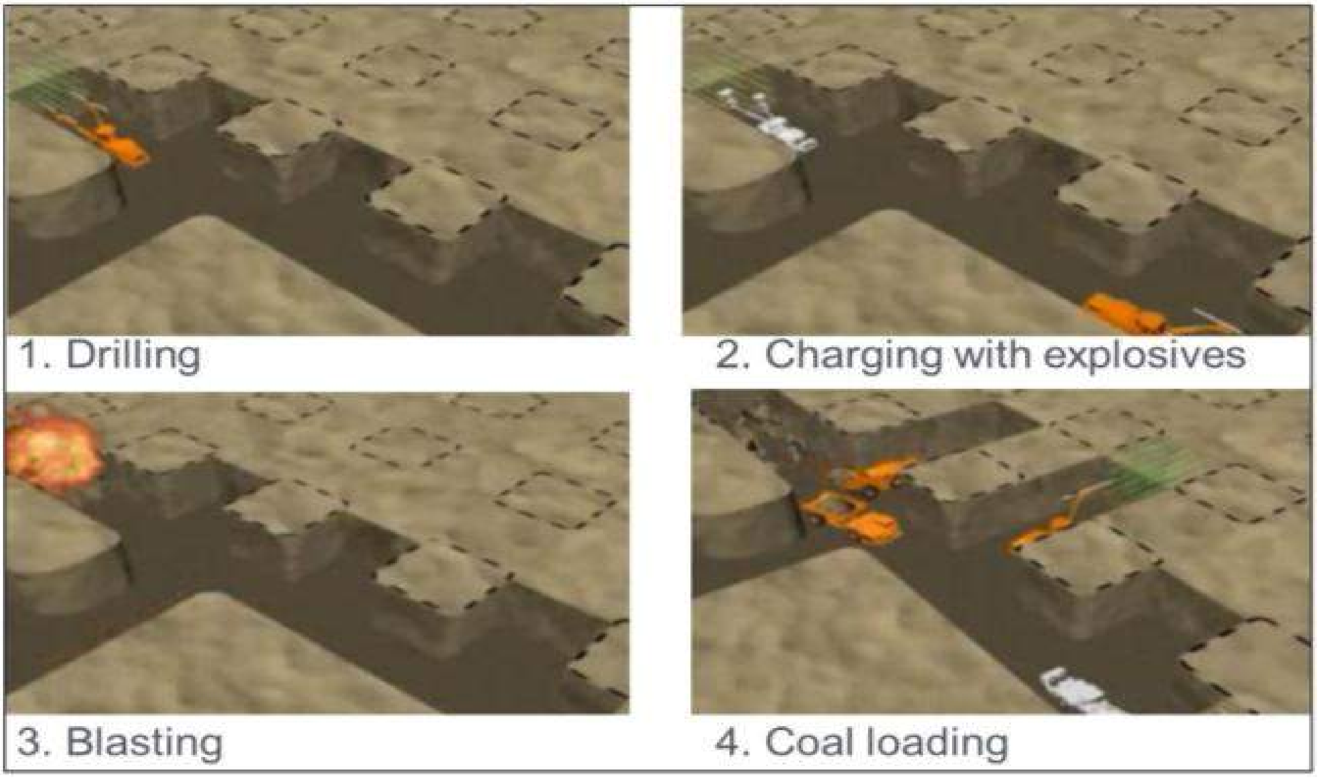


Figure 4-7: Schematic Illustration of Drill and Blast Mining

It has been conveyed by Mindset that due to the structural stability of the underground workings and distance from large buildings, no blast and vibration assessment is required. Refer to **Appendix E** for a copy of this opinion from Mindset.

- Continuous Miner

Continuous mining method utilise a CM machine which is a large machine with a rotating steel drum equipped with tungsten carbide teeth that scrape ore from the coal seam. The CM are utilised for bord and pillar type mining and produces a constant flow of ore from the working face of the mine. The CM rotates the oscillating steel drum to cut away designated sections of the coal bed. When the coal is extracted, a conveyor system is utilised to transport and load the coal from the seam.

CM mining methods offer larger productivity levels than drill and blast methods, however the capital costs associated with CMs are more expensive. This method lends itself to a range of mining heights and is very useful in flat seams with good floor conditions. Due to the weight of the machinery and its required passage over the floor whilst cutting, it requires a stable floor in order to ensure that the floor is not cut with the coal increasing the contamination of the ore. In areas where shale is present in the floor, its interaction with water may lead to the decomposition of the floor posing stability issues for the CM operation. **Figure 4-8** illustrates an example of a CM.

Figure 4-8: Typical Example of a Continuous Miner

4.5 Discard Dump

A co-disposal discard dump is required to be engineered and constructed within the preferred surface infrastructure layout area. Co-disposal refers to the type of disposal that will be undertaken of the discard generated as a result of the wash plant activities. Two types of discard will be generated:

- Coarse discard, fragments of crushed and roughly sized material; and
- Fine discard in the form of a slurry.

Course discard is transported to the discard dump via trucks of conveyor and deposited on a clay lined area which is then graded to the required compaction ration and design. Fine discard slurry is transported via pipes to the centre of the discard dump and deposited into slurry pools. The discard dump will be constructed with earth walls during the initial phases of construction/ operation following which the coarse discard will be deposited in layers, thereby creating additional walls. A typical conceptional cross-section of a co-disposal discard dump is illustrated in **Figure 4.9.** The benefits of containing the fine discards within the walls of the coarse discards include:

- Economy of combining mineral residue waste streams;
- Minimise the area required for coarse and fine discards;
- Permits future recovery of the coal fines and retreatment of discard (usually as technology becomes more advanced); and
- Supernatant water is maintained over the low permeability of fines in order to minimise seepage potential.

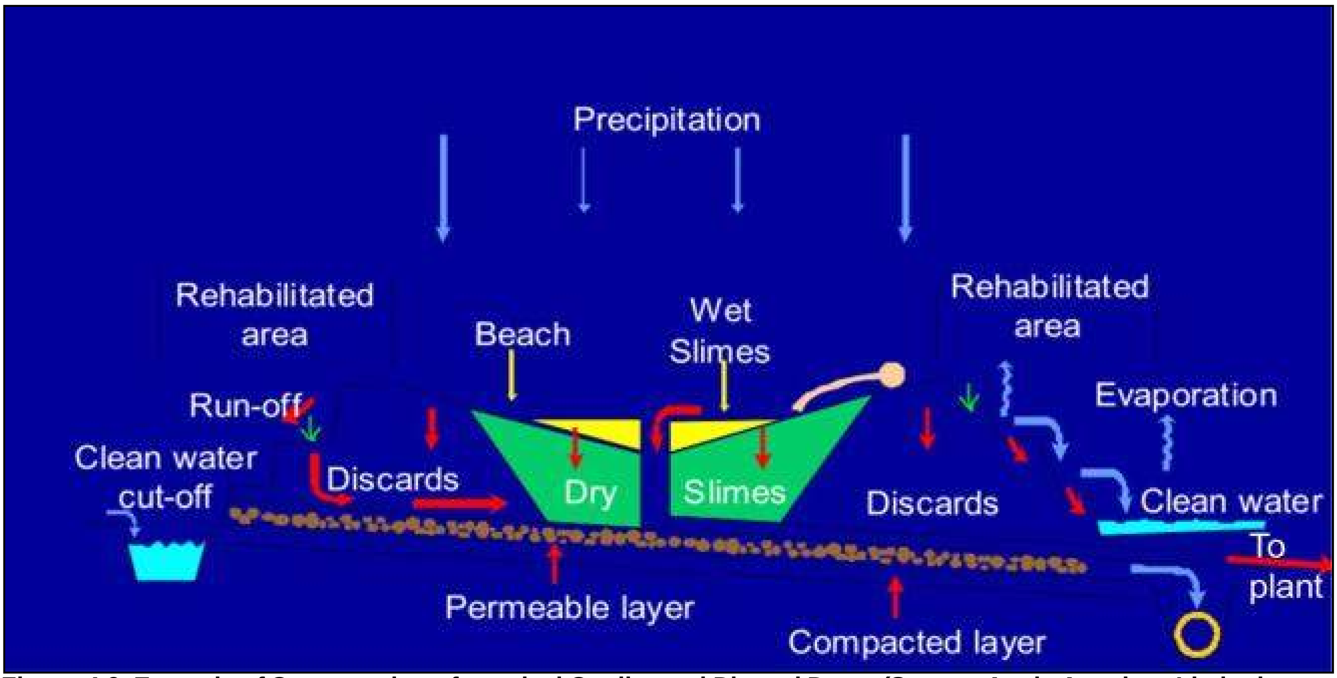


Figure 4-9: Example of Cross-section of a typical Co-disposal Discard Dump (Source: Anglo American Limited, 2013)

There is no provision for a slurry pool or tailings dam as per the flow sheet of Mindset (**Figure 5-6).** The water from the co-disposal discard dump is recovered in stages by using thickener and frameplate filter. The discard after the filter press will be directed to the discard bin for onward transfer to the discard dump.

Although the final engineering plans for the co-disposal discard dump have yet to be designed, the technology that is utilised during the construction of the discard dump decreases the likelihood of spontaneous combustion, and can be engineered from the onset of the project with rehabilitation in mind. WSP has developed a conceptual stormwater management plan which includes runoff from the discard dump. This will ensure that contaminated seepage/ leachate or runoff from the dump is collected in lined toe-dams and piped either back to the wash plant or PCD as process water.

4.5.1 Alternatives Considered

Two locations for the proposed discard dump were identified, both located outside of the prospecting right boundary, on Farm Vaalbank 74 HT. The alternative discard dump location was deemed unfeasible due to its distance from the wash plant and adit location. Furthermore, this location would require vehicles and/ or conveyor systems to traverse the road located to the north of the proposed surface infrastructure location. This had the potential to cause contamination on the surrounding land from spillages of discard and would require a greater distance in the transportation of the discard from the wash plant. Furthermore, a bridge or culvert would have had to be constructed, which would have increased the disturbance footprint of the proposed project.

NSS undertook a wetland delineation assessment of the two alternative discard dump locations which is detailed in **Section 8**. Although wetlands are located on the alternative location, the wetland area that will be impacted is considered to be less than the preferred location.

It has been noted that the discard generated (discard with CV less than 12 – 14) from the wash plant can be reprocessed through a beneficiation plant thereby producing a product with adequate CV content to be received by Eskom power stations (Majuba Power Station). Atha will be considering the possibility of briquetting for the reuse of discard residue. According to Mindset (2013), should this be decided, it is estimated that the plant will have the capacity to reprocess approximately 130 tons of discard per hour. This will minimise the extent of the proposed co-disposal discard dump facility as well as generating additional income as a result of selling the beneficiated discard. This will also eradicate the impacts of the co-disposal discard dump following closure.

4.5.2 Preferred Alternative

The preferred alternative was deemed feasible due to the fact that:

- It is located closer to the proposed wash plant,
- The unpaved road to the north of the site does not need to be affected, and
- The footprint of disturbance will be localised to a specific area.

It is recommended that the co-disposal discard dump be constructed in 'terrace' approach that promotes ongoing rehabilitation thereby reducing the visual impact of the discard dump.

Figure 4.10 indicates the alternative discard dump locations and associated wetlands delineated by NSS. It is understood that wetlands will be impacted on by the co-disposal discard dump which may result in the preferred location being rejected due to the sensitivities of the wetlands and impact on the Assagaai River located downstream (associated with sulphate or potential acid mine drainage contamination downstream of the discard dump). This is considered a risk to the proposed project and, should the project go ahead, various licenses, permits and agreements between government authorities, NGO's and landowners will need to be obtained.

It is recommended that a coal discard reprocessing/ beneficiation plant be constructed in order to reduce the footprint size of the co-disposal seaward dump facility and ensure that no visible sign of the discard facility remains following closure.

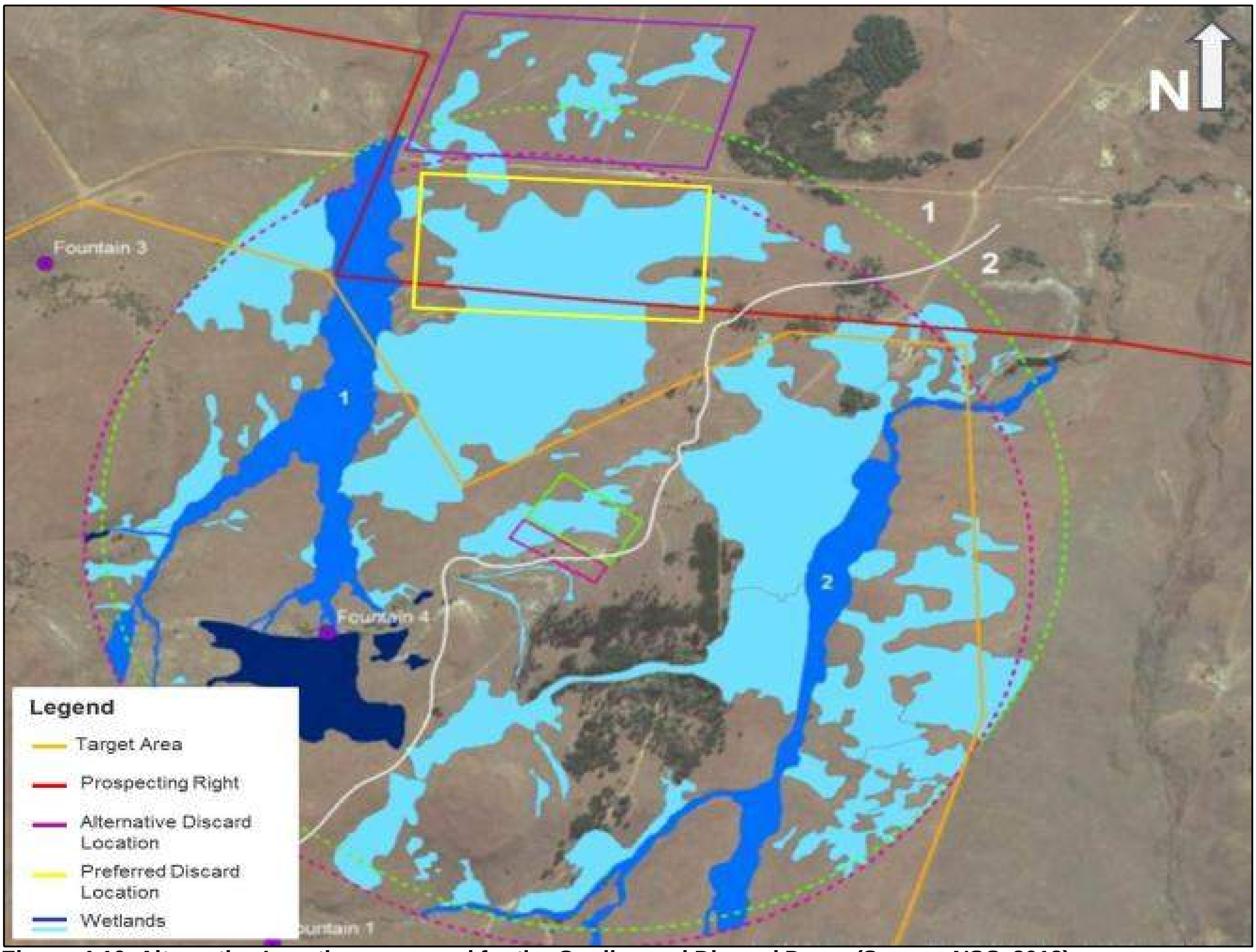


Figure 4-10: Alternative Locations assessed for the Co-disposal Discard Dump (Source: NSS, 2013)

4.6 Transport and Logistics

The coal will be transported via road to the Piet Retief Siding. It has been noted that the existing unpaved road that runs adjacent to the target area will be utilised to transport coal through Dirkiesdorp and onto Piet Retief. A number of alternatives were assessed with regards to the coal transport route.

4.6.1 Alternatives Considered

It was indicated that a previously existing route located east of the prospecting right boundary traverses a number of farms to the R543 (refer to **Figure 4.10** below). WSP Civil and Structural Engineers assessed this route as an alternative although indicated that the route is badly deteriorated from infrequent utilisation, and the capital required to upgrade the road is unfeasible. Furthermore, as this route is disused and that the road may need to be widened in order to accommodate an additional lane a full biodiversity assessment would be required as the route crosses wetlands and rivers.

Additional route alternatives assessed included the route of the unpaved road from the site to Wakkerstroom and onto the R543. This route is considered to be a longer distance than the preferred route and requires mining vehicles to travel on the R543 for an additional 30 km. Furthermore, the potential impact of mine vehicles on the town of Wakkerstroom may be considered more significant than the preferred route.

4.6.2 Preferred Alternative

The preferred route comprises the existing unpaved road adjacent to the target area that continues through the town of Dirkiesdorp, linking with the R543 approximately 13 km from the proposed mine. According to the air quality impact assessment (summarised in **Section 8**), the impact of dust resulting from construction and mining vehicles utilising the road is considered significant, and as a result, it is recommended that this route be surfaced with dust-aside prior to construction activities and watered regularly to reduce dust entailment. Following three years of operation, the road will be tarred. The road will need to be upgraded to the satisfaction of a registered civil engineer and safety concerns of the public will need to be taken into consideration.

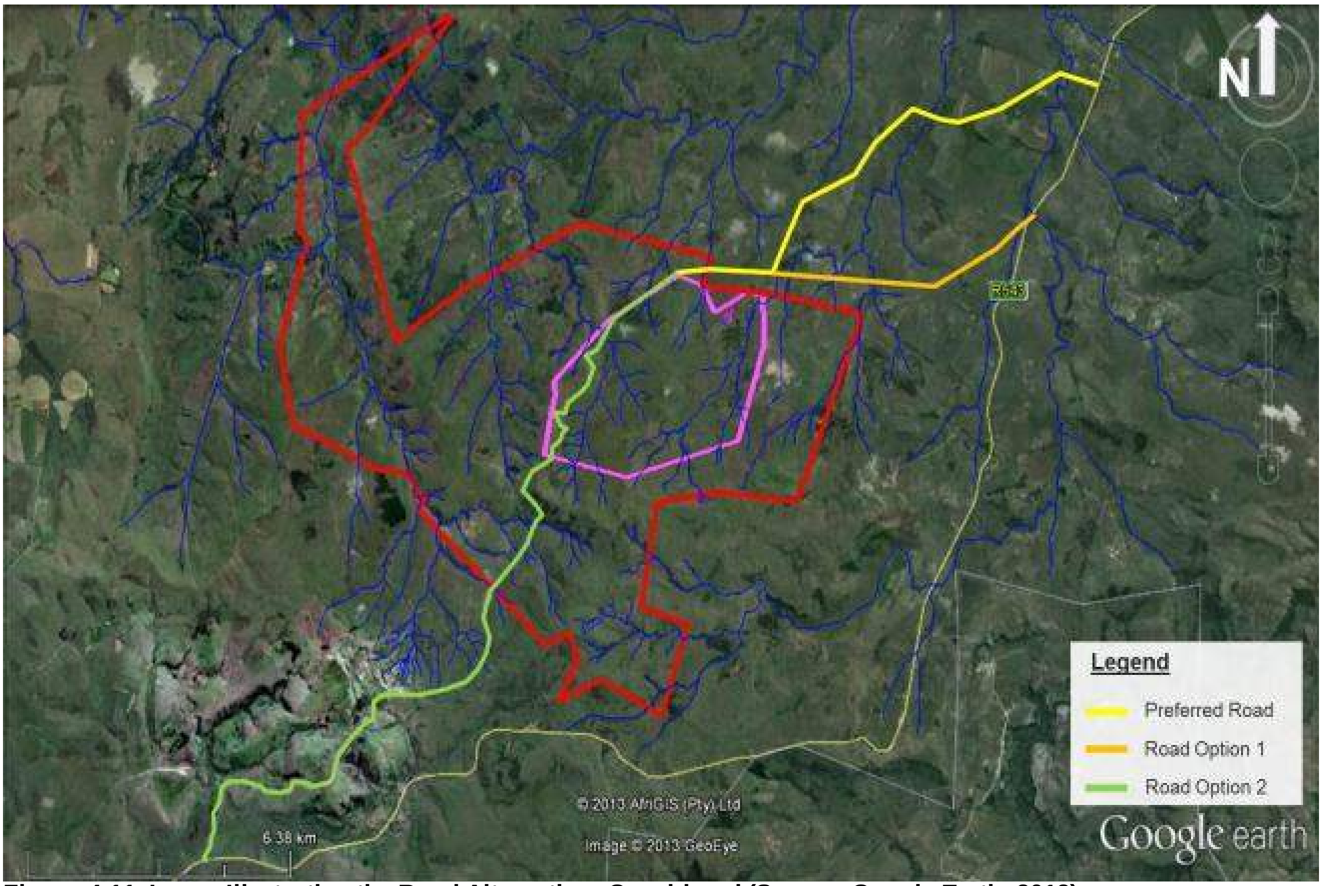


Figure 4-11: Image Illustrating the Road Alternatives Considered (Source: Google Earth, 2013)

4.7 Siding Location

4.7.1 Alternatives Considered

A railway siding will be required to stockpile coal prior to transport via train to Richards Bay Port Terminal on the East Coast. The most practicable options include the transport of coal via road to a nearby, existing siding. The options considered for the rail siding include the Panbult and Piet Retief Sidings. The Piet Retief Siding is situated, 60 km northeast of the proposed Yzermyn Underground Coal Mine. Coal would be transported on the existing road through the village of Dirkiesdorp, which is situated approximately 13 km from the proposed mine site, and onto the R543 to the Siding. The Panbult Siding is also situated near Piet Retief, but it has been conveyed that the siding does not have adequate loading space and storage volume and therefore was not considered further.

4.7.2 Preferred Alternatives

The Piet Retief Siding was also considered for the transport of export quality coal to Richards Bay. The siding is operated and managed by JINDAL, who has indicated that sufficient space is available and that an upgrade to the siding is not required. The Piet Retief Siding is located on the periphery of the town of Piet Retief. Mining vehicles transporting coal will not be required to travel through Piet Retief. The Piet Retief Siding is therefore the preferred alternative.

4.8 Land Use

To ensure compliance with the requirements of the MPRDA, an assessment of potential land use alternatives is to be considered. This will determine what land use is most optimal and has the least impacts.

4.8.1 Alternatives Considered

The evaluation of alternative land uses and development assesses the potential activities that can be undertaken on the project site in the event that the proposed Yzermyn Underground Coal Mine does not go ahead. When identifying and evaluating alternative land uses, consideration needs to be taken on current land use in the surrounding area as well as the proposed development plans for the regional area. The following alternatives have been assessed:

- Commercial agriculture;
- Community focussed agricultural practices;
- Tourism; and
- Mining.

Potential direct impacts as well as cumulative impacts will be assessed with regards to commercial agriculture, subsistent agriculture and tourism. These alternative land uses are influenced by the underlying soils and land capability, which is discussed in detail in **Section 8**. The farms comprising the target area, as well as the surrounding farms, are utilised for agriculture (grazing), conservation, grassland area, cultivated land (subsistent farming), vacant areas, rivers and other wetlands.

4.8.1.1 Commercial Agriculture

The Farms Yzermyn 96 HT Portion 1, Goedgevonden 95 HT and Kromhoek 93 HT are currently used for commercial grazing of livestock (sheep and cattle). No commercial cultivated farming practices are undertaken within the target area. According to Johan Uys (personal communication, 2012), the farms are used during the winter periods due to the vegetation/ grasses in the area. The natural grassland environment is suitable for the stock grazing industry for commercial and subsistence farmers. A scattering of subsistence farmers have made their home within the target area.

According to WSP's soil, land use and land capability assessment, the majority of the study area has a grazing capacity ranging from less than 4 ha/ AU to 10 ha/ AU. Within the northern extremities, on the crest of hills and adjacent to the watercourse on steep topography, the grazing capacity is reduced to between 11 ha/ AU and 17 ha/ AU. This represents a good to excellent grazing capacity. The grazing capacity of the target area is expected to have an average grazing capacity of 5-7 ha/ AU.

Commercial grazing is the current land use of the project area and will be considered the principal alternative land use. It has been noted that previous farming methods employed cultivation of (presumably) maize.

- Potential Impacts with Commercial Agriculture

As no commercial cultivated farming practices occur within the target area, the impact of cultivated agriculture will not be considered. Commercial livestock farming has been taking place in the project area and surrounds for generations. As conveyed, the land is primarily utilised during winter to sustain cattle and sheep, however, it has also been required during summer periods. As the area has a good to excellent grazing capacity that is alternated on a rotating basis, the potential environmental degradation resulting from the commercial agriculture land use is considered minimal; however, dongas and sheet erosion scars may occur with increased load/ cattle capacity and mismanagement of the farms.

The following potential environmental impacts associated with commercial agriculture may occur:

  - Slaying of wild animals in order to protect livestock;
  - Increase in sheet erosion resulting from over-grazing;
  - Increased erosion of soil resulting during high-intensive rainfall events;

- Increase in sediment in surrounding rivers from loss of topsoil;
- Establishment of dongas from cattle tracks;
- Dust generation as a result of erosion;
- Air pollution during controlled burning events; and
- Air pollution as a result of fossil fuels from use of machinery.

- Potential Cumulative Effects

As the farms comprising the target area as well as the surrounding farms are currently utilised for commercial grazing, and environmental degradation assessed during the baseline assessment of the biophysical environments is considered good, the potential cumulative impacts associated with continued grazing activities will not be of high significance. Although predators (i.e. jackals, wild pigs, etc.) are common within the area, there is an understanding with commercial farmers to attempt to preserve the area as feasibly as possible.

In the event of land degradation occurring throughout the area, it will result in the loss of land suitable for agriculture and worst case scenario will result in desertification. Good agricultural practices throughout a region are therefore vital together with a polyculture approach to minimise the potential cumulative impacts from occurring.

Commercial agriculture also has positive impacts as it provides for food production, production of textiles from sheep and cattle hides, and the income associated with the sale of cattle for breeding purposes. Depending on the grade of produce it may also allow for export, therefore bring in foreign exchange. Agricultural activities also create employment in an area.

The choice of commercial agriculture as an alternative land use may be put at risk as a result of stock-theft and poaching, however the current farmers within the area are in close communication with the police and as farming provides employment opportunities, this can be controlled. It has been conveyed from Atha that commercial farming can continue as the mining operations will be underground and no subsidence is anticipated. Nevertheless, it is important to encourage sustainable commercial farming in an area in which is considered a primary livestock farming area.

4.8.1.2 Community Farming

Community agriculture is normally characterised by subsistence farming of monoculture crop farming and grazing. In the majority of instances, subsistence agriculture achieves less than half of maximum achievable yield. Such a land use will require long term inputs of land management, resources and education from an external source to achieve a sustainable community agricultural project which will not only provide a food source but will also provide an income. It must be noted that a number of initiatives have been attempted by BirdLife SA, although the development of these projects is not known.

- Potential Impacts with Community Farming

Although the land required for community based agriculture will be less that of commercial farmers, if not adequately educated, the farming activities (grazing, cultivation, forestry, etc.) can result in various environmental impacts such as erosion and associated land degradation, overgrazing, pollution from pesticides and herbicides and the establishment of dongas from overgrazing.

- Cumulative Impacts with Community Farming

In the event that the surrounding areas are allocated for community agriculture it may intensify the loss of agricultural potential through bad land management. It may allow for a greater area to be allocated for grazing and may result in an increased likelihood of overgrazing. However the greater area will also have a carrying capacity which if exceeded may result in overgrazing, erosion and associated sedimentation of rivers.

Community agriculture can have a positive impact through the upliftment of communities. It also needs to be considered that people within communities are being pushed from rural areas to urban areas by factors such as poverty, lack of available land, and decreasing agricultural jobs due to increased mechanisation. Although community based farming may initially provide means to create a living, if not correctly guided, could fail causing additional social issues and potentially further environmental impacts.

4.8.1.3 Tourism

The main industry in Wakkerstroom is focused on tourism and the village has over 40 accommodation establishments (www.wakkerstroom.co.za, 2012). It is further understood that a high concentration of tourists (local, national and international) visit the area for the scenery, fishing, mountain biking, off-road trails for motorbikes, hiking, cultural and heritage aspects and, most importantly, birding. These tourist attractions are undertaken in a sustainable manner and have buy-in from surrounding farmers, residents of Wakkerstroom as well as other NGOs (WWF-SA, BirdLife SA, MTPA, etc.).

Furthermore, a number of areas adjacent to and/ or surrounding the prospecting boundary have been gazetted as conservation area due to the significant biodiversity in the area. These areas include threatened high altitude grasslands, wetlands and indigenous misbelt forest and are also home to threatened and endemic plant, bird and animal species (WWF-SA, 2010).

As these tourist attractions are currently adequately managed, the impacts on the environment can be calculated as less intensive, suggesting that tourism can be an attractive alternative for development. According to the Ward Councillors of Wakkerstroom (2012), the tourism industry employs and directly affects (positively) a small number of the community.

- Potential Impacts with Tourism

Tourism is seen to have a positive impact on the physical environment should it be managed appropriately as land degradation is not anticipated to occur. With the growth of tourism in the area, the following impacts may arise:

  - Over utilisation of natural resources such as water as additional accommodation establishments are constructed;
  - Degradation of the natural environment from the construction of additional accommodation establishments;
  - Increased noise, dust and nuisance from motorbikes and quads utilising the off-road trails;
  - Increase demand of municipal services within the town of Wakkerstroom;
  - Increase of social-ills such as theft or robbery as a result of ‘foreign’ tourists frequenting the area;
  - Decrease of air quality from the burning of fossil fuels as tourists travel to and around the area;
  - Increased traffic as a result of increased tourism in the area;
  - Increase of employment opportunities to the local community as a result of increased tourism; and
  - Increase in disputes between the ‘haves’ and the have-nots’.

The potential impacts identified above are based on a worst-case upsurge of tourism within the area without adequate management. In truth, tourism can contribute to the local economy of an area with minimal disturbances to the environment if management adequately.

- Cumulative Impact with Tourism

The cumulative impacts of tourism are minimal and generally positive provided that it is properly managed. It could also promote the development of the natural cultural diversity of the area and assist with the development of the local economy. The income generated from tourism is not as significant as that from agriculture or mining but it is more sustainable over the long term. Tourism could also impact cumulatively on the social environment if the local communities are correctly involved with the activities.

4.8.2 Preferred Alternative

From the above mentioned possible land use alternatives, tourism will likely have the least impact on the receiving environment and may be seen by stakeholders as the most favourable option due to close proximity to existing protected environments and the occurrence of threatened and endemic plant, bird and animal species. When compared to mining, agriculture will be a preferred land use as it will have a less of a significant impact on the receiving environment in comparison to that of mining.

However, the potential income that mining will generate for the region as well as employment opportunities may outweigh these land use alternatives. There will be substantial revenue to the government through royalty, tax, VAT, etc. The FDI Capital is invested and substantial amounts of revenue are invested back in the region in terms of contractor, logistics and transport, equipment purchasing, etc.

4.8.2.1 Land Use after Mining Activities

The LOM for the proposed Yzermyn Underground Coal Mine is currently estimated at approximately 15 years. This is considered short term in term of coal mining projects. It is likely that post mining land use will involve agriculture in some form. Preferably, if managed in accordance with the rehabilitation plan, the soil will be suitable for agriculture (grazing of cultivation). Should the mining operations be managed in an acceptable manner (to stakeholders and authorities), it could be possible to implement grazing activities simultaneously with mining as the operations will be underground.

4.9 Water Supply

It has been calculated that the proposed Yzermyn Underground Coal Mine will require water for the construction, operation and decommissioning phases. For the purpose of this study, water required for the decommissioning phase has not been considered, as this will need to be calculated five years prior to the commencement of decommissioning activities.

During the construction phase, water will be required for potable requirements as well as for dust suppression. It is estimated that potable water will be trucked in as no water treatment plant would have been constructed. Water required for dust suppression has been calculated at approximately 300 m^3 per day. It has been noted that the expected water that may seep into the adit during construction is between 35 – 80 m^3 per day.

According to Mindset (2013), during the operational phase, the wash plant will require 40,000 m^3 to commence beneficiation activities and a further ~ 1,100 m^3 of make-up water per month to remain operational. A volume of approximately 2,534.4 m^3 of potable water per month will be required for employees and some 440 m^3 for the wash bay per month. In addition, dust suppression activities will require 6,600 m^3 of water per month. Therefore, in order to commence with the operational phase, an initial secured water volume of approximately 50,674.4 m^3 of water will be required. Thereafter, a monthly demand of approximately 10,674.4 m^3 water will be required to maintain operational activities.

4.9.1 Alternatives Considered

As indicated in the scoping report, alternative sources of water were considered, which included municipal water, borehole water or water from surrounding dams (Heyshoop Dam). It has been conveyed that no municipal water services exist to supply the proposed Yzermyn Underground Coal Mine. Furthermore, due to the sensitivities of the Heyshoop Dam and costs required to pipe water to the site, obtaining water from surrounding dams is not considered feasible.

Two boreholes have been identified as strong yields to supply the mine with water at a rate of 12,900 m^3 per month based on a 12 hour abstraction rate. It is, however, recommended that these boreholes are pump tested for at least 72 hours to confirm the results presented in the geohydrological assessment. The resultant cone of depression in both the shallow and deeper aquifers is not expected to extend more than 1 km from the boreholes. However, this may potentially result in the drying of wetlands which is not considered acceptable due to the sensitivities of the site and surrounds.

It has been noted that design aspects such as installing a roller belt-filter press which will generate dry slurry discard. The water resulting from the belt-filer press can be reused within the wash plant thereby reducing the need for make-up water. The dry discard will also minimise the potential seep from the co-disposal discard dump which will need to be treated prior to reuse within he process. This will be included as a mitigation measure within the ESMP.

4.9.2 Preferred Alternative

According to the hydrological and geohydrological assessments undertaken for this project, water is proposed to be supplied from rainfall (collection in dirty water areas, pumped to the proposed PCDs and reused within the wash plant and/ or treated for potable water requirements) and from two boreholes onsite. The anticipated water seeping into the underground workings has been calculated to be between 330 and 1,280 m^3 per day (resulting in approximately 9,900 and 38,400 m^3 per month, based on a 30 day month) which will be routed to the PCDs onsite. According to the hydrological assessment, an anticipated volume that can be supplied from water harvesting (collection of rainwater) is approximately 56,000 m^3 will be generated during the wet season and 23,000 m^3 in the dry season (resulting in ~ 9,300 m^3 per month in the wet season and 3,800 m^3 per month in the dry season). It is therefore recommended that natural seepage into the underground workings and collection of contaminated rainwater be utilised as the water requirements for the proposed Yzermyn Underground Coal Mine during the operational phase**. Table 4-3** tabulates the volume of water that has been calculated to be received by the surface layout area. Detailed water balance calculations and illustrations are referenced in **Section 8.6.3**

Table 4-3: Potential Source and Volume of Water

Source of Water	Volume per Month (30 days)	Volume per Day
Seepage of water to underground workings	9,900 – 38,400 m^3	330 – 1,280 m^3
Dewatering of boreholes (two boreholes, 12 hours per day)	12,900 m^3	430 m^3
Water harvesting (wet season)	9,300 m^3	310 m^3
Water harvesting (dry season)	3,800 m^3	126,7 m^3
Total Volume (Dry Season)	**26,600 – 55,100 m^3**	**760 – 1,720 m^3**
Total Volume (Wet Season)	**32,100 – 60,600 m^3**	**1,070 – 2,020 m^3**

4.10 Power Supply

A power supply is essential for the operation of the proposed Yzermyn Underground Coal Mine. Please note that it was indicated in the scoping report that power supply would be sourced in partnership from Eskom, however, this has yet to materialise and as such, alternative power supply options have been assessed.

4.10.1 Alternatives Considered

As detailed in the scoping report, it was proposed that a new NPSPL 132/ 22 kV substation be constructed and installed in close proximity to the proposed Yzermyn Underground Coal Mine. The proposed substation was to form part of the existing Normandie 132 kV system network and could be supplied from the Geelhoutboom 132/ 22 kV and 132/ 11 kV substation, located approximately 40 km north of the project site.

However, the initial capital required to construct the substation and link the distribution lines is considered uneconomical at the time of compiling this document. Negotiations will continue with Eskom regarding the power supply to the site, however, should a substation and power lines be agreed, Atha will be required to undertake a separate environmental authorisation process prior to the installation of the lines and substation

4.10.2 Preferred Alternative

It has been noted that power will be supplied by five onsite diesel fed generators which will have the capacity to generate approximately 10 MVA of power which will be utilised for the proposed Yzermyn Underground Coal Mine operations. The generators will be housed in a soundproof container thereby reducing the noise impact during operation. Furthermore, filters will be fitted to the generators in order to reduce the impact on the impact on the ambient air quality of the area.

Diesel will be stored onsite in 10 x 15 kl aboveground storage drums which will be designed in accordance with SANS 10889 to ensure compliance to relevant South African requirements. It is anticipated that the generators will be installed in various stages, with two generators being installed for the construction period and a third for the commencement of mining operations. Within three years, all five generators will be installed and operational.

4.11 No Go Alternative

The 'no go' option refers to the possibility that the proposed Yzermyn Underground Coal Mine does not go ahead. Currently, the site is located in an area which is used partially for agricultural purposes, primarily for the grazing of livestock. The no-go option would result in the continuation of the status quo, that being limited to agricultural use of the site. The no-go option will have a positive effect on tourism as the biophysical environmental will remain unchanged and the potential impacts associated with the proposed Yzermyn Underground Coal Mine will not occur.

A brief overview of the implications of the no-go option is provided below. It is understood that a mineable coal resource exists within the target area, however there is concern pertaining to the sensitivities of the site and potential cumulative impacts that may result with the implementation of the project. The continuation of agriculture will not provide the level of short-term economic growth to the area that mining may offer, such as increased employment of residents in the area, greater economic input allowing development of the towns and surrounding areas, and greater socio-economic stability in the area. However, the no-go option will preserve conservation important habitats, fauna and flora species and may promote the growth of tourism in the region. It is understood that the short term employment opportunities (initially 15 years) will benefit previously disadvantaged communities, however, may impact on the surrounding environment that could leave lasting environmental degradation for years to come.

4.11.1 Skills and Employment Opportunity Loss

If the project were not to precede, the additional economic activity, skills development and job opportunities would not be created and the coal reserves remain unutilised. Additional services and infrastructure such as municipal water (potentially), electricity and sanitation (potentially) will not be developed. The proposed mine could potentially result in the provision of jobs for around 417 people in semi-skilled work on the mine. This does not include ancillary business that may result from the development of the mine (i.e. indirect business opportunities). It has been projected that these employment opportunities will be sourced primarily from the small town of Dirkiesdorp. The Dirkiesdorp community is a rural, largely unemployed Black African community, who rely on social grants and intermittent mining and agriculture-based employment for household income. The employment opportunities in Dirkiesdorp are approximately 90, whilst the population is around 8,000. Therefore the provision of jobs could potentially be significant in the town, provided local residents are employed.

4.11.2 Loss of Potential Economic Growth

It is estimated that the production will be 180,000 per month or 23,500 tons per section per month, resulting in an expected ROM of 2.25 million tons of ore per annum. The initial life of mine has been calculated to be 15 years, with possibilities for extensions based on existing resources in the remainder area within the prospecting boundary. If Atha was not to proceed with the proposed operation, mining of these coal reserves will not be precluded or avoided, as another application in terms of the MPRDA may be made by another company.

By not mining the coal reserves available in the proposed mining development area, this will prevent the availability and use of a valuable coal reserve for the generation of electricity at a time when there is a shortage of electricity that is hampering economic growth in the country.

Furthermore, the socio-economic growth injection resulting from the proposed mining investment by Atha will not occur. This economic boost may not continue following the closure of the proposed Yzermyn Underground Coal Mine, however, investment from Atha into the local economic development projects defined in the SLP, if managed adequately, will continue into the future thereby benefitting future generations.

Atha FDI in terms of Capex on the project from project initiation by Atha includes money spent on liasoning, legal, administration, money paid to previous lease owner, technical expertise, exploration and compensation for farm lands, road upgrade and engineering and procurement construction management (EPCM) (R 153,200,000.00 spent). Total royalty to be paid is estimated at R 1,310,000,000,00 for a period of 10 years in the form of taxes and VAT. Furthermore, costs spending on infrastructure and logistics is R 4,977,042.00 over 10 years. According to Atha, this amount has been spent with an understanding that the project may be granted.

4.11.3 Precedent

According to the MTPA, there are currently a large number of applications for mining within the greater southern Mpumalanga region. If the proposed Yzermyn Underground Coal Mine had to be authorised, this may set a precedent in the region which may result in the granting of additional mining rights within a 30 km radius of the site. Due to the documented sensitivities onsite, and should a precedent be set to mine within the area, the combined impacts of mining, afforestation and agriculture could have a deleterious impact on the biodiversity at a provincial and national level (NSS, 2013).

4.11.4 Bi-lateral and Free Trade Agreements associated with the BRICS

BRICS is the acronym for an association of five major emerging national economies: Brazil, Russia, India, China and South Africa. With the possible exception of Russia, the BRICS members are all developing or newly industrialised countries, but they are distinguished by their large, fast-growing economies and significant influence on regional and global affairs. As of 2013, the five BRICS countries represent almost 3 billion people, with a combined nominal GDP of US$14.8 trillion, and an estimated US$4 trillion in combined foreign reserves (World Economic Outlook, 2013).

The South African Government has entered into a number of bi-lateral and Free Trade Agreements with India, as a co-member of the BRICS grouping in critical identified areas of investment, which areas include mining, energy, healthcare and agriculture. The South African and Indian government's objective for foreign direct investment agreements are linked to a socio-economic growth model based on equity and justice, addressing poverty and underdevelopment, especially in rural areas of South Africa.

Through the Free Trade Agreement, South Africa and other bi-lateral agreements, invited Indian companies to participate and invest in six specific areas; mining and beneficiation, infrastructure development, agriculture, green economy initiatives and tourism. The mutual understanding and underlying principle of the investment invitation is that such investment will provide incentive to the business communities of the two countries to explore mutually beneficial commercial opportunities and contribute to the growth of bi-lateral trade, whilst directly also contributing towards socio-economic upliftment through job creation, rural development, skills and technology transfer, enterprise development and the development of small, medium and micro enterprises (Atha, *per coms*, 2013).

It is understood that should the project not be authorised, the commercial opportunities associated with socio-economic upliftment through job creation, rural development, skills and technology transfer, enterprise development and the development of small, medium and micro enterprises will not occur.

4.11.5 Loss of Income Tax and Royalties

Should the project not go ahead, there will be a direct loss of tax income from the proposed Yzermyn Underground Coal Mine, income that will continue to be spent in South Africa from the ongoing maintenance of conveyor systems, mining fleets, diesel that will be purchased (which has supplements *viz.* road tax). Royalties will also not be generated which must be paid to the South African Government. Furthermore, income tax generated from employees, contractors and companies servicing the proposed Yzermyn Underground Coal Mine will not be generated. According to Atha (*per comms,* 2013), for each R 100.00 of sales generated from the proposed Yzermyn Underground Coal Mine, approximately 90% will be re-invested directly back into South Africa. This may be reviewed and confirmed during the feasibility study.

4.11.6 Sense of Place

The mining will be underground over the entire target area of around 2,500 ha where it is anticipated that no disturbance to surface topography will occur (excluding the area to be disturbed for the surface infrastructure, including the ventilation shaft). The disturbance on the surface has been calculated to be approximately 80 ha. It has been noted that the project may impact the sense of place within the area, and should the project not go ahead, the current natural state of the environment will not be disturbed. Furthermore, if the project does not proceed, a number of proposed farms comprising the prospecting area and surrounds have been included in the proposed Mabola Protected Environment due to the sensitive, endemic and critically important biomes identified onsite. This will have a positive effect for the biodiversity and ecosystems in the area thereby having a positive impact on the ecotourism of the region and a direct influence on the sense of place.

4.11.7 Impact on Tourism

It has been noted that approximately 400 jobs have been created as a result of eco-tourism in the Wakkerstroom area (A. Burns, *per comms*, 2012), dependent on the bird life. It is anticipated that as Wakkerstroom is in close proximity to the proposed mine, and should the development continue, contractors and clients of the proposed mine may require accommodation within Wakkerstroom. This may have a positive effect on accommodation venues in the Wakkerstroom area and could result in an increase of tourism and associated job opportunities. Unmanaged environmental impacts resulting from the proposed mine may degrade the surrounding surface and groundwater sources, resulting in a reduction in biodiversity and decline in eco-tourism. Should the project not go ahead, existing employment opportunities pertaining to tourism will be retained.

4.11.8 Impacts on Surrounding Agricultural Areas

Commercial livestock farming has been taking place in the project area and surrounds for generations. As conveyed, the land is primarily utilised during winter to sustain cattle and sheep, however, it has also been required during summer periods. As the area has a good to excellent grazing capacity that is alternated on a rotating basis, the potential environmental degradation resulting from the commercial agriculture land use is considered minimal; however, dongas and sheet erosion scars may occur with increased load/ cattle capacity and mismanagement of the farms. It should be noted that cattle grazing activities can continue within the target area excluding the surface infrastructure layout area, should the project be successful. Potential contamination to surface water and dewatering of groundwater may reduce the grazing capacity of the area. Potential impacts associated with surrounding agricultural areas are discussed in **Section 8.5.4.** Should the project not go ahead, existing farming practices will continue.

5 Project Description

5.1 Overview

Following detailed exploration activities, a coal resource in the target area has been identified within the prospecting boundary. It has been noted that the mine will utilise underground conservative drill and blast/ bord and pillar mining methods with a portal/ adit being sunk within the northern section (27°13’14.05”S; 30°18’39.25”E) of the target area. Atha will be applying for the target area as the primary mining area in the mining right application.

Although feasible coal reserves exist within the target area, a number of geological structures and faults have been identified at several stratigraphic levels, which would influence the stratigraphy and coal qualities of the coal seams. Faults present in the area that may have an impact on the coal seams deposition, presenting potential operating issues as the dolerite structures comprise hard rock which needs to be mined through in order to reach the coal face. These have been identified and accounted for in the resource estimation that are SAMRAC and JORC compliant. The proposed mining scheme has been developed following considerations of such structural and intrusive features and the LOM of the project within the target area has been determined accordingly.

Please note that no opencast mining will be considered as part of the project. Two incline shafts will be developed in order to access the coal reserves of the Alfred and Dundas coal seams. Coal will be mined from underground bord and pillar mining methods (drill and blast and continuous miner operations). The coal will be removed via conveyor systems to a ROM raw coal stockpile at the surface prior to being conveyed to a wash plant.

Existing infrastructure and services in the area are limited, and services such as access roads, power and water supply will need to be established. Infrastructure that will need to be constructed includes, but is not limited to, administration offices, change houses (including ablution facilities), workshops, conveyor systems, wash plant/ beneficiation plant, pollution control dams and water separation systems (clean and dirty water separation), sewage treatment plant and water treatment plant. Furthermore, a co-disposal discard dump will need to be developed to store discard that is unfeasible to utilise due to its low calorific value and high ash. The site infrastructure layout is provided in **Figure 5.1** and is overlaid over the satellite image in **Figure 5.2**.

It is anticipated that the coal will be transported by road to an existing coal siding (operated by Jindal) at the Piet Retief Siding near Piet Retief for dispatch to Richards Bay Coal Terminal on the east coast or to other destinations for supply of coal (i.e. ESKOM) as appropriate. It is anticipated that the haul route will take the existing unpaved road through the village of Dirkiesdorp, which is situated about 13 km from the proposed mine site, and onto the tarred R543 to the Piet Retief Siding, located approximately 60 km away

In order to minimise the discard quantity, it is proposed to wash coal in a two-stage washing plant that would help in maximising the recovery of saleable product from ROM stockpile. According to calculations, it is anticipated that 81% of the coal mined will be saleable with the remaining 19% being transported to the discard dump for co-disposal. Discard from wash plant will be deposited on a discard dump and the washed coal will be conveyed to two separate stockpiles; primary product for export quality (1,234,032 tons per annum) and a secondary product (597,840 tons per annum) that will be railed for use in Eskom power stations. According to the surface layout design, the mining operations (adit, plant area, administration offices, pollution control dam, discard dump, etc.) will comprise an area of more than 80 ha, as illustrated in **Table 5-1**. In addition, the unpaved road from the site to Dirkiesdorp (approximately 13 km) will require upgrading (tarring/ paving). It is understood that the road reserve will extend to 8 m in width. No additional upgrade is required at the Piet Retief Siding as it is already in use by Jindal Mining. Refer to **Appendix F** for a letter received from Jindal indicating adequate area exists to accommodate the coal to be generated by Atha at the siding.

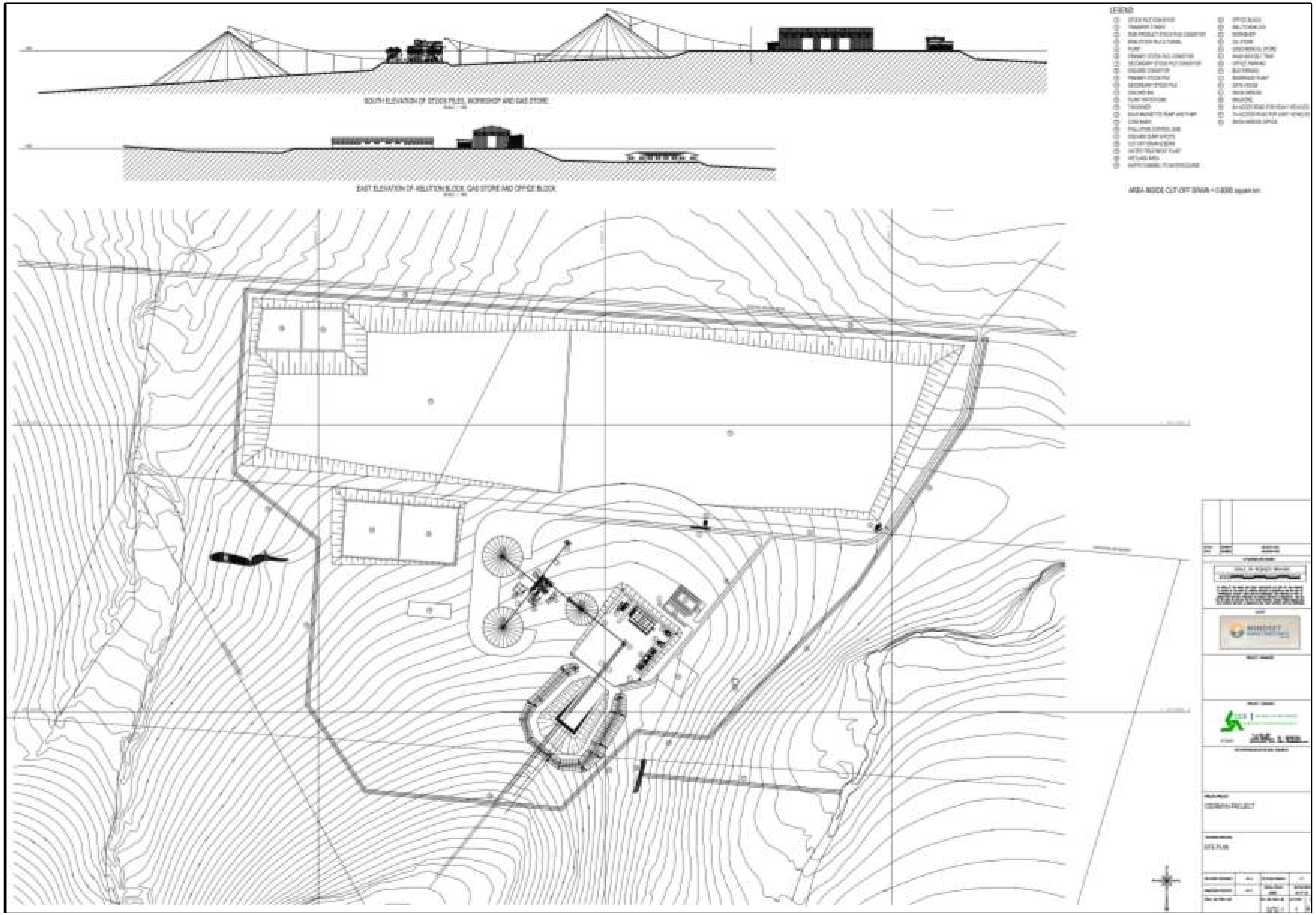


Figure 5-1: Preferred Surface Infrastructure Layout Plan (Source: Mindset, 2013)

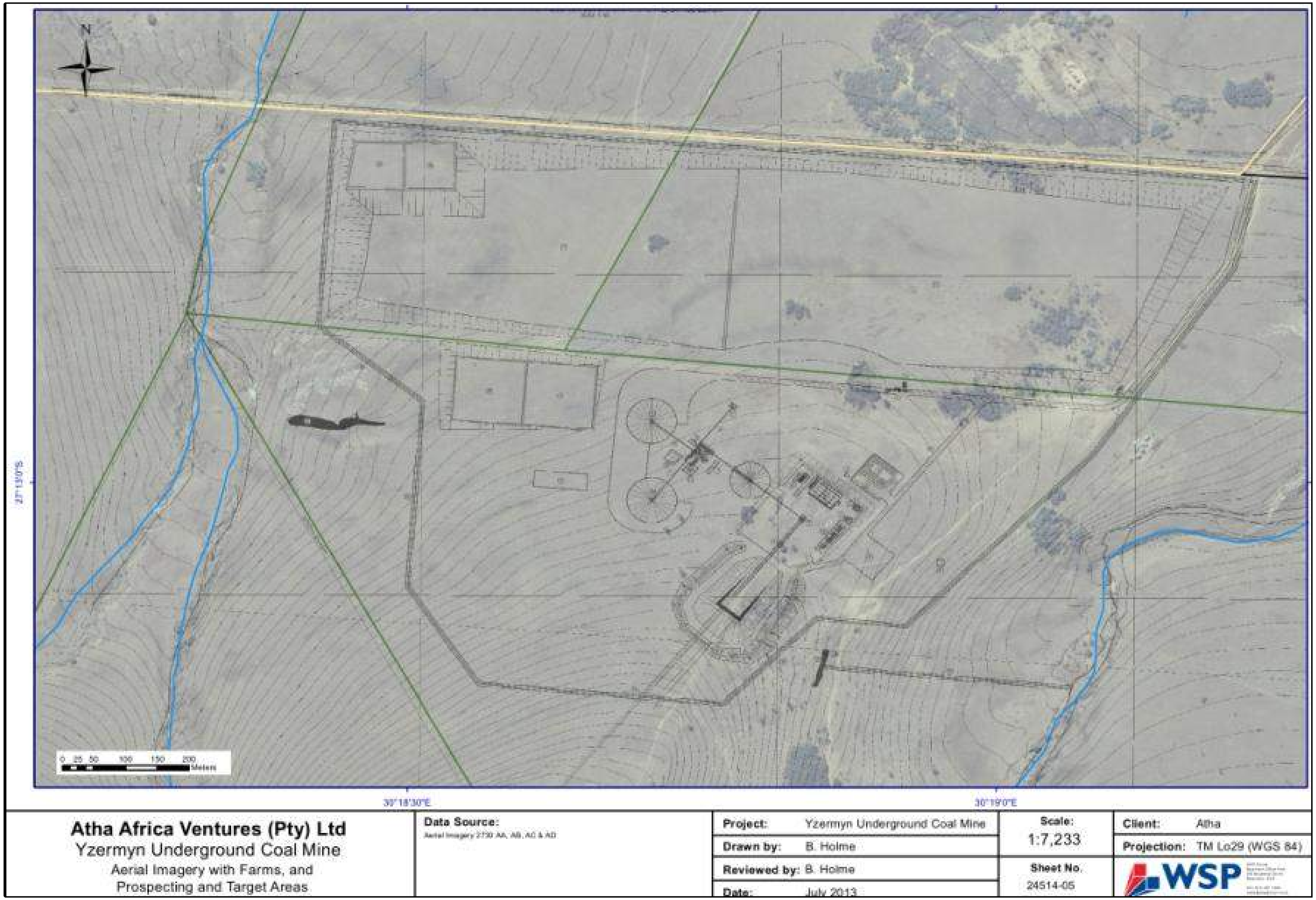


Figure 5-2: Preferred Surface Infrastructure Layout Overlay

Table 5-1: Surface Area to be disturbed by Infrastructure

Surface Area		Area in m^2	Area in ha
1	Total Box cut area	24507	2.4507
2	Work shop and others	19980	1.998
3	Bus parking	2652	0.2652
4	Office Building + car parking	2870	0.287
5	Plant area	57271	5.7271
6	Isolated PCD	28289	2.8289
8	Discard dump + PCD outside Lease	436152	43.6152
9	Road other than municipal road	13771	1.3771
Total area		**585492**	**58.5492**
Total surface are for proposed to be acquired for Infrastructure		809500	80.95

5.2 Coal Deposits

It is proposed that the Utrecht Coalfield will be mined which comprises the Karoo Supergroup geological stratigraphic unit. The Alfred and Dundas coal seams, which form part of the Utrecht Coalfield, will be extracted. In the Utrecht Coalfield, the seams have been a major source of moderately good coking coal and require little beneficiation. The lower Dundas Seam rank varies from medium volatile bituminous to anthracitic, with the coal mined as a source of bituminous coal in the north eastern sector of the coalfield and as anthracite in the southern sector. However, the sulphur content can be high, in excess of 1%.

The Alfred Seam is of better quality in the Utrecht Coalfield, particularly towards the bottom portion of the seam. The seam is generally high in ash and sulphur content, but beneficiation can produce relatively high quality, low ash coal with low sulphur and phosphor.

According to Mindset, it is proposed that eight sections be deployed, four sections in the Alfred Seam and four sections in the Dundas Seam. From initial exploration, the Alfred coal seam extends from 11 to 319 m deep, with an average coal thickness of 1.65m. The raw air-dried calorific value (CV) of the Alfred Seam in the target area varies at 26.5 MJ/kg in the northwest to 22 MJ/kg in the east. The average volatile matter (VM) content for the Alfred Seam is 19.74%, with a maximum of 22.5%. The practical yield of the first wash coal from the Alfred Seam averages 55% over the target area with a maximum of 75% in the northwest decreasing to 59% in the east (based on RB1 specification coal of 27 MJ/kg). For second wash coal (i.e. middling), the average yield is around 26.5%.

The Dundas coal seam has a 30 – 40 m parting and extends from 24.5 to 354 m below the ground, with an average seam thickness of 1.66 m (localised thinning in the east of the target area). The raw air-dried CV of the Dundas Seam stretches from 27.8 MJ/kg in the north of the target area to 24.3 MJ/kg in the south. The average VM content for the Dundas Seam is 20.1%, with a maximum of 22.5%. The practical yield of the coal from the Dundas Seam averages 54.7% over the target area with a maximum of 75% in the northwest decreasing to 58% in the east (based on RB1 specification coal of 27 MJ/kg). For the second wash coal (i.e. middling), the average yield is around 26.5%.

The coal strikes (Alfred and Dundas Seams) north-east south-west and dips to south-east. It is estimated that the production from the mine will be approximately 180,000 tons per month or 23,500 tons per section per month, resulting in an expected yield of 2.25 million tons of ore per annum. The reason for the variance is based on shift selection which will be clearly illustrated on the mine plan. The total tons *in situ* of coal have been calculated at 80.32 Mt which comprise 38.82 Mt of Alfred Seam coal and 41.49 Mt of Dundas Seam coal (Mindset, 2013). The table below (**Table 5.1**) summarises the estimated raw coal resources for the proposed Yzermyn Underground Coal Mine.

Traditional underground shifts operate a 2-shift system per operation for five days, followed by a single shift on the sixth day. A Fulco shift system may also be utilised which will provide for a 7-day 24-hour operation. It is noted that no production will take place on the seventh day.

The deposit in the target area can be mined for at least 15 years at the abovementioned production rate. It is anticipated that additional mining activities will move into adjoining potential areas substantiated by future exploration as the mine progresses. Additional studies are being undertaken to identify the feasibility of making low quality coal available for Circulating Fluidised Bed Combustion (CFBC) Boilers in India.

Table 5-2: Yzermyn Underground Coal Mine Resources (Mindset, 2013)

Seam	Av Width (m)	Area (m^2)	Volume (m^3)	GTIS[4]	Geolog. Loss	TTIS[5]	CV
Alfred	1.65	15,244,013	25,047,907	38,824,256	5,823,638	33,000,618	23.95
Dundas	1.66	16,002,653	26,430,968	41,496,621	6,334,493	35,272,128	24.22
Average	*1.65*	*31,246,666*	*51,478,875*	*80,320,877*	*12,048,131*	*68,272,745*	*24.09*

The mineable coal at the proposed Yzermyn Underground Coal Mine will be accessed by two declines from a single adit which will intersect the Alfred and Dundas coal seams at their respective horizons. A single vertical ventilation shaft will be required. The raw and washed qualities of the coal is summarised in the table below:

Table 5-3: Raw and Washed Coal Qualities (Mindset, 2013)

Type	Resource	Moisture %	Ash %	Volatiles %	Carbon %	Sulphur %	CV (MJ/kg)	Yield %
Raw	Alfred	2.46	23.94	19.74	53.88	1.23	23.94	100
Raw	Dundas	1.80	25.82	18.62	53.76	0.96	24.39	100
Washed Export	Alfred	8.1	15.4	21.2	57.8	1.04	5900 Kcal/Kg	51.8% particles
Washed - Middling	Alfred	8.4	29.7	17.2	50.40	1.14	21.5 MJ/Kg	30.4% particle
Washed Export	Dundas	7.4	17.50	19.20	57.80	0.89	5900 Kcal/Kg	56.20% particle
Washed - Middling	Dundas	7.8	32.50	15.30	50.20	0.69	21.5 MJ/Kg	23.5% particle

The construction of the proposed Yzermyn Underground Coal Mine is proposed to be undertaken over a period of four to six months commencing from the last quarter of 2014. According to Mindset, the construction will comprise 20 hour operation, seven days per week. The construction phase of the development will involve the following aspects:

- Erection of perimeter fences;
- Site preparation and clearance;
- Installation of services;
- Construction of a laydown area;
- Stormwater management;

[4] GTIS – Gross Tones In Situ

[5] TTIS – Total Tones In Situ

- Waste management;
- Construction of the adit; and
- Construction of the infrastructure associated with the proposed Yzermyn Underground Coal Mine as per the site layout design.

Prior to the commencement with construction, the preparation of tenders for all mining equipment, earthworks, fencing, civils, construction of infrastructure, etc. will be finalised with a view to gather quotations from various local suppliers.

5.3 Infrastructure

5.3.1 Erection of Perimeter Fencing

Security razor wire fencing, 2.1 m high, will be erected around the boundary of the mining area. Access to the area will be through a single access point, located off of the unpaved gravel road located approximately at coordinates 27°12'44.22"S; 30°19'13.15"E. A security gate house will be constructed to control access of employees into the construction area, and following construction, into the mining area.

The entrance will be of sufficient width to accommodate large construction vehicles. Prior to operation, a private search room will be constructed and turnstiles will be installed to monitor employees arriving and leaving the mine.

5.3.2 Site Preparation

During the construction phase, the site will be cleared of all vegetation and topsoil will be stripped to a depth of 700 mm or refusal. The area to be cleared has been calculated at 286 m^2 in area, and an approximate volume of 202.2 m^3. The soil will be stockpiled to a height of 2 m in order to reduce the erosion potential and may be revegetated naturally. The topsoil will be stockpiled to the south and southwest of the laydown area, and will be located within the stormwater trench of the site. The extent of site preparation is illustrated in **Figure 5.3**.

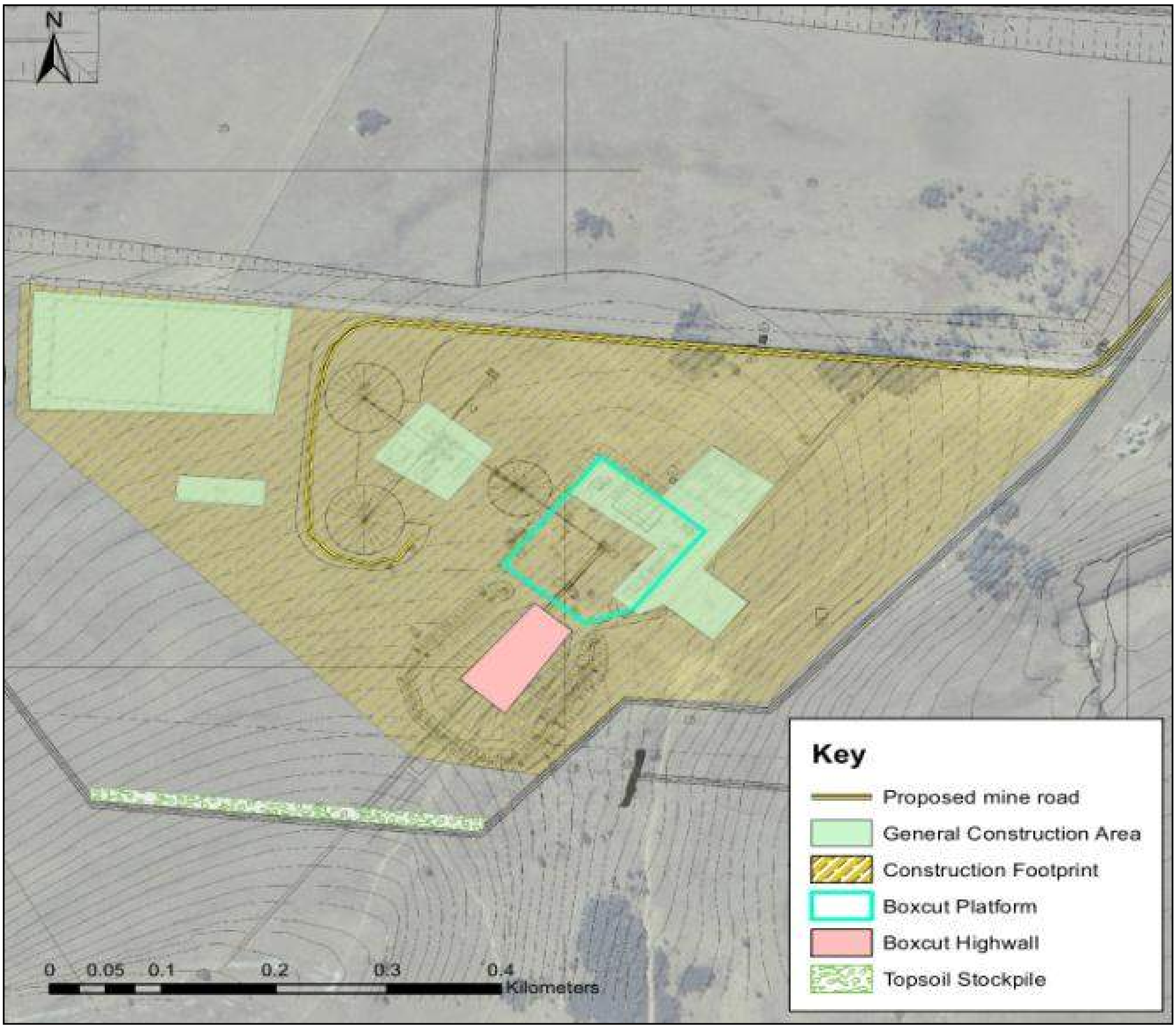


Figure 5-3: Extent of Surface Infrastructure Preparation (excluding Co-disposal Discard Facility)

5.3.3 Adit Platform and Fill Material

The adit platform and fill material will be sourced from the development of the high-wall/ adit entrance and sinking of decline shafts. The material will be removed from the adit location to the platform area or the construction laydown area via front end loaders (FELs) and will be compacted and graded. According to the LIDAR survey, approximately 84,446 m^3 of material will be required to 'construct' the adit platform area (Mindset, 2013). Additional information pertaining to the adit and associated platform is detailed in **Section 4.3.8**. The adit platform and construction laydown area is illustrated in **Figure 6.4**.

5.3.4 Site Office and Workshop

A central construction site office will be constructed in which to administer the construction activities. The construction office will comprise offices for middle- to top-management construction personnel and will include boardrooms for project meetings. The site office will be upgraded prior to the commencement of the operational phase.

Workshops will be constructed to maintain construction equipment, machinery and vehicles. Workshops will be constructed with impervious foundations to ensure contamination with underlying soil does not occur. The workshops will also contain a wash bay that will be connected to a collection sump, ensuring no contaminated washwater is discharged into the surrounding environment. Honey suckers will maintain the collection sump on an *ad hoc* basis. The workshops will be utilised for the operational phase of the project.

5.3.5 Access and Haul Roads

The existing unpaved road from Dirkiesdorp to the project site will be utilised for the construction phase of the project. **Table 5.3** summarises the anticipated vehicles that will be utilised during the construction phase. According to Mindset (2013), the construction vehicles and equipment to be utilised will be transported to the site during commencement of the construction phase and will only leave the site once construction has been completed. All construction vehicles, equipment and machinery will be stored onsite within a designated and secured area during the construction phase. Please note that light-weight construction vehicles (bakkies) will travel to and from site on a daily basis.

Table 5-4: Number of Vehicles during Construction Phase

Vehicle	Number
Excavators	4
Construction trucks – articulated dump truck (ADTs)	10
Graders	2
Dozers	2
FELs	2
Buses or minibus taxis	Dependant on contractor
Light-weight construction vehicles (bakkies)	Dependant on contractor
Delivery vehicles (delivering construction material, etc.)	Dependant on contractor

The unpaved road from Dirkiesdorp to the project site will only be upgraded during the third year of operation. The road will be graded on a weekly basis during the summer months and twice a month during winter. Dust suppression activities will be implemented in order to reduce nuisances associated with dust, and safety management measures will be implemented along the route for health and safety purposes.

Although an access route exists from the unpaved road to the mine site, this road will need to be upgraded in order to accommodate the large construction and mining vehicles. Similarly with the unpaved road, the access route will be graded and dust suppression measures implemented. This road will be upgraded to a paved road during the third year of operation of the mine. Refer to **Appendix C: Traffic Impact Assessment** for a copy of the traffic impact assessment report.

5.3.6 Construction Personnel

As the site will be constructed in various phases in line with the construction/ installation of specific items, the number of construction personnel is dependent on the contractor. For example, a crew of approximately 30 operators and six supervisors will be required during the development of the box-cut, high-wall, adit platform and decline shafts. Separate contractors will be installing the conveyor systems, constructing the wash plant, etc. concurrently with the teams developing the adit entrance. It is conservatively estimated that no more than 100 people will be onsite at any time during the construction phase.

According to Mindset (2013), no accommodation will be provided onsite to any contractor of construction personnel. All staff will be housed at the nearest suitable accommodation and transported to the site on a daily basis. The site will be access controlled by security personnel on a two-shift approach.

5.3.7 Site Construction

In order to complete construction within six months, construction of items will be undertaken concurrently. The following details the construction activities that will be required:

- Erection of security fence and access controlled gate around the layout area;
- Grading of unpaved road, within the project site as well as the unpaved road from Dirkiesdorp to the project site;
- Site clearance and soil stripping;
- Installation of gensets and connection of power;
- Installation of fuel storage tanks;
- Development of high-wall and adit platform;
- Construction of site office (including ablution facilities, parking, etc.);
- Construction of sewage plant;
- Construction of workshops, wash bays, etc.;
- Construction of stormwater management system;
- Construction of wash plant;
- Installation of conveyor systems;
- Construction of pollution control dams;
- Construction of associated infrastructure required for operation (explosives store, water treatment plant, weigh bridge, etc.);
- Development of decline shafts;
- Construction of co-disposal discards facility.

5.3.8 Blasting and Adit Sinking of Decline to Coal Face

The coal seams dip from west-north-west to east-south-east and due to the depth of the seams below natural surface the northern limit is considered the only option to establish access. The coal field seems to be faulted into various blocks and it must be accepted that various faults will have to be negotiated during the life of the mine.

The following is proposed for the development of the adit:

- Adits
  - A 10 degree dip towards the high-wall;
  - Hard material battered at 70 degrees to ensure stability;
  - A 5 m horizontal bank between the toe of the soft material and hard material drop-off;
  - Soft material stripped to a depth of 7 m and battered at a slope of 1:5 (1 vertical to 5 horizontal);
  - All the inclines are planned based on a 10 degree incline, 7 m wide by 3 m high;
  - Steeper inclines will have a long lasting detrimental effect on machines throughout the life of mine;
  - Width and height of inclines are to ensure maximum ventilation quantities and to reduce pressure on ventilation fans;
  - Two inclines at 20 m centres, a shared belt road and a shared travelling way are planned to both seams; and
  - A vertical upcast ventilation shaft of 107m in depth can only be established once mining on the Dundas seam has commenced. The ventilation shaft will be installed through a raised-bore approach.

Once mining commences and according to the characteristics of the roof, floor and pillar conditions, the mining parameters will be 6 m wide bords, mining to seam height and pillar centres depending on depth to seam. According to Mindset (MWP, 2013), primary development safety factor to be not less than two and all other mining panels to be worked to a safety factor of not less than 1,6. Safety factor formulas to be used will be Salamon's formula where the pillar width to mining height ratio is less than five and the Squat Pillar formula where pillar width to mining height ratio is equal or exceeds five.

Once the adit has been established, actual development of the coal seam by means of two 7 m by 3 m declines can commence. These declines will be at 10 degrees to allow for safe passage of vehicles and allow efficient conveyor operations.

Figure 5.4 below illustrates the schematic mining layout overlay (excluding associated mine infrastructure and discard location). The illustration indicates the location and extent of the adit platform, adit high-wall as well as the two declines, schematic layout of the underground mine plan and the location of the ventilation shaft.

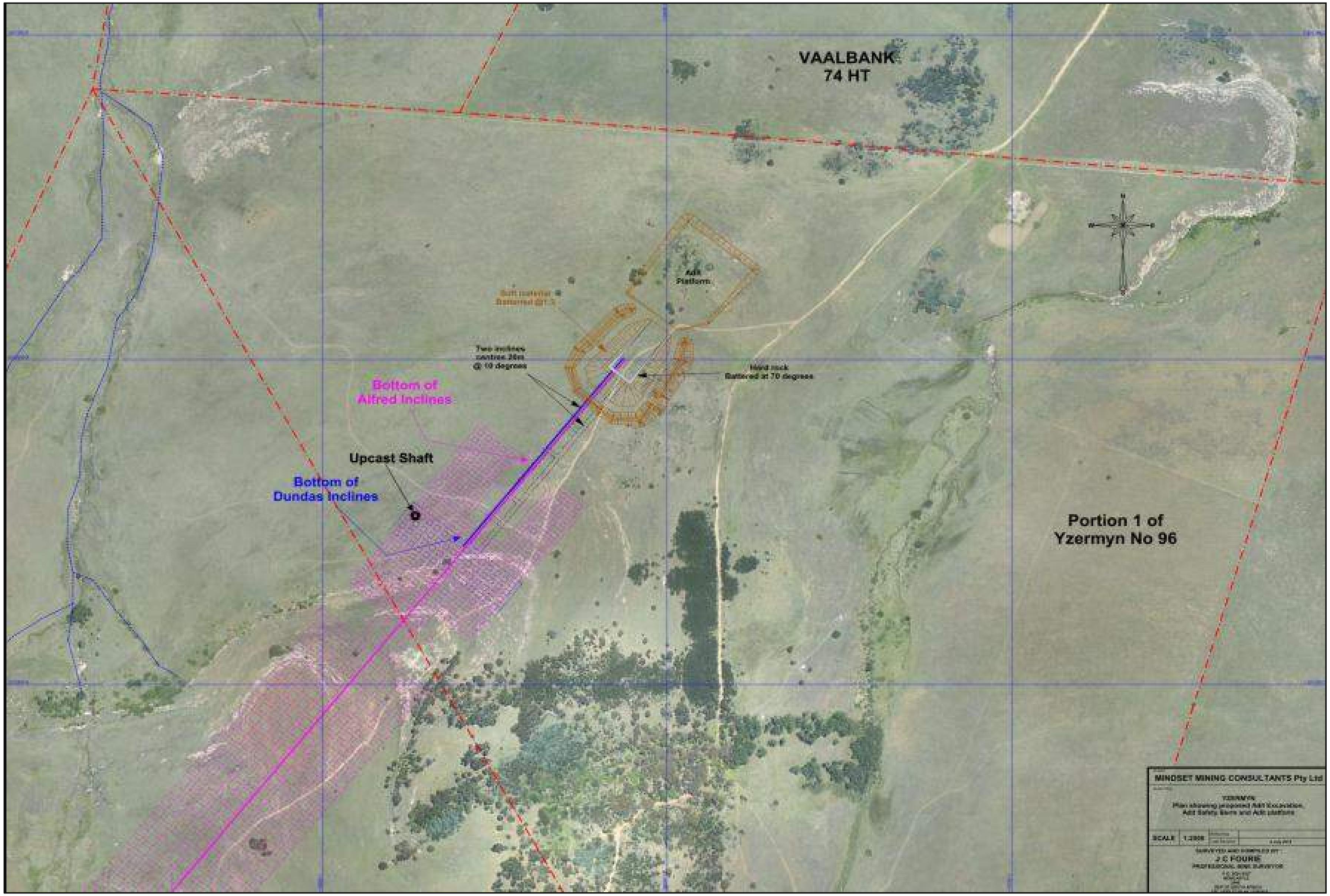


Figure 5-4: Image Overlay Illustrating Box-cut Adit and Mining Area Overlay (Source: Mindset, 2013)

The total adit footprint area has been calculated to be 1.0548 ha (previously indicated in the scoping report to be 0.84 ha). It is proposed that the overburden and waste rock excavated during the development of the adit will be used for infill for an adit platform (**Figure 5.5** illustrates a schematic representation of the overburden excavation and infill to develop the adit platform). A portion of the overburden may also be stockpiled to the northwest to act as an earthen berm to restrict the visual impact that the mine may have on the surrounding environment.

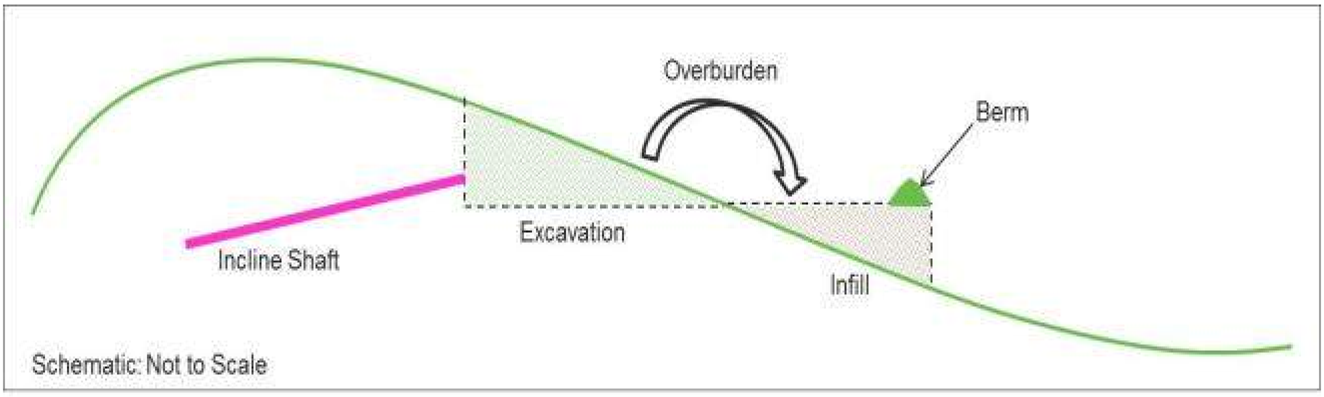


Figure 5-5: Schematic Illustration of High-wall Installation

The table below details the specific information associated with the installation of the adit and excavation of the high-wall.

Table 5-5: Volumes associated with the High-wall

Adit	Soft Overburden	Hard Overburden	Total Overburden	Tunnel to Alfred	Tunnel to Dundas	Total Tunnel Volume	Total Rock Volume
Eastern	42,286 m^3	18,680 m^3	66,966 m^3	422 m	383 m	16,657 m^3	35,256 m^3

Table 5-6: Volumes associated with the Yzermyn Adit

Infrastructure	Total	Volume
Alfred Seam		
2 x incline shafts	383 m	8,043 m^3
3 x ventilation connections	39 m	819 m^3
Total Alfred Rock Work Distance	422 m	8,862 m^3
Dundas Seam		
2 x incline shafts	312 m	6,552 m^3
2 x ventilation connections	26 m	546 m^3
Brushing of belt road	45 m	616 m^3
Total Dundas Rock Work Distance	383 m	7,714 m^3
Upcast Ventilation Shaft		
1 x ventilation shaft (5m diameter)	107 m	2,100 m^3

In accordance with GNR.704 of the NWA, no mining or mining activities may occur within the 100 year flood lines of the intermittent stream that runs through the project area and outside of a 100 m buffer zone from streams, the area which is greater will be adhered to. In the event that Atha plans to mine within this area, exemption from GNR.704 will need to be applied for before mining commences, and a WULA obtained.

Furthermore, buffers detailed in the ESMP (**Section 12** of this report) are to be complied with (buffer zones relate to Freshwater Ecosystem Priority Areas (FEPAs), wetlands identified onsite (System 1 and 2 wetlands) and importance of critically importance/ threatened fauna and flora species.

Once the decline development has been completed, equipping one decline with conveyors, pipes, cables and any other required equipment will require one month for finalisation. Following the equipping of the declines, actual coaling can commence on both seams by means of opening up around the shaft bottom.

The development of the adit and decline shafts is seen as coaling and the main development can be established within a month of commencement. This will allow for additional sections to be added as-and-when pit rooms become available.

5.3.9 Ventilation Shaft

The raise boring of the 107m ventilation shaft can commence once the area has been developed and will not interfere with actual mining operations, as it can be done in conjunction with coaling and should be complete in one month.

5.4 Mining Methods

Coal mining is conducted via opencast or underground mining in South Africa. A number of mining methods have been assessed during the scoping phase of the project. The proposed Yzermyn Underground Coal Mine will utilise bord and pillar mining to extract the coal reserve. Bord and pillar mining is commonly used for flat or gently dipping bedded ores or coal seams.

According to the Mine Works Programme (2013), the estimate coal reserve within the target area comprises a total of 50.14 million m^3 of coal over a block area of 30.8 million m^2. Currently, it is anticipated that the target area has sufficient reserves to mine approximately 2.2 to 2.5 million tons of ore per annum, resulting in a Life of Mine (LoM) of approximately 15 years based on current technology. It has been noted that additional reserves can extend the Yzermyn Mine LoM, which are discussed in **Section 8**.

It has been previously noted that no opencast mining will be undertaken as part of the proposed mining operation. A number of underground coal mining methods have been assessed and are detailed in **Section 4.4**. It is proposed that conventional drill and blast and/ or CM, bord and pillar mining be executed for the project. The proposed mining will limit the surface disturbance to the adit entrance and surface infrastructure (wash plant, PCDs, discard dump, administration buildings, access roads, conveyors, etc.).

Although CM has a higher productivity level than drill and blast methods, it requires increased capital and may be damaged when mining into dolerite intrusions. Therefore, it is proposed that both methods of mining be employed to obtain a good spread, providing flexibility of operations. **Table 5.6** summarises the equipment that will be required for each mine section. All equipment barring the load haul dumper and battery scoops will be electronically driven.

Table 5-7: Mining Equipment Required

Continuous Mining Method	Drill and Blast Method
1 x continuous miner	1 x face drill
3 x shuttle cars or battery scoops	1 x feeder breaker
1 x roof bolter	1 x transformer
1 x feeder breaker	1 x section switches
1 x transformer	3 x scoops
1 x section switches	1 x roof bolter
1 x pump	1 x load haul dumper
1 x load haul dumper	1 x hilti electric drill system
	1 x hilti flameproof panel

Continuous Mining Method	Drill and Blast Method
	1 x pump

Although the geology of the area is considered structurally stable, support will be required in order to ensure failure of underground compartments does not occur.

5.4.1 Coal Hanging

Once the coal has been extracted, it will be delivered by conveyor from the underground operations to a 12,000 mt ROM 'raw coal' stockpile ahead of the coal handling and preparation plant (wash plant). The stockpile will have sufficient capacity to accommodate differences and fluctuations in the production rates between mining and processing. The ROM raw coal stockpile capacity is calculated on the following operating assumptions:

- Underground operations manage 2-shift per day operation for 5-days, followed by a single shift on the sixth day and no production on the seventh day;
- Average ROM raw coal production per shit will be 4,400 tons (as received);
- Maximum ROM raw coal production per shift can be 4,800 tons;
- Wash plant nominal capacity at 320 tons/ hr (air dried), operating 360 days per year with 90% availability equating to an annual production of 2.25 million tons (mt) (as received basis assuming 4.24% total moisture); and
- The raw coal stockpile capacity will be designed to allow the wash plant to operate 22 hours per day, seven days a week, with an eight hour planned maintenance shutdown weekly.

It is proposed that underground feeder breakers will reduce the raw coal material to a nominal 200 mm top size. The wash plant cannot accept material exceeding this size.

It is anticipated that the ROM raw coal stockpile will be positioned on top of a tunnel from which the raw coal will be drawn to the bottom of the stockpile by tunnel vibratory feeders as a design rate of 327 tons per hour and fed onto a 50 mm vibratory screen. The oversize material from the vibrator screen will be fed to a crusher from where the crushed material will be recycled back to the 50 mm vibratory screen. To minimise the production of fines from the crusher, it is assumed that the crusher design and set-up will result in an operating efficiency of 90%. This will result in a build-up of oversize material within the crusher circuit with the feed to the 50 mm vibratory screen calculated to be 427 tons per hour.

This is illustrated in the process flow diagram in **Figure 5.6.**

5.4.2 Coal Processing

The extracted coal from the underground mine will require further beneficiation. Following vibratory screening and crushing, the resultant material will be transferred via covered conveyor to the beneficiation/ wash plant. The plant is been designed to produce a multi-grade product (comprising primary export quality coal and secondary Eskom coal). Beneficiation of the coal will involve washing, crushing and screening in order to separate the waste rock and unfeasible coal from the saleable coal. This will be undertaken via a desliming process, washing in a spiral plant, flocculation of ultra-fines and washing of the product in a dense medium separator (DMS) cyclone plant. The process is described in detail below.

The dense medium section will comprise conventional two-stage wash. The crushed raw coal material (0.63 x 50 mm) will be fed to a desliming screen from which the coarse material (0.63 x 50 mm) will feed an 800 mm diameter DMS cyclone module for a low gravity wash at a 1.49 relative density (RD). The underflow from the primary cyclone will be transferred to a secondary cyclone for a high gravity wash at 1.64 RD. This operation will remove 16.6% of the material as coarse discard. This discard will be dewatered over a 0.63 mm drain-and-rinse screen before being conveyed to a 200 mt silo from where it will be loaded and transported to the co-disposal discard dump by the appointed contractor.

On average 56.9% of the feed to the cyclone module will report to the primary cyclone overflow. Subsequent dewatering treatment, including a drain-and-rinse screen and screenbowl centrifuge, will deliver a 27.5 MJ/kg thermal coal product. The secondary cyclone overflow after dewatering treatment will deliver a 21.0 MJ/kg thermal coal product with an average recovery yield of 26.5%. Both products will be conveyed to separate clean coal open stockpiles for subsequent delivery loadout, either by rail or road truck.

It is assumed that both products will be sold un-sized and that no dry product screening capacity is required.

The fine fraction (0.63 x 0.63 mm) from the desliming screen will be fed into a classifying cyclone to remove the ultra-fine material (<150 micron). The fine fraction (0.15 x 0.63 mm) will be upgraded by a two-stage spiral plant. The ultra-fine material will feed a thickener before being sent to a filter press. The resultant “discard” will be conveyed to the discard silo for deposition onto the discard dump. The spiral plant will remove 25.6% of the fine material as discard. This discard will be dewatered over a 0.5mm dewatering screen before being conveyed to the discard silo for deposition.

On average 43.9% of the fine material feed to the spiral plant may be recovered as a 25.0 MJ/kg coal product, which after dewatering and drying in a screenbowl centrifuge (estimated total moisture of 13%) will be blended with the 27.5 MJ/kg cyclone product to produce a 5,900 kcal/kg net as received (NAR) export quality thermal coal product. A further 30.5% will be recovered as a middlings product (product in mineral content between a concentrate and a tailing), which after dewatering and drying, will blend with the 21.0 MJ/kg secondary cyclone product to produce a low CV thermal coal product with 21.5 MJ/kg. Equipment that will be used for the proposed mine is detailed in **Table 5.7** below.

It is expected that process water will be sourced from boreholes and dirty runoff water collected in the pollution control dams on the surface. Water requirements and availability is discussed in **Section 4.9.**

Discard material generated from the beneficiation process will be transported from the wash plant via road or conveyor to a nearby permanent discard dump for stockpiling. The product yield produced from the beneficiation process will be stockpiled at a designated product stockpile area located in close proximity to the wash plant. Coal transport vehicles will load the product coal and may transport the coal via road to Eskom power stations and to the Piet Retief Siding. This is illustrated in **Figure 6.6** below.

Table 5-8: List of Equipment to be utilised

Activity Area	Equipment Required
Raw Coal Handling	2 x vibratory feeders 1 x double roll crusher Feed conveyor (walkways/ weightometer) Recirculating conveyor Dry vibratory screen (single deck)
Desliming Plant	Feed conveyor (walkways/ weightometer/ automatic swing sampler) Wet vibrating desliming screen Underflow tank Desliming slurry pump Classifying cyclone Primary DMS feed conveyor
Spiral Plant	First stage washing Second stage washing 3 x fine slurry pumps 3 x fine product dewatering screens 3 x tanks 3 x dewatering cyclones 2 x screenbowl centrifuges

Activity Area	Equipment Required
Ultra-fines	Thickener underflow pump Flocculent addition Lime/ acid neutralising agent dosing Process water (including process water tank and pump)
DMS Cyclone Plant	Mixing tank 2 x cyclone feed pumps 2 x DMS cyclones 3 x drain and rinse screen 1 x drain screen 2 x heavy media pumps Header box Wet drum magnet Demagnetising coil 2 x centrifuges
Stockpiling	Product conveyor (weightometer/ automatic sampler) Middlings conveyor (weightometer/ automatic sampler) Discard conveyor (weightometer/ manual sampler) Discard bin
Extras	Density controller 2 x MCC Tramp metal over belt magnet

It is proposed that the vehicles will utilise the existing road infrastructure which will be upgraded to the town of Dirkiesdorp. The vehicles will then travel on the R543 to the Piet Retief Siding located approximately 60km east, near Piet Retief. Coal will either be stockpiled at the siding or loaded into wagons before being transported by rail to Richards Bay Port Terminal for export.

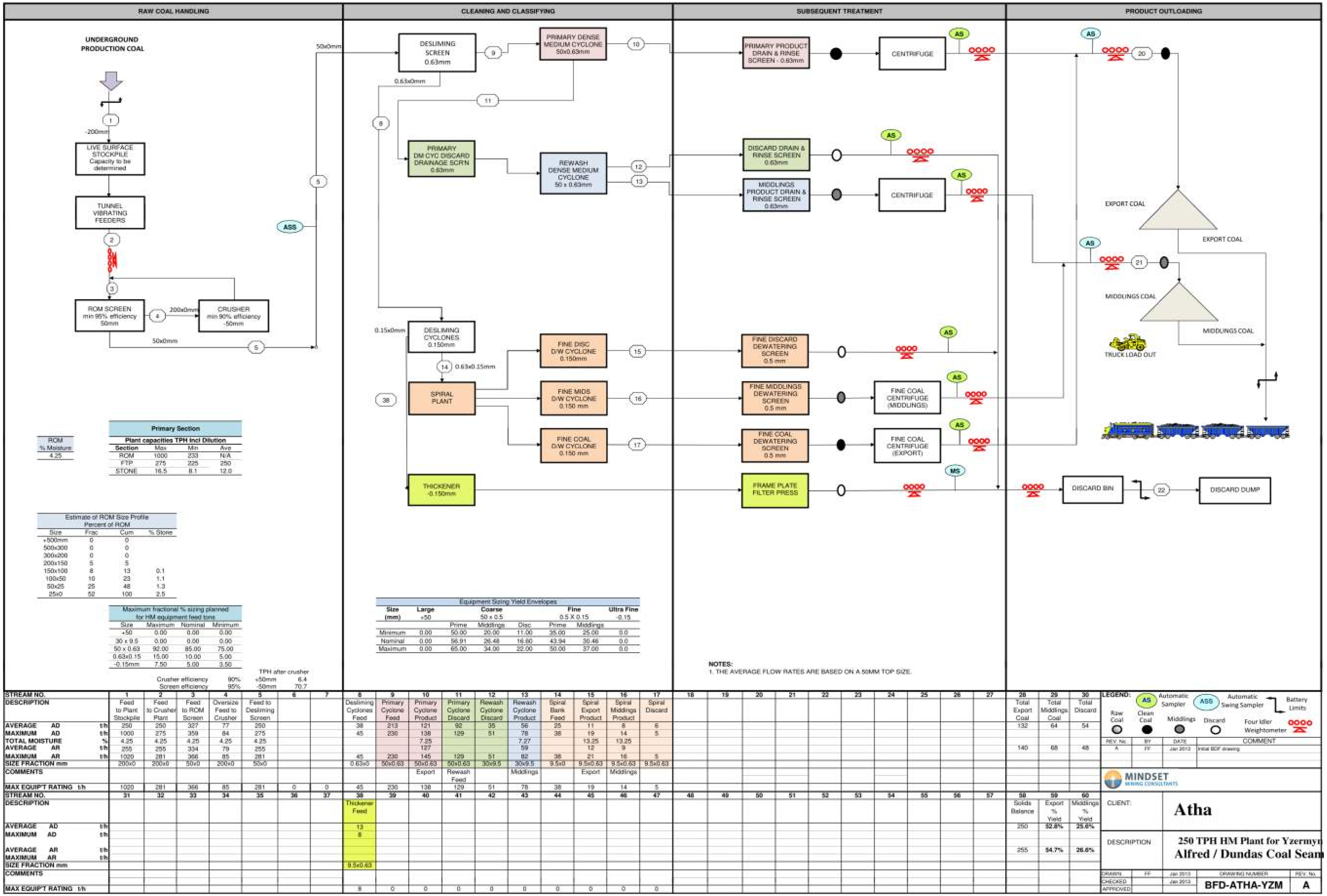


Figure 5-6: Yzermyn Underground Coal Mine Process Flow (Mindset, 2013)

5.4.3 Coal Market

5.4.3.1 Local Thermal Coal Demand and Supply

Currently, domestic thermal coal demand comprises 73.6% of total demand/ production for South Africa. This coal is primarily used to produce electricity by Eskom and industrial applications such as the production of synthetic fuels by Sasol. Increased local demand is expected to be driven by the opening of the Sasol Mafutha plant, an increase in export capacity coupled with increased international demand, the increase in load factor of current power stations, the return to operation of the Grootvlei, Camden and Komati power stations, and the new coal fired power stations (Medupi and Kusile).

South Africa is heavily reliant on thermal coal for power generation, as it counts for approximately 85% of Eskom's installed capacity. Eskom is currently undertaking a 12,000 mW build programme; the fifth largest in the World. This will increase Eskom's capacity from 41,939 MW to 53,939 MW and will ultimately lead to an increased demand of thermal coal. The importance of coal for electricity generation was also identified in 2008 when low coal stocks, poor quality coal, wet coal, inadequate maintenance and technical problems resulted in rolling blackouts across South Africa.

Thermal coal is also used in the industrial sector through the production of steam and process heat for manufacturing applications and the production of coal-based synthetic liquids. Sasol operates two Coal-to-Liquid plants that supply up to 150,000 barrels of synthetic liquids per day, accounting for 20% of South Africa's total liquid fuel supply.

The South African coal industry produced approximately 238.8 million tons in 2009. The Mpumalanga Province contains the bulk of South Africa's marketable coal reserves (62%), located in Witbank, Ermelo and Highveld coalfields. The Limpopo Province contains 32% of South Africa's thermal coal and 88% of the country's coking coal reserve. According to Wood Mackenzie's analysis of existing operations and proposed projects indicates an increase in South African production to approximately 333 million tons per annum (mtpa) by 2015, an increase of some 73 mtpa from 2010. It is envisaged that the production of coal in South Africa may increase to 374 mtpa by 2019 (Mindset Mining Right Application, 2013).

5.4.3.2 Export Demand

Worldwide coal consumption increased from 0.5 billion tons to 7.3 billion tons from 2000 to 2008, representing a 45.5% growth. This was largely driven by China and India's increased coal usage and is expected to continue with China's increasing industrialisation and growth. Although countries such as India and China have extensive coal reserves, there are difficulties exploiting these resources rapidly enough and in some circumstances, with inadequate safety and efficiency. This has resulted in the emergence of large net importers of coal such as China and India, and additional mid-tier importers such as Thailand, Malaysia and Chile (Mindset, 2013).

As noted previously, an amount of 238.8 million tons was produced in South Africa in 2009. Of this amount produced, 175.7 million tons was utilised locally (73.6%) and 63.1 million tons was exported (26.4%). Demand for coal in South Africa is increasing with increased demand for electricity and power. The majority of South African coal is exported via the World's single largest export terminal, the RBCT. The RBCT was upgraded in 2010 which expanded the terminal's capacity to 91 million tons. The rail infrastructure however remains inadequate with the existing rail capacity to the RBCT limited to less than 65Mtpa. It is known that Transnet Limited has committed to expanding the Richards Bay railway line to 81 MTpa in 2014/ 2015.

Current market conditions as well as rising Chinese and Indian coal demand indicate that the requirement for export coal may continue to increase in the future. With the current market assessment rate of between $ 84.57 per ton and $ 88.60 per ton of export thermal coal, demand is available for export coal (mine works programme, 2013).

5.4.3.3 Anticipated Production

The proposed Yzermyn Underground Coal Mine will produce a C grade steam coal (27.5 MJ/kg) for export purposes and a D grade coal (21.5 MJ/kg) for Eskom. Traditional power generators issue annual enquiries for one-year supply contracts. Contracts will be negotiated one year prior to the becoming operational. Marketing surveys indicate that there is a strong demand for C-grade coal on the international market. According to the mine works programme (Mindset, 2013), the following product will be generated from the proposed mine:

Table 5-9: Product Yield Market Split

Product	Total Tons (Annually)	Proportion
Power station D grade coal	597,840	32.6%
Export C grade coal	1,234,032	67.4%
Total	**1,831,872**	**100%**

5.5 Mine Infrastructure, Services and Activities

5.5.1 Power Supply

A power supply is essential for the operation of the mine workings. Power supply infrastructure including transformers and power lines are to be planned in partnership with Eskom, however discussions are still underway and sufficient information is not available for inclusion into this project. Currently, power to the site will not be supplied from Eskom. Should this be identified as a feasible alternative in the future, Atha will be required to undertake a scoping and EIA will be required in terms of the NEMA and an EMPR Amendment will need to be undertaken in line with the MPRDA. An alternative power supply that is considered is the use of diesel generators, which will be utilised for the purpose of this project. According to Mindset (2013), approximately 10 MVA will be required to operate the mining activities.

Five 2 MVA diesel generators will be installed and utilised for power. It is anticipated that the generators will be installed in various stages, with two generators being installed for the construction period and a third for the commencement of mining operations. Within three years, all five generators will be installed and operational.

5.5.2 Water Supply and Requirements

The main user of water in underground operations is the CM machine, where water is used to allay dust at the cutting drum as well as for cooling the picks. Water is applied at all coal transfer points to allay dust as well as on travelling roads. The wash plant is the main water user within the surface operations.

According to Mindset (2013), during the operational phase, the wash plant will require 40,000 m^3 to commence beneficiation activities and an approximate further 1,100 m^3 of make-up water per month to remain operational. A volume of approximately 2,534.4 m^3 of potable water per month will be required for employees and some 440 m^3 for the wash bay per month. In addition, dust suppression activities will require 6,600 m^3 of water per month. Therefore, in order to commence with the operational phase, a secured water volume of approximately 50,674.4 m^3 of water will be required. Thereafter, a monthly demand of approximately 10,674.4 m^3 water will be required to maintain operational activities.

Initial water requirements will be sourced from available groundwater supply and from surface water harvesting. Once mining commences, the recharge from the underground workings will be sufficient to supply all the water requirements for the operation. PCDs will provide provision for water in the case of a lack of supply for various reasons or in the case of an emergency on the mine. The storage facility will also limit the volume of groundwater discharge that may need to be dewatered from underground workings.

It is expected that natural recharge in the underground workings will be sufficient for all underground operations. This water will be kept in closed circulation by making use of underground dams. Water from these dams will be pumped to pollution control dams on the surface where they will be used in the wash plant or treated for potable water. The water will also be used for dust suppression on unpaved roads, coal stockpiles and around the surface layout area.

It will be necessary to apply for a WULA and following commencement of commercial production, Atha may be required to undertake an Integrated Water Use License Application (IWULA) and an Integrated Water and Waste Management Application (IWWMA). A WULA has been compiled and will be made available to stakeholders for review prior to finalisation and submission to the DWA.

5.5.3 Access Routes

Sufficient access roads will need to be established to ensure uninterrupted access to the mine. Currently a 13.6 km gravel road exists which is not considered suitable. The road will need to be upgraded (to a hard surface) to manage anticipated traffic volumes as well as the weight of the vehicles which will be transporting the coal. The paving of the road is also required to minimise the generation of dust during the construction and operational phases.

Depending on the level of design selected for the road construction, it is estimated that the cost will range between R 550,000.00 and R 3,200,000.00 per kilometre. Based on the envisaged production output averaging of 7,250 tons saleable coal to be produced per day, it is calculated that approximately 241 road-haul trucks, will use this road on a daily basis.

5.5.4 ROM Stockpile

Refer to **Section 5.4.1**.

5.5.5 Conveyor System

An ‘open’ conveyor system will be installed in order to transport the ore from the underground working face to the processing plant. It is proposed that additional conveyors may be installed to transfer the discard material to a discard dump, and transport the coal product to an ore stockpile prior to removal by vehicles. Although it was originally indicated that open conveyor systems will be installed, to minimise noise and air quality impacts, the conveyor system is recommended to be closed.

5.5.6 Wash Plant

A wash plant will need to be constructed, which will include a desliming plant, spiral washing plant and a DMS cyclone plant. The ore material from the underground workings will be washed, crushed and screened in the processing plant. The process separates the different grades of coal. The prime grade and middling products will be taken to respective market and only the rejects (19% of ROM) will be stored on the discard dump. Refer to **Section 5.4.1-2.**

5.5.7 Saleable Coal Stockpile

The proposed Yzermyn Underground Coal Mine will produce a C grade steam coal (27.5 MJ/kg) for export purposes and a D grade coal (21.5 MJ/kg) for Eskom. Refer to **Section 5.4.2** for additional information.

7250 tons of saleable coal will be produced per day. This can comprise C grade steam coal (export quality - 27.5 MJ/kg) and D grade coal (poor volatility - 21.5 MJ/kg) or can compromise of one single, mixed product. The saleable stockpile has been calculated to store four days 'storage float'. The stockpile will extend to a length of 70 m and a maximum height of 25 m. The stockpile capacity has been calculated at approximately 30 Kt. This is calculated at 81% product and 19% discard

5.5.8 Co-disposal Discard Dump Facility

Factors of safety will remain in line with accepted South African legislation and best practice. Furthermore, Piezometers may be used during construction to monitor pressure levels, for stability evaluation. The following components will need to be included into the design of the discard dump:

- Clean water diversion trench/bund wall;
- Dirty water/ leachate interception drains and filters; and
- Return water dam.

The co-disposal discard dump facility is expected to act like a dam and it has been assumed that the side walls will be constructed to contain the 50-year storm event runoff. As a result, only the side slopes of the Co-Disposal Facility will contribute to direct surface runoff to the PCDs. Given the lack of design details available for the facility, the side slope areas have been estimated as per the Storm Water Management Plan developed for this project and need to be updated once the design details are finalised. The catchment of the discard dump is separated into the eastern and western portions, with the following areas:

- Eastern co-disposal portion: 49,528 m^2;
- Western co-disposal portion: 57,916 m^2.

According to Mindset (2013), the disposal dump will have the capacity to contain 10.45 Mt of co-disposal discard. The proposed discard dump will be 300 m in length, 100 m in width and will not extend more than 30 m in height. The discard facility will have two PCDs to manage leachate and contaminated runoff. All leachate and runoff will be captured in cut-off toe drains before being pumped to the PCDs for reuse in the process. The discard dump will be underlain with compacted clay in order to reduce the potential for contaminated leachate, seepage and runoff impacting the downstream environment.

As discussed in Section 4 of this report, it is recommended that Atha install a roller-belt filter press to drain excess water from the discard material for reuse in the wash plant, thereby reducing the volume required for make-up water. Furthermore, it has been noted that the discard generated (discard with CV less than 6) from the wash plant can be reprocessed through a beneficiation plant thereby producing a product with adequate CV content to be received by Eskom power stations (Majuba Power Station).

According to Mindset (2013), should this be decided, it is estimated that the plant will have the capacity to reprocess approximately 130 tons of discard per hour. This will minimise the extent of the proposed co-disposal discard dump facility as well as generating additional income as a result of selling the beneficiated discard. This will also eradicate the impacts of the co-disposal discard dump following closure.

5.5.9 Ventilation Shaft

An upcast ventilation shaft is proposed to be constructed in order to assist with air circulation in the mine. An upcast shaft returns air to the surface from the underground workings. Dust, heat and gasses from the underground workings are extracted out of the underground workings via the upcast shaft. Air flow is produced by a main fan which creates a difference in pressure between the shaft systems and the atmospheric pressure at the surface.

The raise boring (*machine that drills a pilot hole following which a 'reamer' is attached to the drill bit after it has intersected the underground mining works. As the drill raises back up to the surface, the reamer drills the overburden material resulting in excavated rock dropping to the floor. This rock is then transported to the surface*) of the 107m ventilation shaft can commence once the area has been developed and will not interfere with actual mining operations, as it can be done in conjunction with coaling and should be complete in one month. According to Mindset, the exhaust duct will extend approximately 3 – 5 m from the ground.

5.5.10 Pollution Control Dam

Three PCDs will be required for the storage of contaminated water originating from the processing plant and other mining activities. Water contained within the PCD will be utilised as process water for the mine. The PCD will be lined and constructed in accordance with the Department of Water Affair's Best Practice Guidelines: A4 – Pollution Control Dam.

The PCDs will serve as temporary storage facilities for dirty water within the mine and contain buffer capacity for surge or excess process water and/ or additional impacts within the process water circuits. These dams will perform a flow balancing or equalisation function. Process water dams are operated from a water conservation perspective in that the retained water is incorporated into the site water balance by returning to the process water systems where appropriate (e.g. as make-up water) (Best Practice Guidelines: A4 – Pollution Control Dams, 2007).

In order to ensure compliance with all South African legislation and codes of practice, the following South African Bureau of Standards[6] (SABS) specifications are recommended for the construction of the PCDs:

- SABS 1200 AD: General (small dams) (1986);
- SABS 1200 DE: Small Earth Dams (1984);
- SABS 1200 DL: Gabions and Pitching (1996);
- SABS 1200 GA: Concrete (small works) (1982);
- SABS 1200 HA: Structural Steelwork (sundry items) (1990); and
- SABS 1200 L: Medium-pressure Pipelines (1983).

Furthermore, the PCDs will comprise:

- 0.8 m freeboard to allow for emergency conditions;
- 2 mm thick HDPE lining to ensure no groundwater is contaminated should this groundwater permeate the water table;
- Embankment widths of 2 m;
- Embankment slopes of 1:2;
- Allowance for small degree of silting up between cleaning cycles;
- Security lights; and
- Personal protective equipment (PPE) such as life jackets and whistles.

According to the hydrology assessment and stormwater management plan, the three PCDs will have a combined capacity of 18,500 m^3 which comprises the following:

- PCD1 – 10,500 m^3 capacity;
- PCD 2 – 3,700 m^3 capacity; and
- PCD 3 – 4,300 m^3 capacity.

Each PCD will be designed to include a sediment trap which will assist with maintenance and cleaning of the PCDs. Sediment traps have been calculated and conceptual designs included in the stormwater management plan (A summary of the stormwater management plan is included in **Section 8** and the full report attached as **Appendix C: Stormwater Management Plan**). The location of the PCDs is illustrated in **Figure 5.7** (Stormwater Management Plan Report, 2013).

[6] Please note that these are recommended codes of practice, additional guidelines, codes of practice, etc. may be applicable.

5.5.11 Clean and Dirty Water Separation

Clean and dirty water systems will be constructed in order to ensure clean and contaminated water is kept separated within the mine area. Stormwater systems will also be constructed, ensuring that clean runoff water cannot become contaminated by any mining activities.

A plan and engineering designs may be developed to ensure that cut-off trenches/ open drains and berms separate the 1:100 “clean” water runoff, from the 1:50 “dirty” water, to divert clean runoff around the PCD’s and discard dump. The PCD’s will be sized to collect the average dirty runoff from the discard dump, mining area and adit entrance, as well as the 1:100, 24 hour storm event. A stormwater management plan has been developed to ensure clean and dirty water are kept separate. Although a cut-off berm of approximately 2 x 2 m will be constructed around the entire proposed Yzermyn Underground Coal Mine surface layout area, it must be noted that the entire area will not be considered ‘dirty’. This is discussed in additional detail in **Section 5.5.12**.

5.5.12 Stormwater Management

Storm water will be managed as per GNR.704 of the NWA: Regulations on use of water for mining and related activities aimed at the protection of water resources (GG 20119 of 4 June 1999). Clean storm water will be directed away from the mining operations using berms and dirty water will be captured within the dirty area and directed towards the pollution control dam for settling and evaporation. The pollution control dam will be sized such that it will be able to contain the runoff from a 1:50 year storm event. The DWA BPG for storm water management will in addition be implemented onsite.

A stormwater system will be installed around the boundary of the mining area. This will act as a clean and dirty water separation system ensuring no uncontaminated runoff enters the mining site. The system will comprise 2 m x 2 m concrete trenches which will be routed to a collection area where water will then be pumped to the PCD for reuse.

According to the stormwater management plan, the area within the cut-off berm is separated into clean and dirty water areas. A summary of the stormwater management plan is included in **Section 8** and the full report attached as **Appendix C: Stormwater Management Plan**.

Figure 5.7 illustrates a graphical representation of the conceptual stormwater management plan indicating the direction of runoff. For the purpose of this illustration, the PCDs are referred to as R1, R2 and R3.

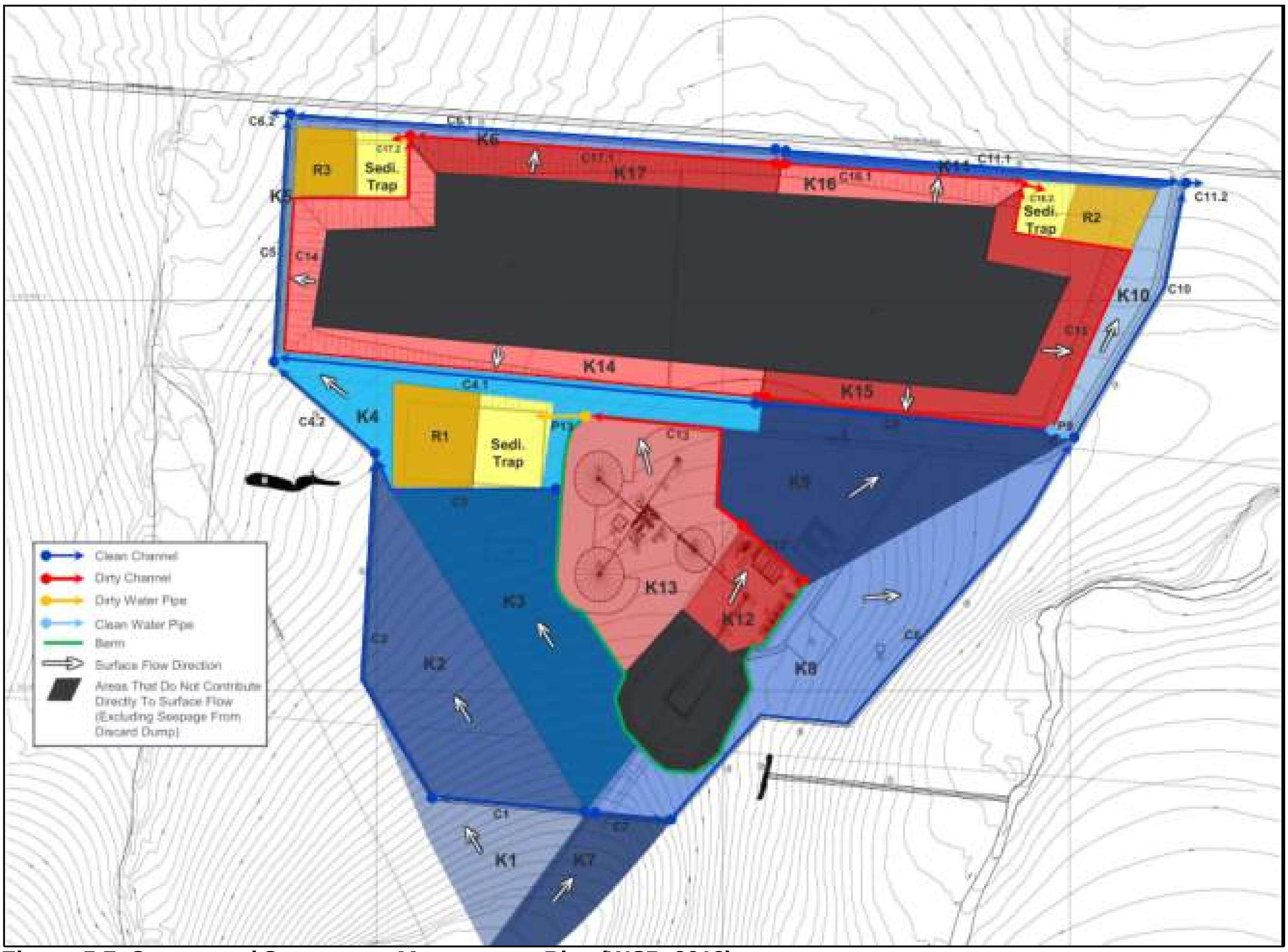


Figure 5-7: Conceptual Stormwater Management Plan (WSP, 2013)

5.5.13 Boreholes

Nineteen groundwater boreholes were drilled for the purposes of this report. A selected number of boreholes were pump tested in order to calculate the yield of the boreholes and potential supply quantities to the proposed Yzermyn Underground Coal Mine. From the pump testing results, only three boreholes produced sufficient supply to be utilised, however, one borehole was drilled into a dolerite sill. Therefore, CBH2D and CBH3S can be used (refer to **Appendix C: Geohydrological Impact Assessment** for a detailed discussion of the pumping results).

Under the assumed pumping regime, approximately 430 m^3/day (12,900 m^3/month) of groundwater could be abstracted. It is however noted that these two boreholes are quite far from the plant (2 – 3.5km). It may be more efficient to undertake a surface geological study to identify water-bearing structures and potential drilling targets closer to the plant. For this purpose, the contact with dolerite intrusions and the faults identified during the prospecting phase can be considered.

5.5.14 Water Balance and Decant Management

The following was taken into account when calculating the water balance for the proposed Yzermyn Underground Coal Mine:

- It has been assumed that water for dust suppression is to be obtained from any of the three PCDs, which will be dependent on a suitable water quality. In the dry season there is expected to be insufficient water held within the PCDs; hence the additional water for dust suppression (16,938m^3/season) will need to be obtained from the mine dewatering activities;
- Due to the dewatering volumes, there is an excess of water expected under all climatic conditions and seepage estimates. It has been assumed that this is treated at the Water Treatment Plant and released to the environment. Taking into account the dry season dust suppression requirements (i.e. 16,938m3/season), the excess abstracted groundwater can be summarised as follows:
  - 209,314 m^3/ season during the wet season and 192,375 m^3/ season during the dry season under the high seepage estimate; and,
  - 35,820 m^3/ season during the wet season and 18,881 m^3/ season during the dry season under the low seepage estimate.
- It must be noted that the mine dewatering volumes have been determined based on the maximum mine void space. As a result, during the initial mine stages where the void space is limited, it is expected that the dewatering volumes will be insufficient to supply the required start-up volume (40,000m^3) and dust suppression volumes (300m^3/day). This water will need to be sourced from alternative sources (e.g. borehole and/or surface water resources) and stored within clean water reservoirs.

Refer to **Section 8.4** for a detailed discussion pertaining to the water balance.

5.5.15 Offices, Control Rooms, Explosives Magazine, Workshops, Ablution Facilities and Parking

Offices, control rooms, explosives magazine, workshops, ablution facilities and parking areas will be required for the mining activities. According to Mindset, portable administration offices will be installed to save costs during the mine establishment phase as well as during the closure and rehabilitation phases. Workshops for mining maintenance will be required to be constructed. Furthermore, the construction of a treatment facility for sewage may be required for the mine. Parking bays will be provided for employees. This area will be paved with light duty 50 mm concrete paving blocks.

There is provision for a bus parking, shelter and drop-off facility located to the east of the platform area. The drop off facility will allow mine workers to be dropped off and picked up safely, ensuring the least amount of pedestrian movement across roadways. The drop-off surfacing will be paved with light duty 50 mm concrete paving blocks.

The explosives magazine will be constructed to the requirements of the OHSA with specific reference to GNR.109 of 2003: Explosives Regulations. The explosives magazine will also comply with the requirements of the Fire Brigade Services Act (No. 99 of 1987) and ensure all fire-fighting appliances and emergency equipment provided in the magazine are so placed and kept that they are readily visible, accessible and available. It is assumed that not more than 1,000 kg of explosive will be stored within the explosives magazine. According to GNR.109 of 2003, the magazine will need to be constructed taking cognisance of the following table:

Table 5-10: Safety Distance of Explosives Magazine (based on 1,000 kg of Explosive)

Class of Explosive	From Magazines (m)	To Process Buildings (m)	To Railways, roads, etc. (m)	To Public Buildings (m)
1.1 and 1.5	24	56	75	150
1.3	14	32	32	63
1.2 and 1.4	9	10	18	36

An area to destruct un-exploded explosives will need to be constructed and should be designed in accordance with GNR.109 of 2003: Explosives Regulations. Destruction should only be undertaken by a registered professional. During the operational phase, expired and unused explosives may need to be suitably disposed of. The NEMWA does not make provision for the disposal of explosives; this is regulated by the Explosives Act (Act No. 15 of 2003) (Explosives Act). Section 10 of the Explosives Act requires that all explosives be kept, stored and transported in accordance with the conditions of an issued permit and any other applicable regulations. Atha will need to apply for a permit in this regard.

5.5.16 Vehicle Wash Bay

The vehicle wash bay will be constructed of a steel portal frame with sheeted roof and sheeted side cladding. The vehicle wash bay structure serves two purposes. The first purpose is to accommodate the washing of the various mine vehicles. The building will be equipped with high pressure washing systems, vehicle hoists, and vehicle ramps to allow washing from all angles. The second purpose of the structure is to allow for vehicle servicing. The hoists allow the vehicle to be elevated for easy access to the underside of the vehicles.

All wash water will be directed into an underground pipe system and discharged into an oil trap. Water flowing through the oil trap will be discharged into the PCD for reuse.

5.5.17 Aboveground Storage Tanks

10 x 15,000 m^3 aboveground storage tanks will be installed according to SANS 10089 Part 1 (2008). The tanks will be constructed within non-permeable bunds, and all water collecting in the bund will be required to pass through an oil separation system before being pumped to the PCD. Dangerous substances such as diesel, hydraulic oil and gear oil will be stored within the tanks. Please note that additional 210 l drums may also be utilised to store these dangerous good, however, all storage will be within non-permeable bunds (refer to **Section 5.6.18: Hazardous Substance Storage** below for additional information).

5.5.18 Hazardous Substance Storage

A hazardous substance storage structure will be constructed in accordance with SANS 10089. All dangerous goods utilised onsite will be stored within the hazardous substance storage facility. The facility will have all necessary fire fighting equipment as well as adequate ventilation.

5.5.19 Sewage Treatment Facility

A sewage treatment plant will be constructed onsite. According to Mindset, the sewage plant will have the capacity to store and treat enough sewage waste for 300 people. Although the mine will require more people to operate, the mining will be conducted in shifts, and it is anticipated that no more than 300 employees will be onsite at any one time.

The sewage plant will comprise a septic tank and will be serviced on a monthly basis by a private contractor. The honey-sucker will transport the sewage to a permitted disposal facility at Piet Retief or Volksrust. No untreated sewage will be discharged from site.

Toilet facility requirements for the underground workings will be met with water-less toilets that will be brought to the surface when full for pumping to the sewage treatment plant.

5.5.20 Water Treatment Plant

It is anticipated that waste water and water containing contaminants may be generated. Therefore, a water treatment plant will be required for the mine. The water treatment plant may be contracted to a third party and constructed with capacity to supply surrounding communities with potable water; however a Water Transfer Permit will need to be obtained from the DWA prior to supplying communities with water. It is anticipated that the water treatment plant may be required to be operational following mine closure; in order to treat decant from the mine. It is proposed that a package water treatment plant be installed that will chemically dose water to meet the requirements of the mine.

Should this dosing be deemed not sufficient, the plant will be upgraded to incorporate a reverse osmosis treatment system. The brine will be routed through a brine treatment process, referred to as freeze crystallisation, which removes purified solvent from the brine as frozen crystals by slowly freezing the solution containing dissolved contaminants. The result is a near perfect water stream and salt crystals that will be removed from site by a registered waste contractor and disposed of as hazardous waste.

Following mine closure, if decant occurs, water may be treated depending on the quality of the decant. The selection of an appropriate water treatment process will be dependent on the mine decant volumes, decant water quality, and the water quality in the receiving watercourse at the time.

5.5.21 Railway Siding Infrastructure

According to Atha and Jindal, the railway siding infrastructure as the Piet Retief Siding is considered adequate to accommodate the volume of saleable coal that is to be generated at the proposed Yzermyn Underground Coal Mine. Agreements will be set in place by Jindal of which Atha will be required to comply with.

5.5.22 Waste Management

According to the MPRDA, mining residue stockpiles can be defined as any debris, tailings, slimes, screening, slurry, waste rock, foundry sand, beneficiation plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated for potential reuse, or which is disposed of, by the holder of the mining right, mining permit or production right.

According to the NEMWA, waste is defined as “any substance, whether or not that substance can be reduced, reused, recycled and recovered:

a. That is surplus, unwanted, rejected, discarded, abandoned or disposed of;
b. Which the generator has no further use for the purposes of production;
c. That must be treated or disposed of; or
d. That is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but—
    i. A by-product is not considered waste; and
    ii. Any portion of waste, once re-used, recycled and recovered, ceases to be waste.

Waste storage areas for the temporary storage of general and hazardous waste that may be generated from the mining activities will need to be constructed. The waste storage and handling facilities will be constructed in accordance with the requirements of Section 21 – 25 of the NEMWA and will also take cognisance of the draft national norms and standards for the storage of waste (Notice 436 of 2011). Furthermore, the waste generated as a result of the mining activities will be classified in terms of the draft national norms and standards for waste classification and management regulations (Notice 614 of 2012). It must be noted that no waste will be disposed of at the Yzermyn Underground Coal Mine.

5.5.22.1 General Waste Management

General waste, as defined by the NEMWA, means waste that does not pose an immediate hazard or threat to health or to the environment, and includes:

a. domestic waste;
b. building and demolition waste;
c. business waste; and
d. inert waste.

General waste that is to be generated by the mining activities will be temporarily stored onsite according to the requirements of the NEMWA and draft regulations (GNR.436 of 2011), collected by an independent waste service provider and disposed of at a licensed general waste site. Where applicable, the hierarchy of waste management will be implemented in order to avoid, reuse, recycle and reduce the volume of general waste generated by the proposed mining activities.

5.5.22.2 Hazardous Waste Management

The definition of hazardous waste in accordance with NEMWA refers to any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.

Examples of hazardous waste include certain solvents, grease, used oil, fluorescent light bulbs, spilled chemicals and fuel, etc. All hazardous waste will need to be collected and temporarily stored in suitable receptacles located on an impermeable, bunded surface and covered. Hazardous waste will be collected by an independent waste service provider and disposed of at a permitted hazardous landfill site.

5.5.22.3 Mine Residue Waste Management

Therefore, residues generated from the beneficiation of coal and waste rock produced from mining activities are excluded from the ambit of the NEMWA; however, best practise will be applied to the mine residues. It is anticipated that fines will be produced from beneficiation activities that can be used as saleable coal. Furthermore, coal spillages from loading of product coal onto trucks may also be produced. The beneficiation/ wash plant and coal stockpiling/ loading areas will be constructed on hardstanding for ease of cleanup and collecting of coal that can be placed on the vehicles transporting product coal.

Waste rock generated from initial adit development activities and waste rock generated from the mining activities (including beneficiation activities) will be transported by conveyor to a discard dump. Similarly, discard material generated during beneficiation activities will be transported and stockpiled on the discard dump.

5.5.22.4 Management of Effluent and Waste Water

All effluent and waste water from the ablution facilities (excluding toilets which will be routed to the sewage treatment plant), wash plant and vehicle wash bay will be routed to the PCD for storage. It is anticipated that effluent generated from the wash bay will undergo primary treatment through an oil-skimmer/ oil separation system in order to reduce hydrocarbons within the effluent prior to pumping into the PCD.

Effluent and waste water originating from the underground workings may contain sewage, hydrocarbons and nitrates from explosive residues. This water will be required to undergo treatment before being discharged into the PCD.

5.6 Socio-economic

5.6.1 Employment

It is anticipated that a total of 576 people will be required to operate the mine when in full production, with eight operating sections, based on a 2-shift operation. Please note that this number does not include contractors. It has been noted that the employment numbers for the first two years will be 280 (Year 1) and 425 (Year 2) people with 576 employees required from the third year. The breakdown of labour is detailed in **Table 5.10** below:

Table 5-11: Employment Breakdown

Category	Year 1	Year 2	Years 3+
Senior Management	5	6	7
Professional qualified and experienced specialist and mid-management	8	12	15
Skilled technical and academically qualified workers, junior management, supervisors, foreman and superintendents	67	94	137
Semi-skilled and discretionary decision making	200	313	417
Total	**280**	**425**	**576**

It is proposed that semi-skilled and unskilled labour will be obtained from the Gert Sibande District Municipality, specifically from the Pixley ka Seme Local Municipality and Khondo Local Municipality, subject to the recommendations contained within the Social and Labour Plan (SLP). It has been conveyed that where practicable, employment will be sourced locally with the intent to develop local skills required by the mine.

However, the more highly skilled personnel such as Artisans, Foremen, Shift and Mine Overseers and Mining and Mechanical/ Electrical Engineers will be more difficult to source, and may be sourced on a National level. Piet Retief is not situated in a recognised mining area and is a considerable distance away from large city centres or traditional mining areas where the required skills will be able to be sourced.

Underground operations manage 2- or 3-shift per day operation for 5-days, followed by a single shift on the sixth day and no production on the seventh day. Different shift systems can be considered to provide optimal efficiency and equipment utilisation. An additional 24 hour Full Calendar Operation (FULCO) system may be utilised that will provide for a 7-day, 24 hour operation employing four teams of personnel on a rotational basis.

The mine, once operational will be required to implement an Employment Equity Plan in accordance with the Mining Charter where at least 40% of management personal will be Historically Disadvantaged South Africans on the appointment of senior staff and 10% of the workforce across the board, specifically those involved in core mining activities, will comprise woman within 12 months from the commencement of commercial production.

5.6.2 Transportation and Housing

It has been noted that no accommodation will be provided for employee's onsite. Employees will be sourced from surrounding local communities. Transport will need to be made available to covey employees from nearby communities to the mine, and visa-versa. Opportunities may exist for the establishment of a local transport company which could be contracted to the mine. It is important to note that housing allowances, as well as traveling allowances have been included in the employees' salaries.

5.6.3 Economics

According to the mine works programme (2013), a primary product price of US$ 85 per ton based on the RBCT API4 Index and a secondary product price of ZAR 9.5/ GJ or R 199.50 per ton, based on current Eskom supply prices was used in the cash flow.

5.7 Decommissioning and Closure

A risk based closure assessment will be undertaken approximately five years prior to closure of the mining operations to identify the most appropriate/ ideal scenario for closure planning. The following steps will be undertaken in order to quantify the final closure plan:

- Establishment of a multi-disciplinary closure team which will manage all facets of the closure phase. This team will consist of a project manager as well as relevant technical and production expertise (including engineers and environmental specialists). Objectives for the team will be clearly defined in collaboration with the relevant authorities.

- Identification of equipment, machinery, vehicles, structures and infrastructure, buildings and land that must be removed/ decommissioned/ remediated will be identified and quantified by a Quantity Surveyor. Aspects associated with the sale of assets will be arranged at the same time tenders will be invited for the removal and demolishment of fixed equipment, structures and infrastructure. Other assets will either be sold or held in a trust until change of ownership has been negotiated and finalised. It will also be required of management to introduce action programmes prior to closure to prepare employees and the community of this event, as detailed in the SLP.
- Once all equipment, machinery, vehicles, structures and infrastructure have been either sold, removed, etc., the demolition and disposal of foundations, concrete works and access roads will commence. Please note that the road network from the Dirkiesdorp town to the mine entrance will remain. All rubble will be disposed of in a permitted site and no waste will be disposed of onsite.
- Following the demolition and removal of assets, rehabilitation and remediation of the disturbed areas associated with the site will commence.

It is not possible to provide an accurate estimate of the duration for the closure and rehabilitation phase as overlap will occur. It is expected that the first year after cessation of mining activities, efforts will be focussed on removal/ selling off of equipment, machinery, vehicles, buildings, structures and infrastructure. It can be estimated that the demolition of structures and infrastructure and rehabilitation may continue for a further 24 months prior to the commencement of the decommissioning monitoring and audit phase.

The post decommissioning phase (aftercare) of monitoring (and remedial action) is expected to continue for approximately 10 years before the target area could be declared stable and safe.

6 Remainder Portion for Future Assessment

6.1 Remainder Area

It has been noted that the proposed mine will have an anticipated life of mine of approximately 15 years with possibilities for extensions based on existing resources in the remainder area within the prospecting boundary. Mindset has indicated that a potential area for future mining may be available which comprises the following farms (as detailed in Error! Reference source not found. below). The remainder area will need to be explored in detail and cognisance of environmental sensitivities will be taken into account. Please note that Atha will be required to undertake a separate ESIA process prior to mining in this area in accordance with the relevant South African environmental legislative requirements.

Table 6-1: List of Farms Comprising the Proposed Remainder Area

Farm	Portion	Reg Div	Province	Extent (ha)
Bloemhof 92	The Farm	HT	Mpumalanga	329.09
Goedgevonden 95	The Farm	HT	Mpumalanga	739.45
Kromhoek 93	The Farm	HT	Mpumalanga	1184.73
Paardekop 109	The Farm	HT	Mpumalanga	400.05
Virginia 91	The Farm	HT	Mpumalanga	925.40
Yzermyn 96	Remaining Extent	HT	Mpumalanga	826.16
Zoetfonetin 94	The Farm	HT	Mpumalanga	553.81

The remainder area is approximately 4,500 ha in area and is illustrated in the aerial image below. Please note that only initial exploration activities have been undertaken on the site and the area still requires additional exploration drilling in order to assess the coal reserve. According to Mindset, the coal within the remainder area has the following characteristics:

Table 6-2: Coal Characteristics of Remainder Area

Seam	Seam Width	Area (m^2)	Volume (m^3)	Gross Tons In Situ
Alfred	1.70 m	32,008,575.00	54,414,577.50	85,430,900
Dundas	1.65 m	15,993,540.00	26,389,341.00	41,431,300

The images below illustrate schematic design of the remainder area indicating the additional Alfred Coal Seam resources (Figure 6-1) and the additional Dundas Coal Seem resources (Figure 6-2).

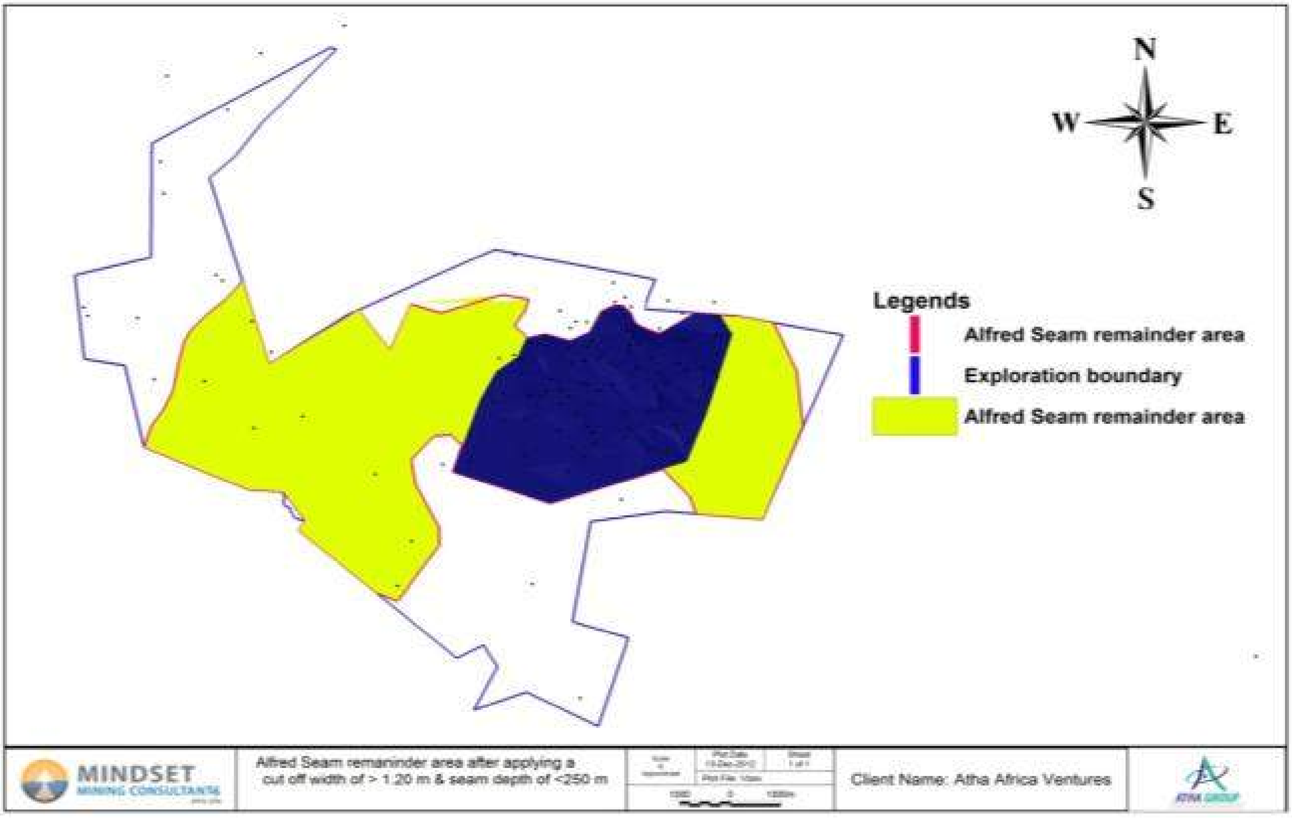


Figure 6-1: Schematic Design Illustrating Alfred Coal Seam (Source: Mindset, 2013)

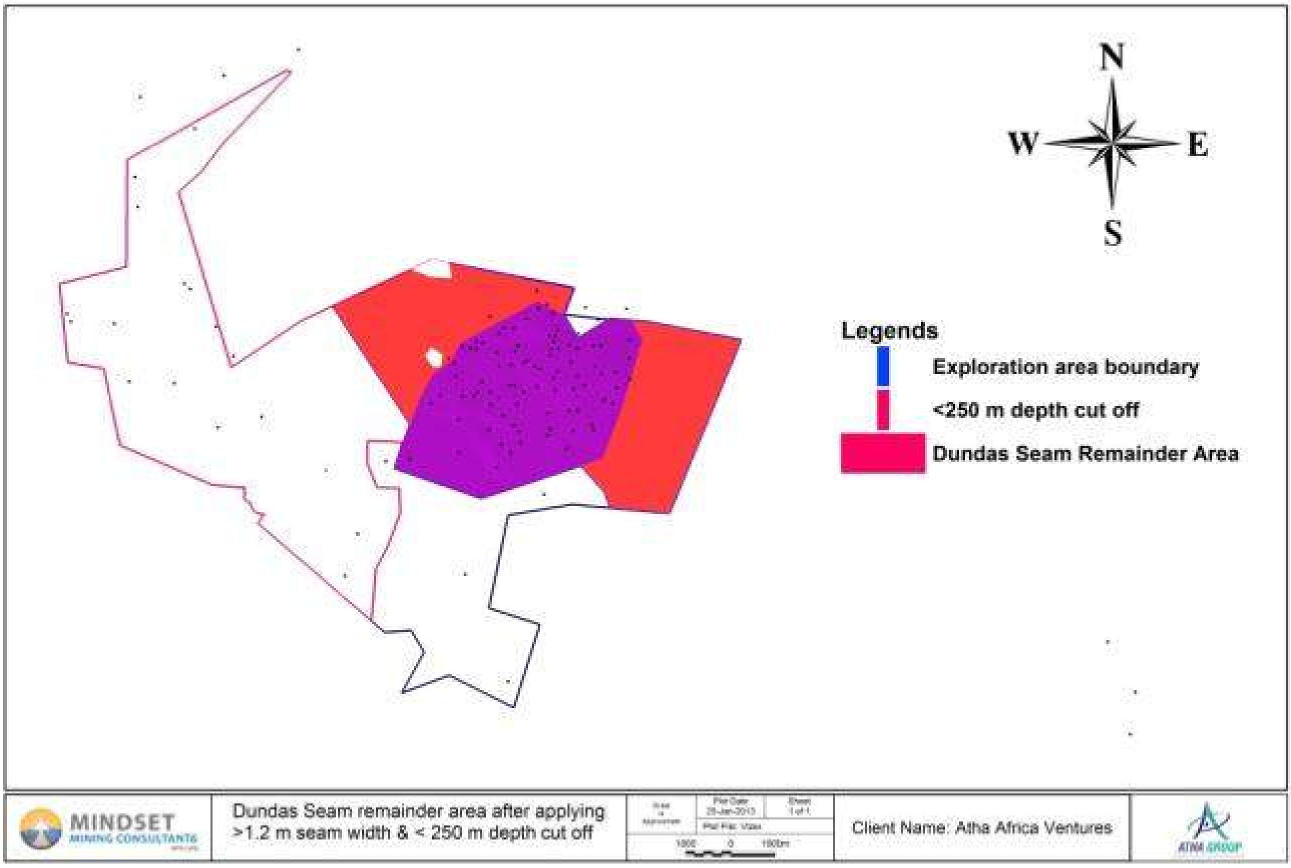


Figure 6-2: Schematic Design Illustrating Dundas Coal Seam (Source: Mindset, 2013)

6.2 Feasibility Assessment of Remainder Area

As per the request of the DEA in a letter dated 9 October 2013, a brief summary of the implications of the remainder area not being feasible and the impacts of the life of mine are detailed below.

Atha is currently identifying the feasibility of the coal reserves within the remainder area. Geological features such as dykes and faults will need to be delineated as part of the exploration activities as this will have an impact on the cost of mining in the remainder area and subsequent feasibility of mining in an area with such complex geologies.

Though the historical exploration in remainder area of prospecting right indicated additional coal resource would require detailed prospecting to identify the feasibility for extension of future mining beyond the target area. Based on the technical studies on exploration data, an area of 1500 hectares of remainder area has been identified as feasible coal bearing for future mine extension. Further detailed exploration in remainder area planned was taken up for during June 2013 and expected to complete by end of October 2013. Thus, in total, the Yzermyn Coal Mining project is expected to cover approximately 4000 hectares.

Currently, the life of mine has been calculated to be 15 years. Should the remainder area be feasible, this will extend the initial life of mine for the project. It is anticipated that no additional adit locations will need to be developed in order to mine the remainder area, however, infrastructure such as ventilation shafts may be required. The remainder area may have the potential to increase the life of mine by an additional 5 – 10 years. It must be noted that the additional years described above are only indicative, and will need to be substantiated following the completion of exploration drilling activities. If the remainder area is not considered feasible, currently, the mine will have a life of mine of approximately 15 years, following which the mine may commence with closure activities.

7 Baseline Setting

As required in section 31(2) of the NEMA Regulations, 2010, this Section includes a description of the environment that may be affected by the activity and the manner in which the biophysical, social, economic and cultural aspects of the environment may be affected by the proposed activity.

The baseline environmental and socio-economic conditions were obtained from the following data sets:

- Topographical maps and aerial images

  Maps and aerial images assist in identifying existing and previous land uses, landscapes (ridges, plateaus, rivers, etc.) and establishing regional overviews of the prospecting area, target area and surrounding area.

- Environmental Potential Atlas for South Africa (ENPAT).

  The ENPAT proactively identifies potential conflicts between proposed developments and critical or sensitive environments. The ENPAT consists of two sets of information – natural/ environmental characteristics, and socio-economic factors. The environmental maps comprise geology, land types, soils, vegetation, hydrology, etc. Socio-economic factors include cadastral aspects and infrastructure, culture, cultural heritage, etc. The sets of information are combined in order to identify the environmental or socio-economic sensitivity of the area.

- Literature review

  Existing screening reports undertaken for the project area, state of the environment reports, environmental management framework reports, integrated development plans, published articles, scientific articles and general information relating to the area has been considered.

- South African National Botanical Institute (SANBI).

  The SANBI map of vegetation types of South Africa has been assessed in order to identify the sensitivities of the surrounding biodiversity.

- Field investigations and site visits

  A number of specialists have been out to site in order to obtain baseline information relating to aspects such as flora, fauna, wetlands, cultural heritage, traffic, etc.

The baseline environmental and socio-economic conditions are required in order to establish a high-level understanding of the sensitivity of (specifically) the target area.

7.1 Geology

7.1.1 Regional Setting

Coal deposits in South Africa are located within sedimentary rocks in the Karoo Supergroup, a large retro-foreland basis which developed on the Kaapvaal Craton and filled between the Late Carboniferous and Middle Jurassic periods (between approximately 360 – 144 million years ago). The Karoo Supergroup comprises 19 coal seams and is approximately 10 – 15 km thick (**Figure 7-1**). The Karoo Supergroup is lithostratigraphically subdivided into the Dwyka, Ecca and Boufort groups, succeeded by the Molteno, Elliot and Clarens Formations and the Drakensburg Formation (South African Committee for Stratigraphy, 1980).The coal seams range in age from Early Permian (Ecca Group) through to Late Triassic (Molteno Formation) and are predominantly bituminous to anthracite in rank, which is a classification in terms of metamorphism under the influence of temperature and pressure (Competent Persons Report, 2009).

Of most importance is the coal bearing Ecca Group, which was deposited in a marine environment, dating between 280 and 250 million years old. It consists predominantly of dark-grey shale which is carbon-rich in places, with interlayered sandstone (Simplified Geology of the Northern Cape Province, 2012). The Ecca Group is subdivided into the Pietermaritzburg, Vreheid and Volksrust Formations. The Vryheid Formation of the Ecca Group contains primarily economical important coal seams (Competent Persons Report, 2009).

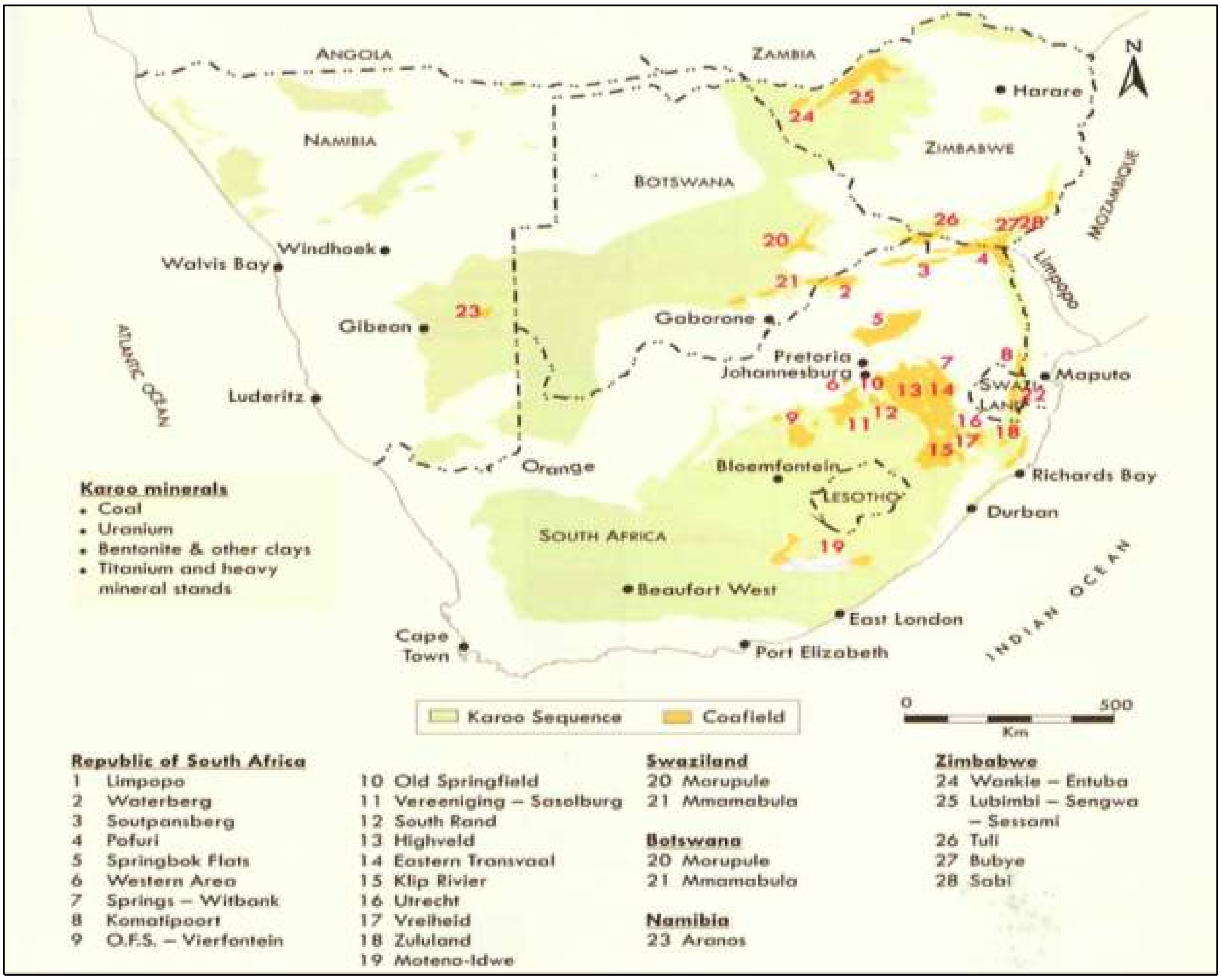


Figure 7-1: Major Coalfields of Southern Africa (Source: Hochreiter, 2011)

7.1.2 Local Setting

The proposed Yzermyn Underground Coal Mine is located within the Vryheid Formation of the Karoo Supergroup, on the northern boundary of the Utrecht Coalfield. Primary economic coal seams formed in the Utrecht Coalfield are the Alfred and Dundas seams. Numerous dolerite intrusions (dykes and sills) intrude the Vryheid Formation, influencing the stratigraphy of the area and quality of the coal (Competent Persons Report, 2009). According to Jeffrey (2005), the Utrecht Coalfield has seams rich in moderately good coking coal and require little beneficiation. The Lower Dundas seam rank varies from medium volatile bituminous to anthracitic, with the coal mined as a source of bituminous coal in the north eastern sector of the coalfield and as anthracite in the southern sector. However, the sulphur content can be high (in excess of one per cent).

The Gus seam is subdivided into three coal quality zones with the upper part comprising mainly dull coal, the central part predominantly bright coal and the bottom section mainly poor quality coal with shale partings. The seam has been noted to have elevated methane gas concentration. The Alfred seam is of better quality in the Utrecht Coalfield, particularly towards the bottom portion of the seam. The seam is generally high in ash and sulphur content but beneficiation can produce relatively high quality, low ash coal with low sulphur and phosphorus (Jeffrey, 2005).

According to the Competent Persons Report (2009), the Alfred and Dundas coal seams are of economic significance with each seam thickness exceeding 1.2 m with suitable qualities within the target area. The two coal seams are discussed below. It has been noted that other seams such as Torbanite, Eland, Gus and Targus seam may also be identified in the target area.

7.1.2.1 Alfred Coal Seam

The Alfred seam in the target area is expected to be located over the total width of the project site approximately 150 m below the surface, with an average seam thickness of 1.65 m. The raw air-dried calorific value (CV) of the Alfred Seam in the target area varies at 26.5 MJ/ kg in the northwest to 22 MJ/ kg in the east. The average volatile matter (VM) content for the Alfred Seam is 19.74%, with a maximum of 22.5%. The practical yield of the first wash coal from the Alfred Seam averages 55% over the target area with a maximum of 75% in the northwest decreasing to 59% in the east (based on RB1 specification coal of 27 MJ/ kg). For second wash coal (i.e. middling), the average yield is around 26.5%.

7.1.2.2 Dundas Coal Seam

The Dundas coal seam is mineable over the total width of the target area, with an average seam thickness of 1.66 m. The Dundas coal seam is located approximately 30 – 40 m below the Alfred seam, and thins to the east of the target area with a thickness of approximately 1.2 m. The raw air-dried CV of the Dundas Seam stretches from 27.8 MJ/ kg in the north of the target area to 24.3 MJ/ kg in the south. The average VM content for the Dundas Seam is 20.1%, with a maximum of 22.5%. The practical yield of the coal from the Dundas Seam averages 54.7% over the target area with a maximum of 75% in the northwest decreasing to 58% in the east (based on RB1 specification coal of 27 MJ/ kg). For the second wash coal (i.e. middling), the average yield is around 26.5%.

7.2 Topography

7.2.1 Regional Setting

According to the Mpumalanga Department of Agriculture and Land Administration, the Mpumalanga Province ranges from 0 m to approximately 2,200 m (Resource Information Report: Mpumalanga, 2005). **Table 7-1** below represents the elevation, hectares of land which occur within the specific elevation, and the percentage of land that comprises the specific elevation.

Table 7-1: Topography of Area

Range (m)	Area (ha)	% of Area
0 – 500	147 227 935	18.6
501 – 100	64 018 237	8.1
1001 – 1500	154 372 203	19.4
1501 – 2000	426 274 303	53.6
2001 – 2200	2 381 422	0.3

7.2.2 Local Setting

According to the ENPAT of South Africa, the prospecting area comprises rolling hills and is located within the 'Low Mountains' landform. Slopes approaching 20% are present in the vicinity of the watercourses located within the south-western portions of the site. The highest elevations (1,900 – 2,300 m above mean sea level) are located within the southern part of the study area. The slopes become less steep (approximately 5%) within the north-eastern part of the study area where the lowest elevation is 1,415 m.

The elevation of the target area ranges from 1,765 masl to 1,470 masl. Hills, ridges, plateaus and valleys form the landform of the target area. A central hill marks the highest point in the area, arising 1,765 masl. The project area slopes in a north easterly direction, towards a watercourse that flows northerly. The hills and ridges are of particular importance as they provide for high spatial heterogeneities, thereby likely to sustain faunal and floral species of conservation importance.

A valley exists to the south of the hill and runs in a south-westerly direction (1,559 masl). A rocky escarpment (1,602 masl) with a sharp cliff face descending into a valley (1,496 masl) to the north of the proposed site runs from east west. The proposed site for the mine adit entry and surface infrastructure is to the north west of the central hill and is an area where the ground slopes downward. **Figure 7-2** illustrates the cross profile of the target area as indicated from north to south, and east to west. The north to south profile (Y-axis) has an average slope of 12% with point 'a' noted to be 1,538 masl and point 'b' 1,372 masl. The west to east profile (X-axis) has an average slop of 7.1% with an altitude at point 'c' being 1,630 masl, and 'd' of 1,511 masl.

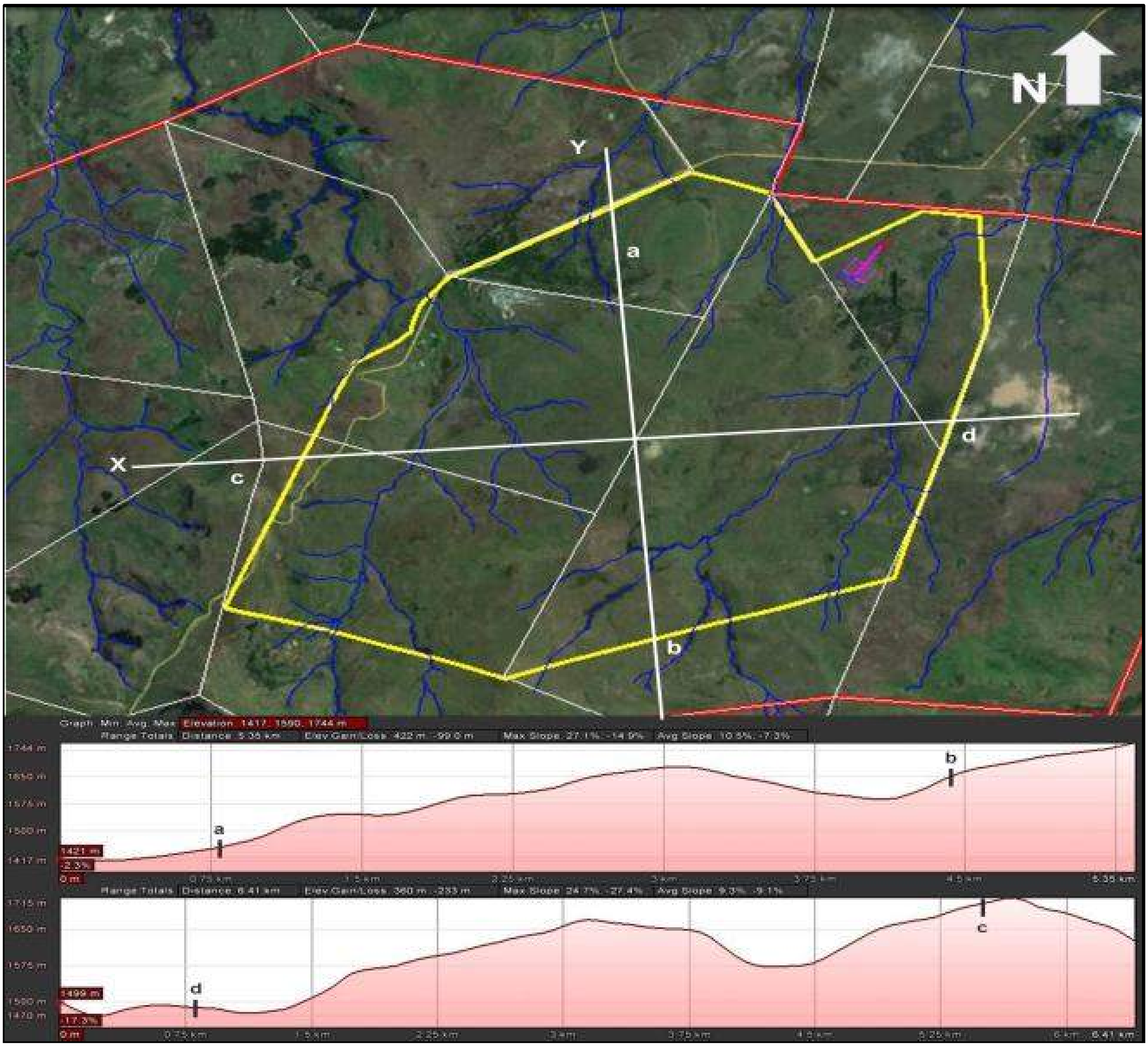


Figure 7-2: Cross Section of Yzermyn Mine Target Area (Source: Google, 2012)

The location of the surface layout area is relatively flat, bordered by two river systems on the west and eastern side. The area slopes gently to the north. The location of the adit is located on the northern slope of a granite outcrop. The location of the discard dump is flat, with all surface runoff being directed to the proposed stormwater drain trench. **Figure 7-3** illustrates the surface layout area indicating the 20 m contour lines. **Figure 7-4** illustrates the elevation and profile map of the surface layout area which is discussed in detail in **Appendix C: Visual Impact Assessment**.

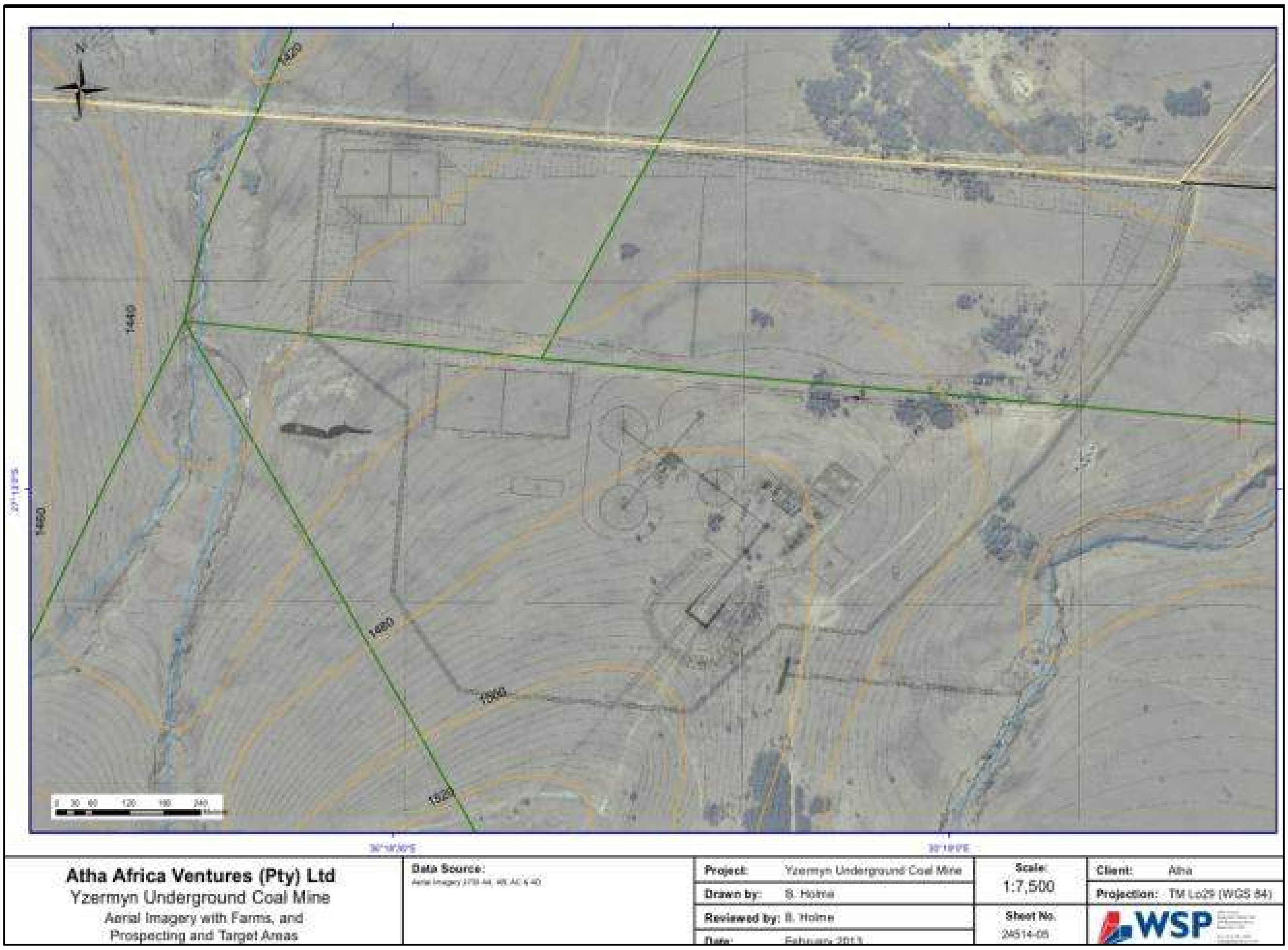


Figure 7-3: Topographical Illustration of the Surface Layout Area

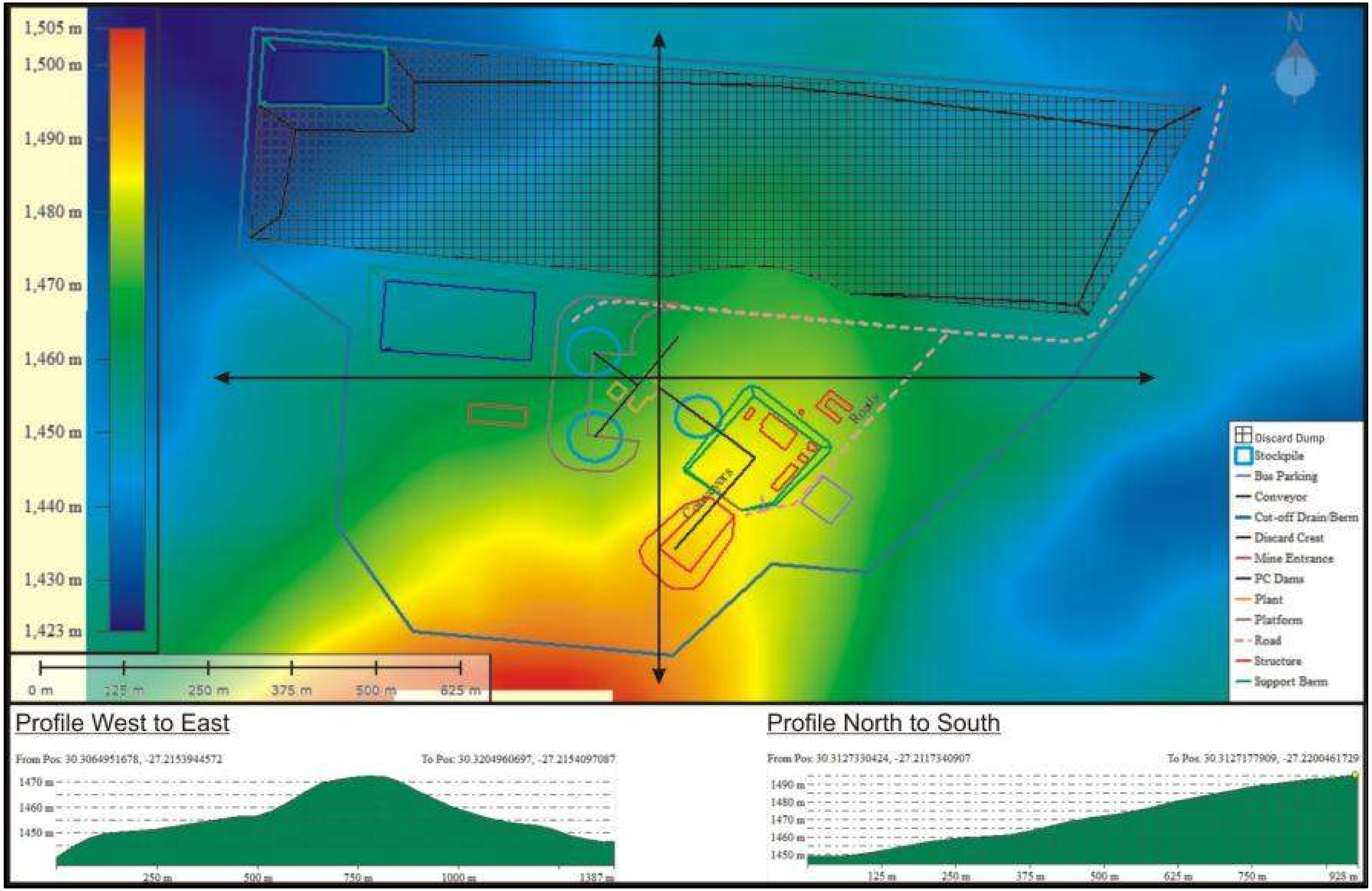


Figure 7-4: Elevation and Profile Map of the Preferred Surface Infrastructure Layout Area (Source: VRM, 2013)

7.3 Soils

7.3.1 Regional Setting

According to the Pixley ka Seme Local Municipality Environmental Management Framework (2011), the majority of land surrounding the prospecting area has loam clay/ loamy soils. High potential arable soils are restricted to the north-eastern portion of the Pixley ka Seme Municipal boundary.

7.3.2 Local Setting

Based on the Department of Agriculture, Forestry and Fisheries (DAFF, 2012), soil class mapping, the soils to the south-west of the study site, located on the crest of the steep hills, are defined as non-soil land classes which will limit land-use options (**Figure 7-5**). Land type mapping for these soils indicates that the rock dominates. Based on the expected geology for the site, where soils are present, these typically comprise sandy clays of a depth ranging between 200 mm and 400 mm. Typical soil forms are Mayo, Milkwood and Shortlands (DAFF, 2012).

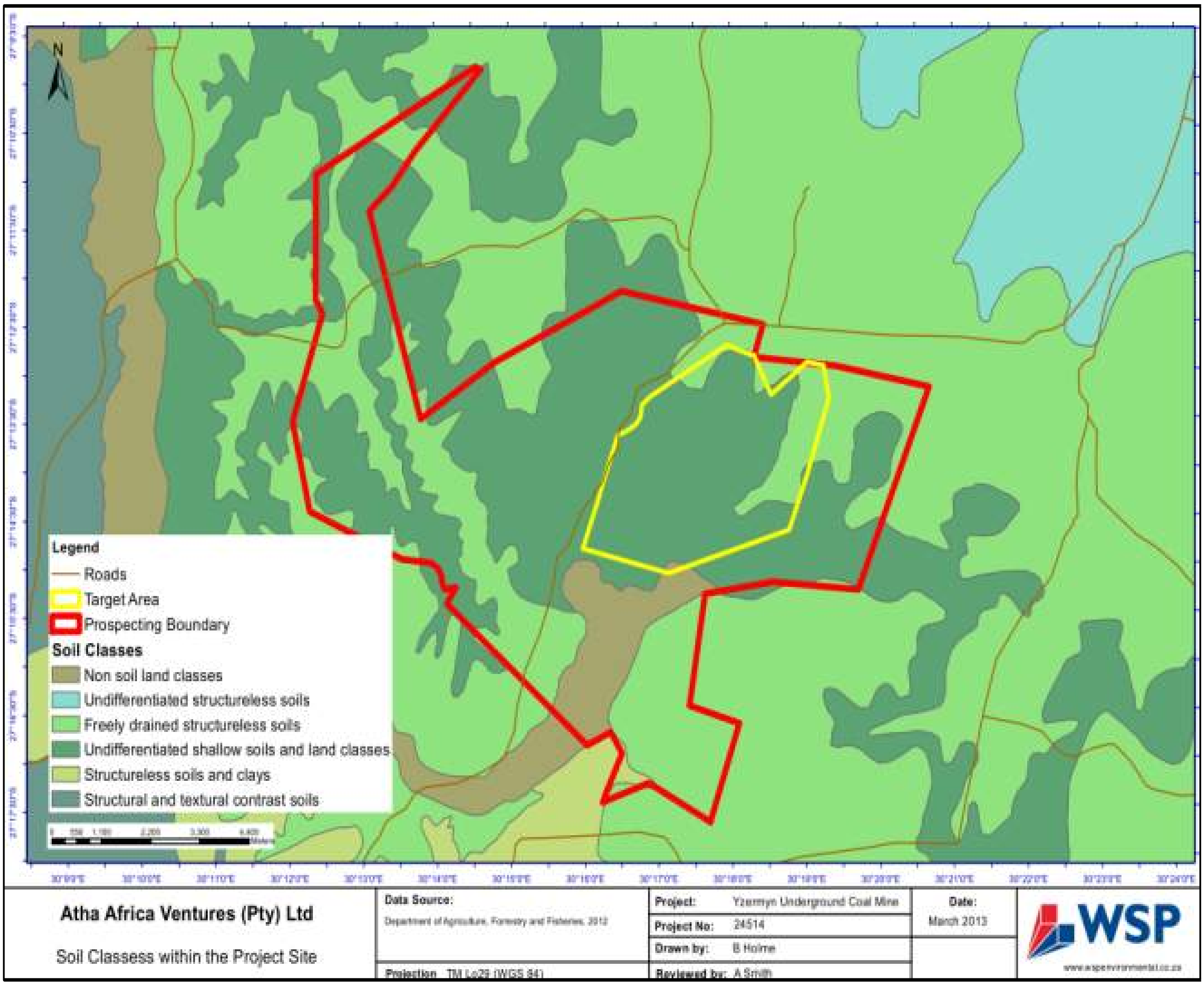


Figure 7-5: Soil Classes within the Yzermyn Mine Prospecting Area (Source: DAFF, 2012)

Within the northern portion of the site where the terrain remains hilly, although not as steep as the south-western portions, the crests and upper slopes of the hills are dominated by soils with minimal development. These soil classes are also present within the valley bottom adjacent to watercourses. The soil classes for these areas indicate undifferentiated shallow soils, which will limit the land-use options. Shallow soils and rocky outcrops dominate within these areas. Based on land type mapping, the soils are dominated by sandy clays and sandy clay loams, with soil depths ranging from 50 mm to 500 mm. The majority of the target area comprises the Hutton, Mispah, Glenrosa and Shortlands soils.

Within the lower elevations, on the mid-slopes of the hills, the soil classes indicate freely drained, structureless soils. Although having favourable physical properties, the soils have the potential for excessive drainage, high erodibility, and low natural fertility. The land type mapping for these soils indicates that these soils typically comprise sandy clays and clays, with some rock present. Soil depths typically range from 450 mm to 1,200 mm, with Hutton soil forms dominating. The soils on the eastern extremity of the target area comprise these soils. **Table 7-2** details the soil forms in the area based on the soil classes according to DAFF (2012) and land types (**Figure 7-6**). It is noted that dolerite exists within the target area. Please note that only FA362, Ba45 and Ea 25 soil types comprise the target area.

Table 7-2: Soil Forms Comprising the Prospecting Area

Land Type	Soil Description	Geology	Soil Potential
Ab64	Red-yellow apedal, freely drained soils; red dystrophic[7] and/ or mesotrophic[8].	Mainly dolerite. Small areas of shale of the Volksrust Formation, Ecca Group, and sandstone, shale and mudstone of the Beaufort Group also occur.	Soils not suitable for arable agriculture, suitable for forestry or grazing where climate permits.
Ac39	Freely drained, structureless soils; Red and yellow dystrophic and/ or mesotrophic.	Shale and sandstone of the Ecca Group, Karro Sequence; abundant dolerite.	Estimated area is unavailable for agriculture.
Ac99	Freely drained, structureless soils; Red and yellow dystrophic and/ or mesotrophic.	Mainly dolerite, with sandstone, shale and mudstone of the Beaufort Group.	Estimated area is unavailable for agriculture.
Ac101	Red-yellow apedal, freely drained soils, red and yellow, dystrophic and/ or mesotrophic.	Mainly dolerite, with sandstone of the Volksrust Formation, Ecca Group	Soils highly suitable for arable agriculture where climate permits.
Ba45	Plinthic catena: dystrophic and/ or mesotrophic; red soils widespread, upland duplex and margalitic soils rare.	Mainly sandstone of the Vryheid Formation, with dolerite.	Soils of intermediate suitability for arable agriculture where climate permits.
Ea25	Vertic, melanic and/ or red structured siagnostic horizons.	Dolerite with sandstone, shale and mudstone of the Andelaide Formation, Beaufort Group.	Estimated area is unavailable for agriculture.
Fa162	Pedologically young soils (lime rare or absent); structureless soils and clays.	Shale and sandstone of the Vryheid Formation, Ecca Group and dolerite.	Estimated area is unavailable for agriculture.
Fa360	Glenrose and/ or Mispah forms (other soils may occure), lime rare or absent in the entire landscape.	Mainly sandstone, shale and mudstone of the Beaufort Group, and dolerite. Small areas of shale of the Volksrust Formation also occur.	Soils not suitable for arable agriculture; suitable for forestry or grazing where climate permits.
Fa362	Glenrose and/ or Mispah forms (other soils may occur), lime rare or absent in the entire landscape.	Sandstone of the Vryheind Formation, Ecca Group, Shale of the Volksrust Formation, Ecca Group, and dolerite.	Soils not suitable for arable agriculture; suitable for forestry or grazing where climate permits.

[7] Dystrophic soils are soils that are rich in humus, giving them a brown colour. They have variable amounts of nutrients and are sometimes depleted of oxygen owing to the high concentration of humus.

[8] Mesotrophic soils are soils that have a moderate inherent fertility; they are neither nutrient rich, nor nutrient poor.

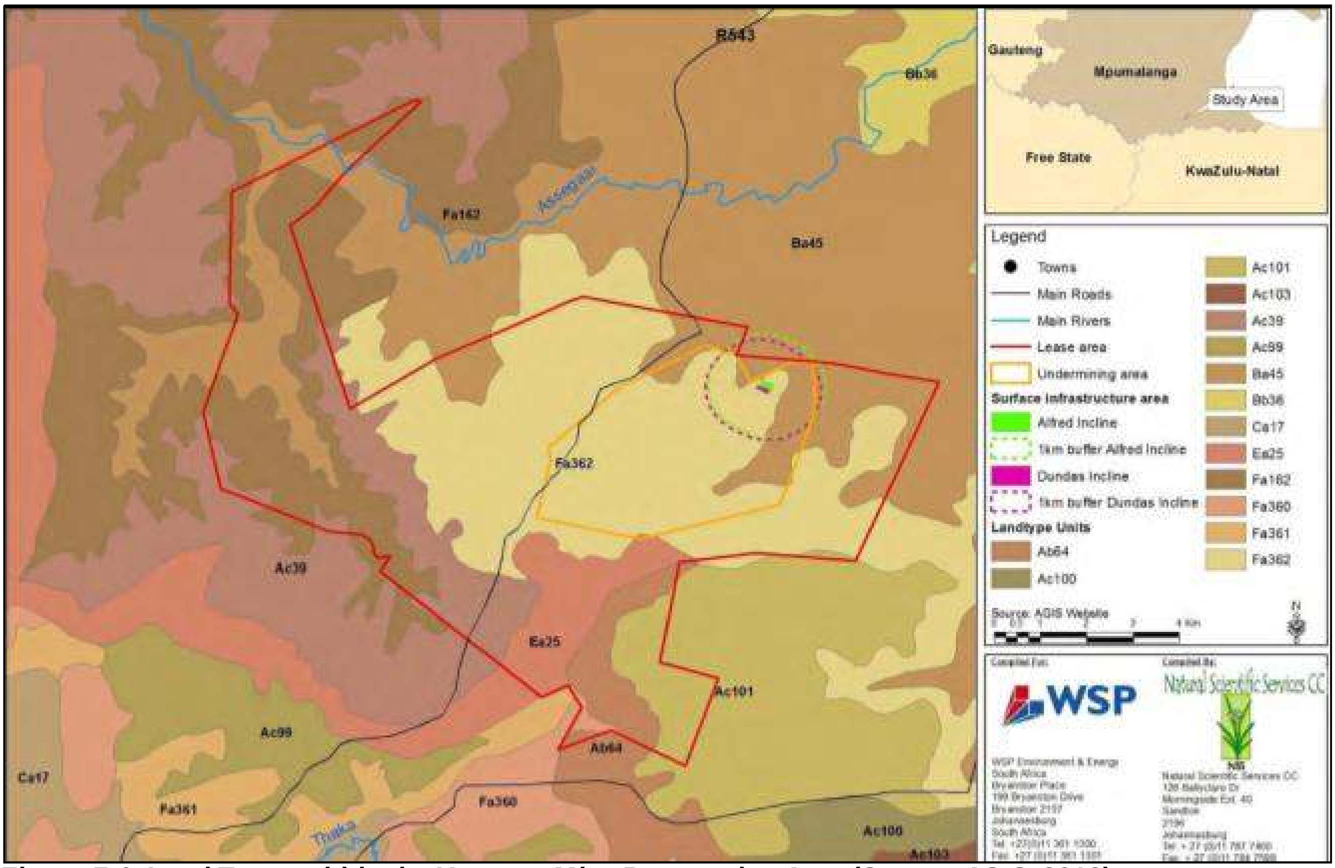


Figure 7-6: Land Types within the Yzermyn Mine Prospecting Area (Source: AGIS, 2012)

7.4 Land Use

7.4.1 Regional Setting

According to the Mpumalanga State of the Environment Report (2003), Mpumalanga is a province dominated by vast open areas of natural vegetation (71% of the total area, comprising grasslands, thickets, woodlands and forests). According to the land cover map, approximately 1.7% of these natural areas are classified as degraded, with an additional 0.03% of the total area being classified as eroded ("dongas and sheet erosion scars").

7.4.2 Local Setting

Although the area in which the study is situated comprises a number of land uses, a small portion has been transformed by recent human activities (Environmental Screening Report, 2008). According to ENPAT data, the predominant land uses within and surrounding the prospecting area include agriculture, conservation, grassland area, cultivated land, forestry areas, vacant areas, rivers and other wetlands.

Unimproved natural grassland dominates the landscape of the prospecting area and surrounds, with thicket bushlands and water bodies and wetlands occurring as well; subsistence farming makes use of cultivated land, whereas a number of active farms utilise the land for grazing. The natural grassland environment is suitable for the stock grazing industry for commercial and subsistence farmers. A scattering of subsistence farmers have made their home within the study area.

The land use within the prospecting right, determined in 2000 by the DAFF, indicates that the majority of the area is comprised of unimproved (natural) grassland (**Figure 7-7**). Currently, the target area and surrounds are being used for grazing by cattle. The northwestern section of the prospecting area contains an ecological corridor that may not be affected. According to the Pixley ka Seme Local Municipality EMF (2011), the prospecting right falls within a critical biodiversity area.

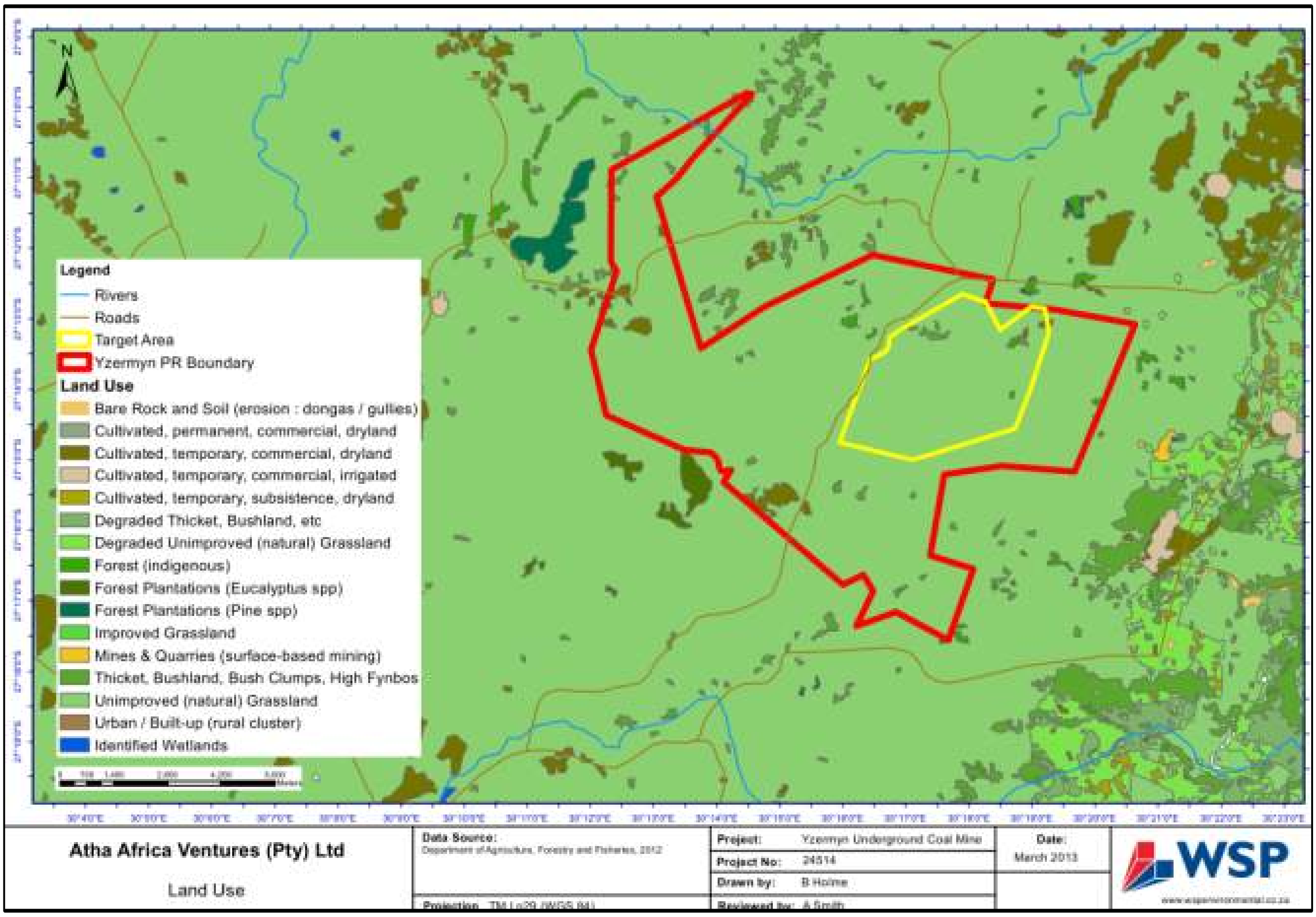


Figure 7-7: Land Use within the Yzermyn Mine Prospecting Area (Source: DAFF, 2012)

Based on Mucina and Rutherford (2006), the general natural vegetation of the prospecting area is dominated by the Wakkerstroom Montane Grassland, although in the lower lying areas adjacent to the watercourses, Paulpietersburg Moist Grassland is present. Patches of thicket and bushland are present on the north and south facing slopes adjacent to the Assegaai River within the northern extremity of the prospecting area. In addition, isolated patches of thicket and bushland as well as indigenous forest are present within river valleys to the north-east and south-east of the target area. Mucina and Rutherford (2006) indicate that the indigenous forest is comprised of Northern Afrotemmperate Forest. Pine plantation forestry is present on a portion of land to the north-west of the site, with cultivated temporary commercial dryland agriculture present within isolated portions of the site.

7.5 Land Capability

7.5.1 Regional Setting

According to the Mpumalanga State of the Environment Report (2003), 40.81% of the province comprises unimproved grassland, where as 18.03% make up forest and woodland, 16.81% form the cultivated land and 10.38 % comprise thicket and bushland. Degraded land cover (forest and woodland, thicket and bushland, and unimproved grassland) and dongas and sheet erosion scars form 1.7% of the province. Wetlands comprise 0.13% and water bodies make up 0.50% of the province. Mines and quarries combine to 0.60% of the province.

7.5.2 Local Setting

Land capability classes are interpretive groupings of land units with similar potentials and continuing limitations or hazards. Whilst social and economic variables are not specifically considered, consideration is given to:

- The risks of land damage from erosion and other causes; and
- The difficulties in land-use owing to physical land characteristics, including climate.

There are eight land classes, denoted by Roman numerals. Classes I to IV are suitable for arable land, Classes V to VII are suitable as grazing land, and Class VIII is not considered suitable for agriculture, with the use being limited to recreation, wildlife, water supply or aesthetic purposes.

According to DAFF (2012), the prospecting area contains four land capability classes (Class II, III, VI and VII) whereas the target area only comprises two classes (Class III and VI). **Figure 7-8** provides an illustration of the land capability within the prospecting right. On the crests and upper slopes of the hills, present within the central and eastern portions of the site, the land capability is Class VI. Land in Class VI has severe limitations that make it generally unsuited to cultivation and limits its use largely to pasture and range, woodland or wildlife. Due to the location of this land capability class on the upper slopes, the limitations are expected to be primarily due to the steep slope and shallow nature of the soils and, as such, cannot be easily corrected. The majority of the target area comprises land with this capability.

On the lower slopes of these hills, the land capability is classed as Class III. Land in Class III has severe limitations that reduce the choice of plants or require special conservation practices. The presence of clayey soils within this area may be the limiting factor for cultivation. The soils on the eastern extremity of the target area comprise land within this capability.

Adjacent to the watercourse on the western side of the property, the land capability is Class VII. Land in Class VII has very severe limitations that make it unsuited to cultivation and that restrict its use largely to grazing, woodland or wildlife. Restrictions are more severe than those for Class VI because of one or more continuing limitations that cannot be corrected. Due to the proximity to the watercourses, the limitation is expected to be due primarily to soil wetness and the clayey soils.

Within the south-eastern extremity of the property, the land capability is Class II. Land in Class II has some limitations that reduce the choice of plants or require moderate conservation practices. The land may be used for the cultivated crops and, although some limitations exist, management practices are easy to apply.

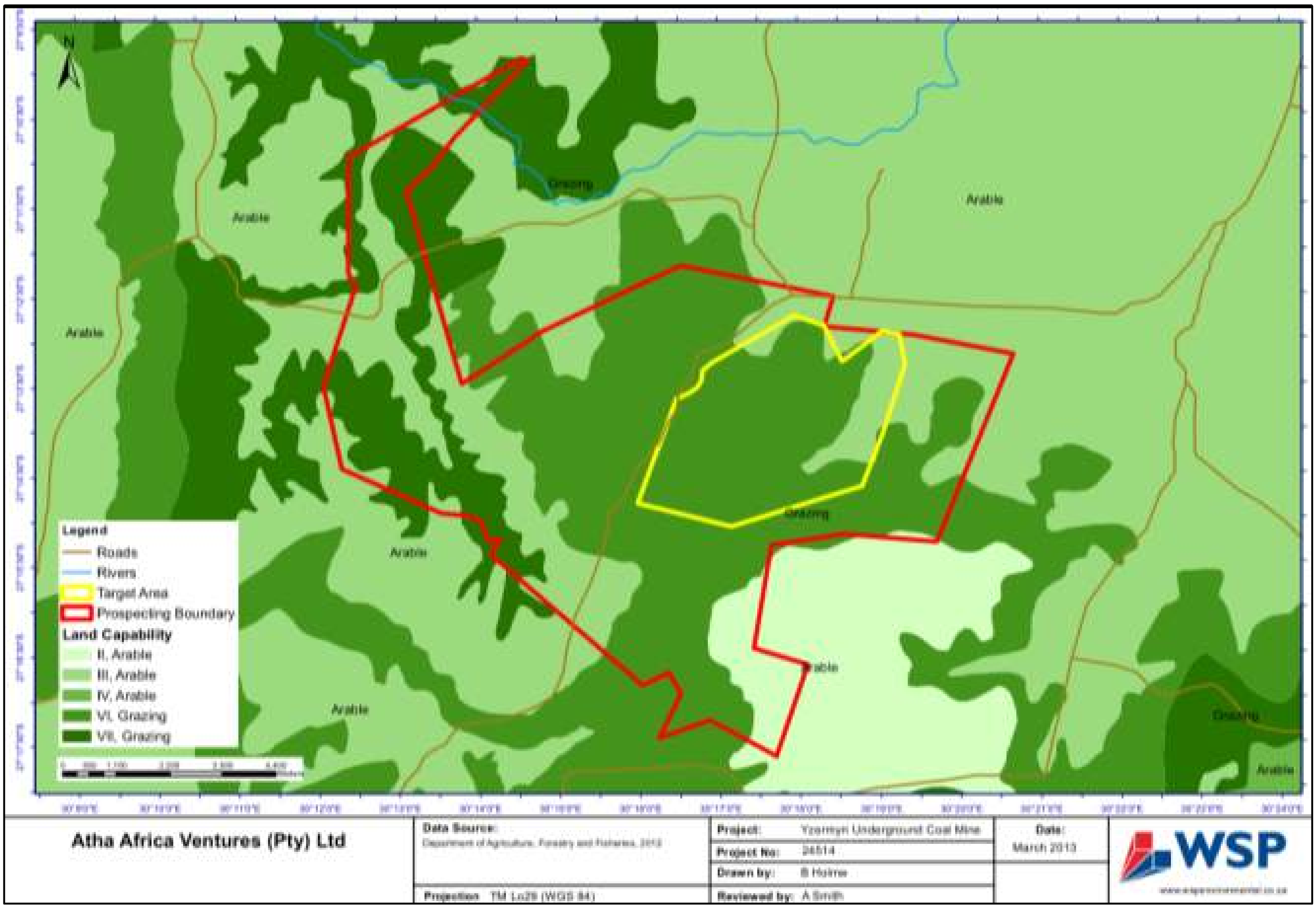


Figure 7-8: Land Capability within the Yzermyn Mine Prospecting Area (Source: DAFF, 2012)

As noted previously, the existing land use within the target area is predominantly cattle grazing. The grazing capacity is defined as the area of land required to maintain a single animal unit without causing deterioration in vegetation or soil condition (a decrease in basal cover, or a change in species composition or vigour of the veld plants). The area required for one animal unit varies considerably and is determined primarily by the veld type, the condition of the veld and topography. An Animal Unit (AU) is equivalent to a mammal of conventional quadruped shape which has a mass of 450 kg (i.e. the size of an average steer).

According to WSP's soil, land use and land capability assessment, the majority of the study area has a grazing capacity ranging from less than 4 ha/AU to 10 ha/AU. Within the northern extremities, on the crest of hills and adjacent to the watercourse on steep topography, the grazing capacity is reduced to between 11 ha/AU and 17 ha/AU. This represents a good to excellent grazing capacity. The grazing capacity of the target area is expected to have an average grazing capacity of 5-7 ha/AU.

7.6 Climate

7.6.1 Regional and Local Setting

The proposed Yzermyn Underground Coal Mine is located within the Pixley ka Seme local municipality which falls under the Gert Sibande District Municipality in the Mpumalanga Province. The Pixley ka Seme Local Municipality has a subtropical climate that receives predominantly summer rainfall with the eastern areas receiving predominantly higher rainfall that the western areas. Summer rainfall events are generally associated with severe thunderstorms. Temperatures in the region range from very cold in winter with severe frost and occasional snow, to warm to hot during summer, especially in the low lying areas below the escarpment (Pixley Ka Seme Local Municipality, 2010).

7.6.1.1 Temperature and Rainfall

Due to the irregular topography of the area surrounding the proposed Yzermyn Underground Coal Mine, meteorological conditions at the site are localised and may differ greatly from one area to the next. The closest available South African Weather Services (SAWS) meteorological station is located ~50 km from the site. This data will not be representative of conditions at the site, so Unified Model (UM) data generated for 27.2371 °S and 30.2953° E was obtained from the South African Weather Service (SAWS) and subsequently used in this assessment.

The UM is a numerical weather prediction and climate modelling software suite developed in the UK and is utilised in various weather forecasting agencies around the world. It is a single model used across a broad range of time scales and spatial scales (convective scale to climate system earth modelling). The atmospheric prediction component makes use of a set of equations that describe the time evolution of the atmosphere. Input data is obtained from observations from satellites, automatic weather stations, ground measurements, radar, weather balloons, wind profilers, aircraft and previous model runs (Dando, 2004).

Figure 7-9 represents the average, minimum and maximum temperatures for the proposed Yzermyn Underground Coal Mine, as calculated from the hourly average UM temperatures for the area. Maximum temperatures occur during October and November (33.2 °C and 33.59 °C respectively) whilst minimum temperatures are experienced during July and August (-4.81 °C and -4.61 °C respectively). Average temperatures range considerably between the summer and winter months, with an average summer and winter temperature range of 18 °C and 5 °C respectively.

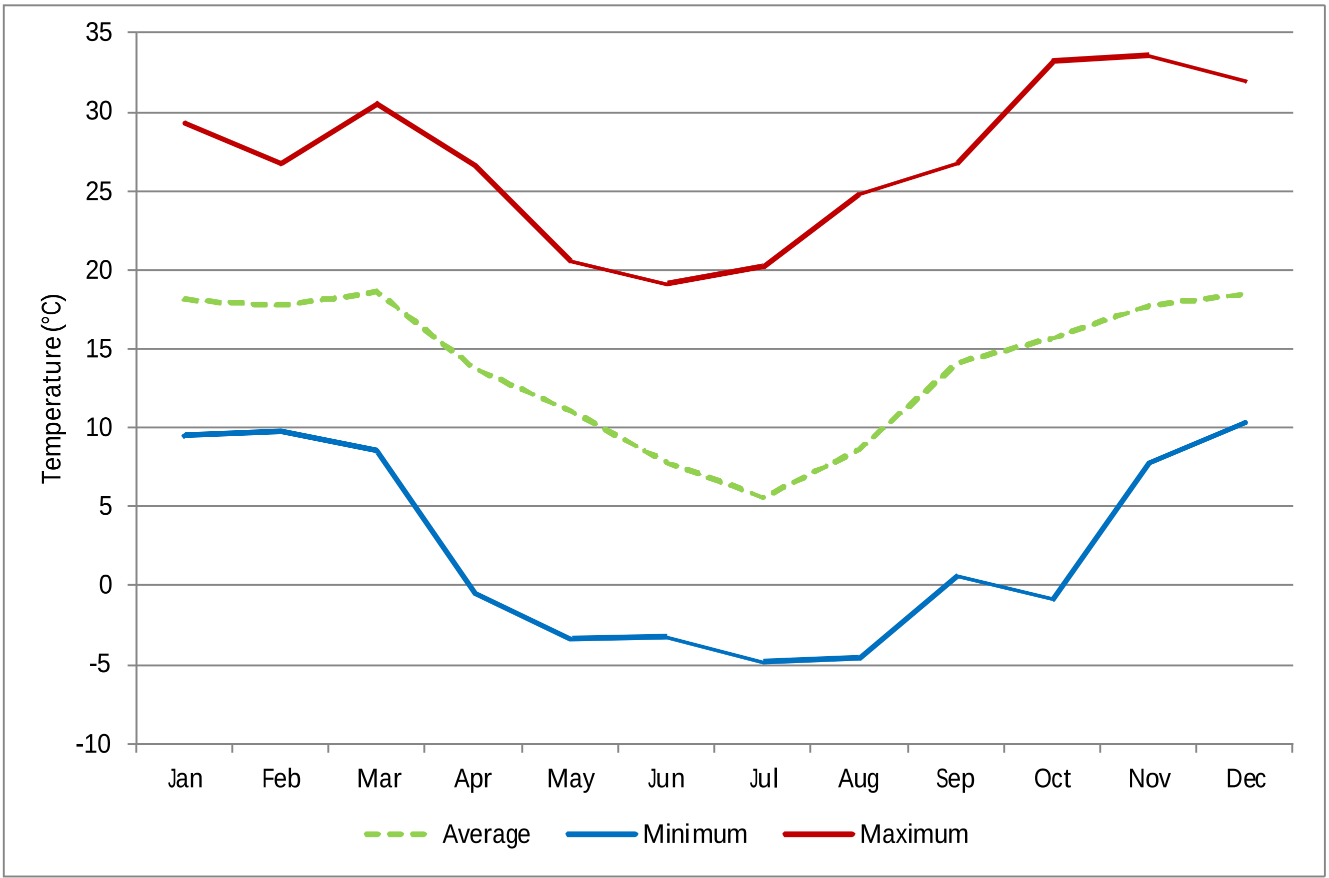


Figure 7-9: Average, Maximum and Minimum Temperatures for the Project Area

Monthly rainfall and average humidity, for the Yzermyn Underground Coal Mine, are represented in **Figure 7-10**. The highest rainfall is experienced during late spring and early summer (October – December), while minimum rainfall occurs during the late autumn and winter months (May, June and August). Relative humidity in the region is considered high, with values ranging from ~60% during winter to ~80% during summer.

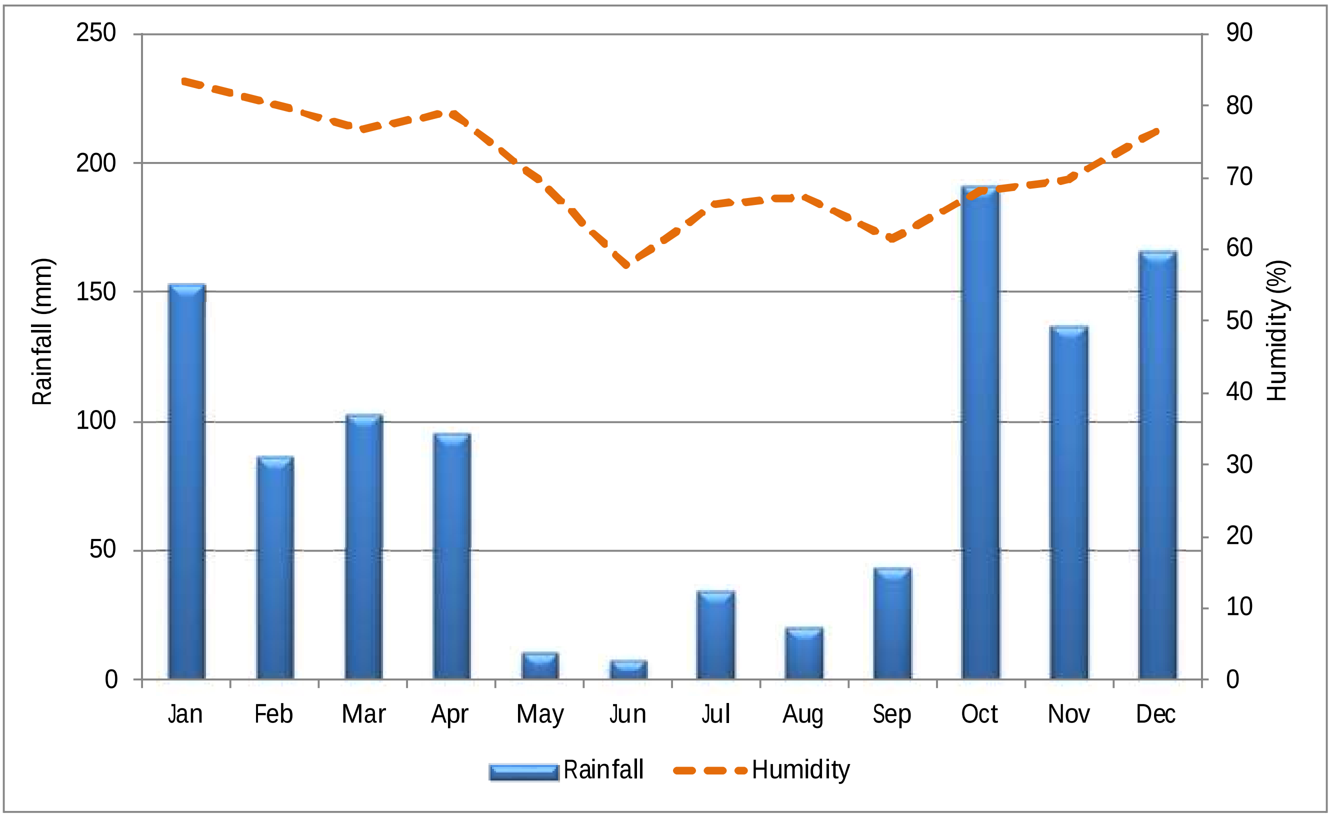


Figure 7-10: Total Monthly Rainfall and Average Humidity for the Project Area

7.6.1.2 Atmospheric Conditions

Atmospheric transport within the area occurs both vertically and horizontally. Vertical transport is primarily due to deep convection. This convection transports air and any air pollutants contained therein from the surface into the upper atmosphere. Vertical motion is eventually inhibited due to the stable layers found preferentially at ~700hPa, ~500hPa and ~300hPa on no-rain days. These stable layers trap pollutants at lower atmospheric levels and so influence the transport of pollutants over the entire southern Africa (Cosijn and Tyson, 1996; Garstang et al., 1996)

On a more local scale, vertical motion and hence dispersion of pollutants is inhibited by surface inversions that form during the night. These inversions are a result of radiational cooling at the surface and are most pronounced before sunrise. In the presence of sunlight, the inversions begin to break down through convective heating and the height of the mixed layer is increased (Cosijn and Tyson, 1996; Tyson and Preston-Whyte, 2000).

In terms of horizontal transport, local winds may transport pollutants within the vicinity of their source. These include: anabatic and katabatic winds, valley and mountain winds, and mountain-plain and plain-mountain winds (Tyson and Preston-Whyte, 2000). On a larger scale, various synoptic systems affect atmospheric circulation over the Pixley Ka Seme Local Municipality as well as circulation over southern Africa. These systems include: continental highs, ridging highs, westerly lows, westerly waves and easterly waves, which transport air and any pollutants contained within over larger distances (Garstang et al., 1996; Tyson et al., 1996).

In the Pixley Ka Seme Local Municipality, transport associated with continental highs occurs all year round, but with greater frequency during winter. Easterly waves show an annual cycle, peaking in summer, with seldom occurrences in winter. Transport associated with ridging highs and westerly waves dominates during winter (Garstang et al., 1996; Tyson and Preston-Whyte, 2000).

Recirculation is important in the transport of pollutants and occurs frequently over southern Africa due to the high frequency of anticyclonic circulations (Garstang et al., 1996; Freiman and Piketh, 2003). Recirculation occurs when air is transported away from its source and returns in the opposite direction after rotating cyclonically or anticyclonically. Recirculation can occur at a number of scales from sub-continental to regional, and an interaction between different scales of wind systems results in further recirculation (Tyson et al., 1996; Tyson and Preston-Whyte, 2000; Freiman and Piketh, 2003).

Wind roses are a useful tool in illustrating prevailing meteorological conditions for an area, indicating wind speeds and frequency of distribution. In the following wind roses, the colour of the bar indicates the wind speed whilst the length of the bar represents the frequency of winds blowing from a certain direction (as a percentage).

In the area of the proposed Yzermyn Underground Coal Mine, winds are predominantly from the west (18 % of the time) and east (16% of the time) (**Figure 7-11**). Wind speeds are strongest from the west with wind speeds ranging from 0.5 $m.s^{-1}$ to 11.1 $m.s^{-1}$.

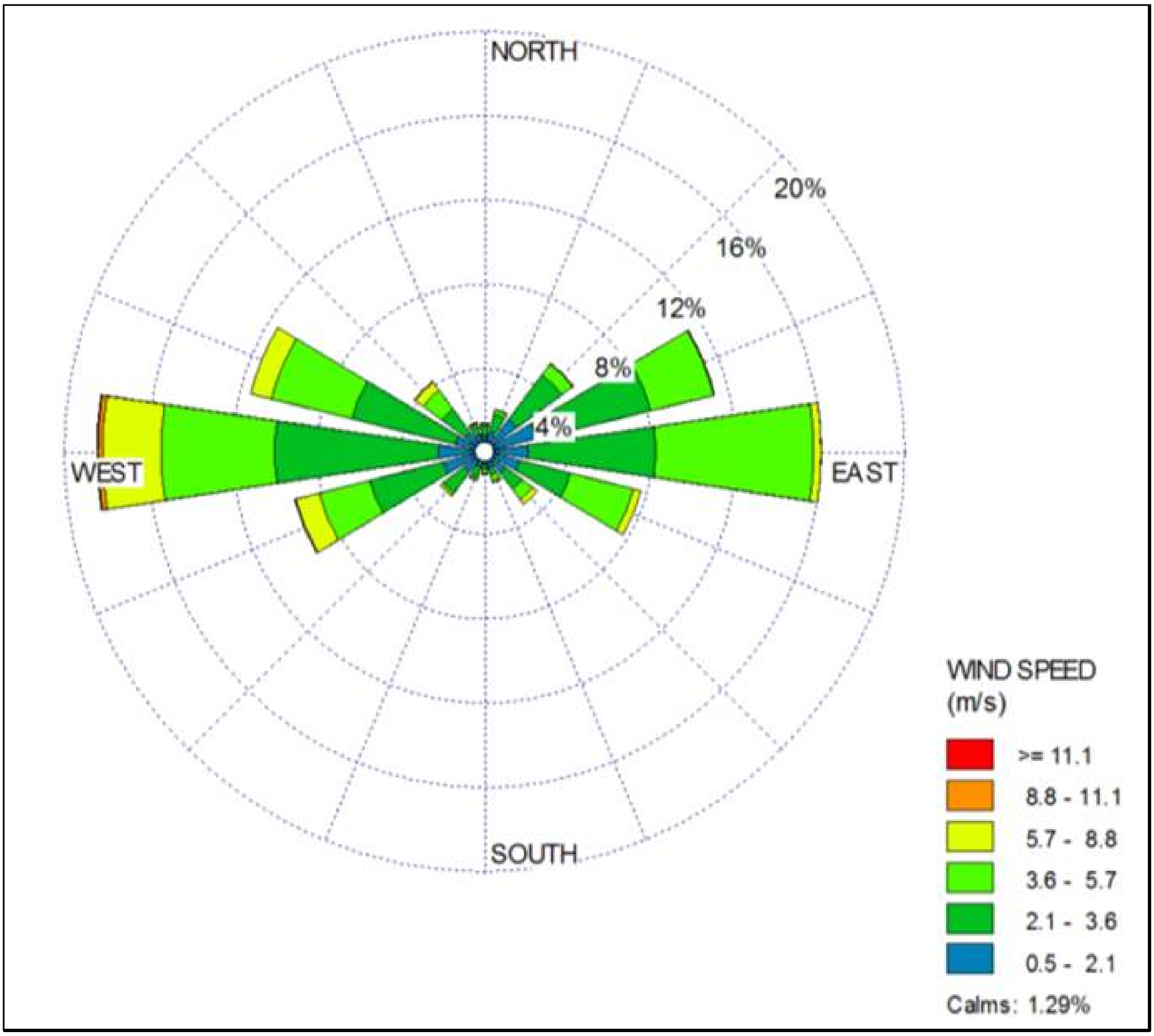
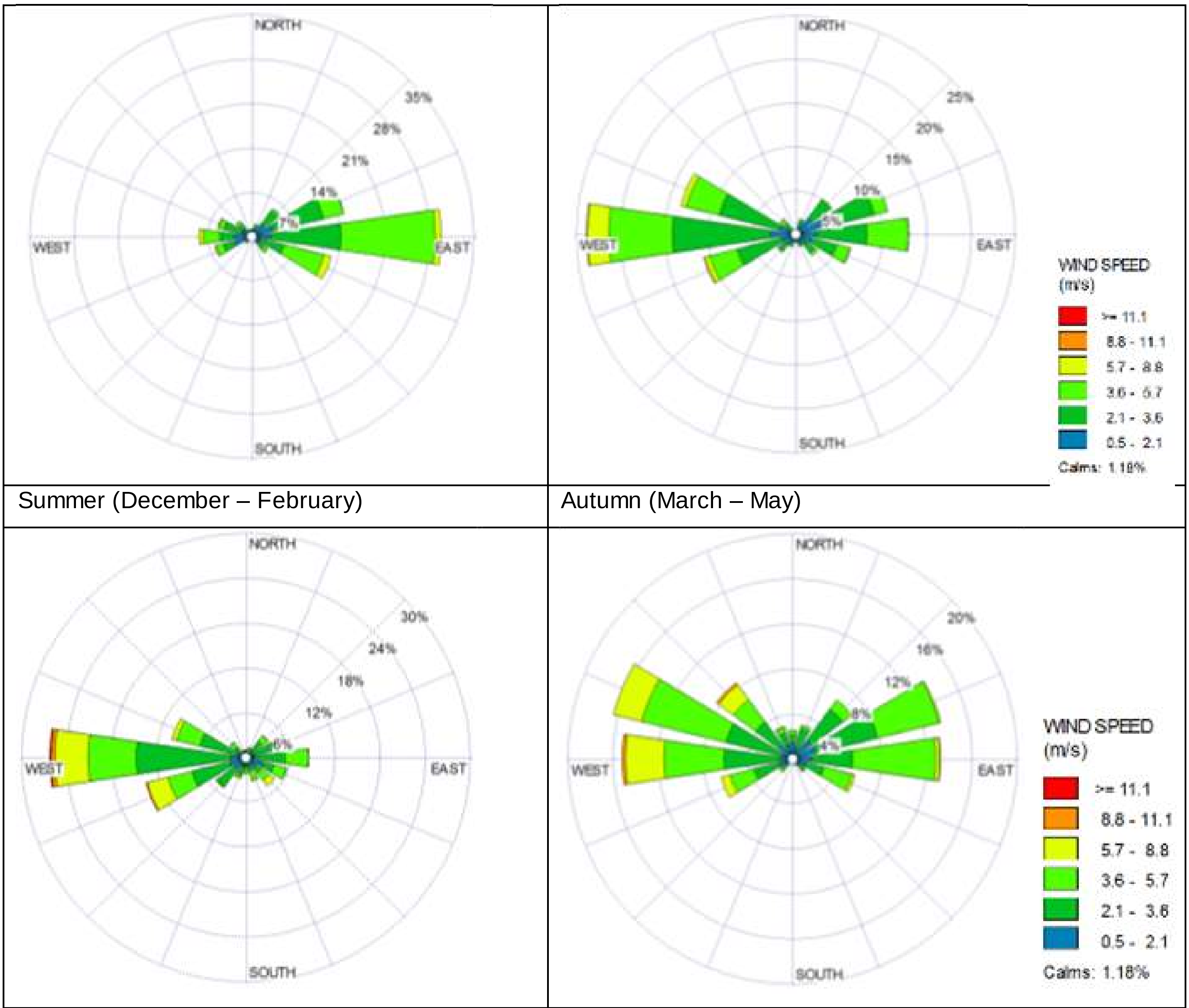


Figure 7-11: Wind Rose Plat for the Project Area for the 2011 Period (Source: South African Weather Service)

Seasonal variations in winds at the target area are depicted in **Figure 7-12**. During summer (December to February), winds predominantly originate from an easterly direction, with the strongest winds experienced from this direction (5.7 to 8.8 $m.s^{-1}$). This dominant easterly flow is a result of easterly waves that impact South Africa during summer, bringing rainfall to the eastern parts of the country. During autumn (March to May) and winter (June to August), there is a definite shift in wind direction. Winds still originate from the east, although a much stronger westerly component is introduced. Winds of up to 11.1 $m.s^{-1}$ are experienced from the west. This westerly wind direction during winter is a result of westerly waves, in the form of cold fronts that move over the country during this time. During spring (September to November), westerly and easterly wind components are experienced, with the strongest winds (up to 11.1 $m.s^{-1}$) originating from the west.



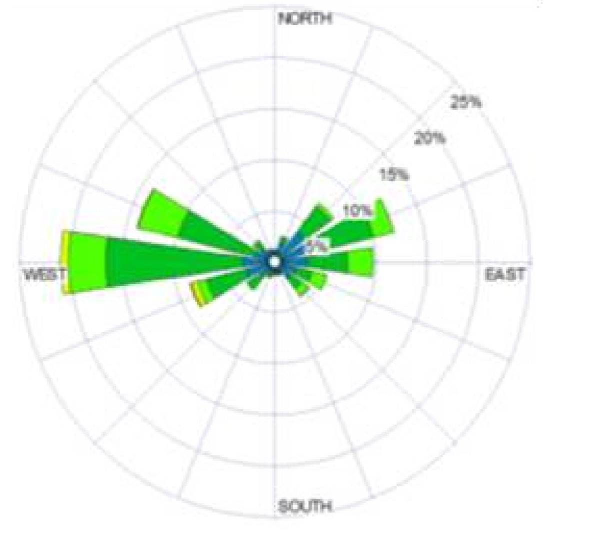
Summer (December – February)	Autumn (March – May)
Winter (June – August)	Spring (September – November)

Figure 7-12: Seasonal Wind Rose Plots for the Project Area (Source: South African Weather Service)

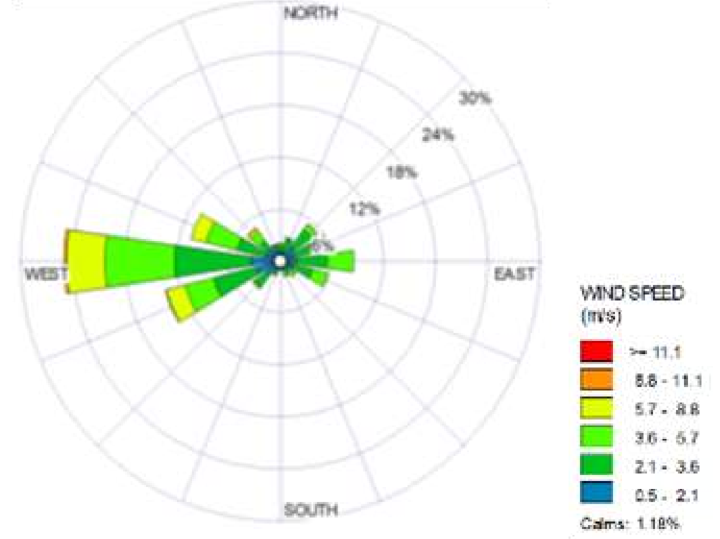
Diurnal variations in wind at the target area are depicted in **Figure 7-13**. From 00:00 to 06:00 westerly flow dominates with smaller west-north-westerly and east-north-easterly components. Winds are calm to moderate, with wind speeds of up to 8.8m.s-1 experienced from the west. Similar wind directions are experienced after sunrise (06:00 to 12:00) with a definite strengthening of the westerly component (up to 11.1 $m.s^{-1}$). After midday (12:00 to 18:00) easterly and westerly winds are experienced, with a strengthening of the westerly component. The strongest winds occur in the afternoon from the west with speeds exceeding 11.1 $m.s^{-1}$. In the evening

(18:00 to 24:00) the westerly wind component diminishes and winds are predominantly easterly, with speeds ranging up to 8.8 m.s^{-1}.

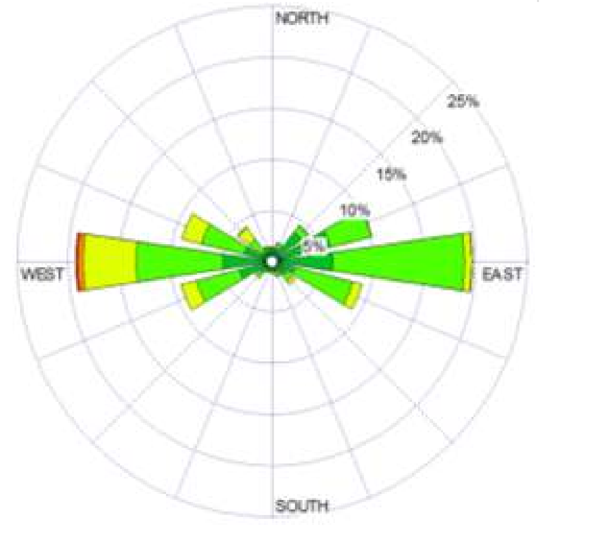
The dispersion of emissions will be lower during the early morning hours as a result of calmer wind speeds. During winter the concentrations of pollutants experienced at the surface at this time, may also be augmented by the formation of surface inversions which trap pollutants and prevent them from being dispersed into the atmosphere. After sunrise, convective mixing is initiated and any pollutants that are trapped at ground level are dispersed into the atmosphere.



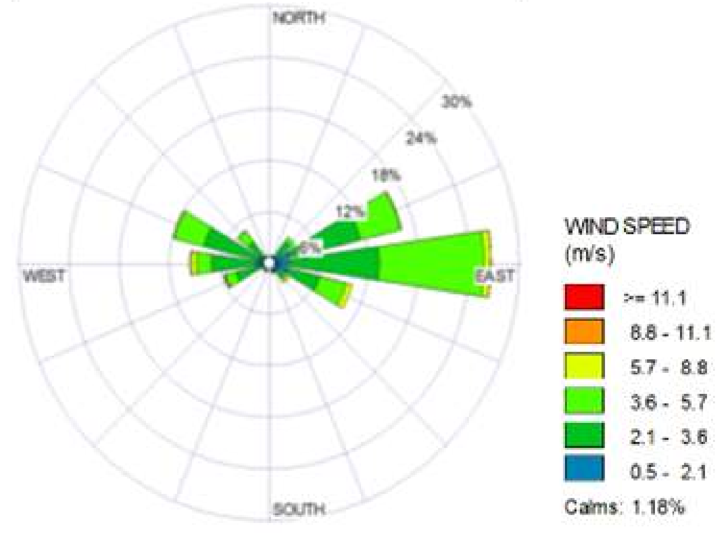
00:00 – 06:00



06:00 – 12:00



12:00 – 18:00



18:00 – 24:00

Figure 7-13: Diurnal Wind Rose Plots for the Project Area (Source: South African Weather Service)

7.6.2 Ambient Air Quality

7.6.2.1 Regional Setting

The proposed target area is located within the Highveld Priority Area (HPA); an air pollution hotspot area prioritised in Section 18(1) of the NEMAQA as an area associated with poor air quality and elevated concentrations of criteria pollutants (such as nitrogen oxides [NOx], sulphur dioxide [SO_2] and particulate matter [PM]) (DEA, 2010). Potential air pollution sources within the Pixley ka Seme Local Municipality, surrounding the target area include:

- Three coal fired power stations (Majuba and Tutuka, located 45 km and 95 km north west of the mining area respectively and Camden, located 60 km to the north);
- Domestic fire emissions from surrounding communities;
- Biomass burning emissions (during late winter and early spring);
- PM and dust fallout from agricultural activities;
- Vehicular emissions; and
- Emissions from small scale industries in surrounding towns.

In order to assess the existing local ambient air quality in the area, WSP conducted baseline dust fallout, PM, NO_2 and SO_2 monitoring in and around the proposed Yzermyn Underground Coal Mine. Measurements were undertaken during the winter (end May to end August) and summer (end October to end January) seasons to provide for a representative dataset for the region. The results of which are further detailed in the subsections below.

7.6.2.2 Local Setting

Sensitive receptors are identified as areas that may be negatively affected by potential emissions generated by the proposed Yzermyn Underground Coal Mine. Examples of sensitive receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas.

The sensitive receptors identified in the area surrounding the proposed Yzermyn Underground Coal Mine include:

- The Wakkerstroom community located 17 km south west of the mining boundary;
- The Town of Volksrust, located 30 km west-south-west of the mining boundary;
- The community of Dirkiesdorp, located 7 km north east of the mining boundary;
- The community of Groenvlei, located 18 km south of the mining boundary;
- The community of Daggakraal, located 20 km north west of the mine boundary; and
- The community of Driefontein, located 25 km north east of the mining boundary.

Rainfall has the potential to remove pollutants from the air, especially particulates, thereby improving the air quality situation in high rainfall areas. During the spring and summer months, air quality in the area may improve due to the high rainfall experienced. Drier conditions, together with increased domestic fuel combustion in the region, may augment the concentration of ambient pollutants during winter.

In order to assess the local air quality in the vicinity of the proposed Yzermyn mine, ambient air quality monitoring was performed during 2012. Results from the monitoring campaigns for dust fallout (DFO), particulate matter (PM), sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) are presented here.

- Dust Fallout

  To determine the concentration of dust that falls to the surface on a daily basis, dust fallout monitoring was performed onsite, in the target area, at eight monitoring locations during the winter and summer period. Since deposition of large (>10 µm) solid particles is a function of airborne concentrations and particle gravitational speed, fugitive dust is principally monitored using passive dust deposition gauges. These comprise open-mouthed containers partially filled with distilled water which are exposed for a designated period of time.

The sampling equipment consists of a non-directional dust fallout bucket with a circular opening of 19 cm and a depth of 33 cm. The specifications are as close as possible to those recommended by the International Standards Organisation using available materials. The low aspect ratio (i.e. the height to width ratio) is required to keep collected particulates (dust) in the dust fallout bucket before they settle in the distilled water (this water is treated with a small quantity of algaecide to prevent algal growth). The South African National Standards (SANS) 1929:2005 prescribed American Society for Testing and Materials (ASTM) method requires the dust fallout bucket is 2 m above ground due the large dust concentration variability as a result of settling below the 2 m. The ASTM method further requires the inclusion of a simple aerodynamic wind shield to facilitate precision in measured dust fallout, which was installed.

The dust buckets were exposed for approximately 30 days each over three months (June – August 2012, in accordance with the SANS 1929:2005 prescribed ASTM D1739 methodology. The buckets were collected and sealed on a monthly basis, and sent to a South African National Accreditation System (SANAS) certified laboratory for analysis. Analysis is undertaken by first filtering out and weighing the insoluble particles are first, whilst the filtered solution undergoes evaporation to determine the soluble particle mass of a sample. This is a standardised sampling technique in South Africa, commonly referred to as 'bucket-monitoring' and was originally derived from the ASTM standard method for collection and analysis of dust fallout (ASTM D1739). It is defined in the local context as a South African National Standard (SANS1929:2005/2009).

The results from the three month winter and summer monitoring campaigns are presented in **Figure 7-14**. Dust fallout rates at all monitoring locations were compliant with the SANS residential limits with the exception of YZ DFO 04 during July 2012. Since this unit was located alongside a sand road, the higher rates recorded at this site may be attributed to road dust and may not be an accurate representation of the dust climate in the region. DFO rates at all other units remain low, with the lowest rates recorded at YZ DFO 03, which was situated in a remotely location (only visible dust sources arising from local livestock).

The elevated dust fallout rates during July at most sites could indicate an increase in vehicular activities related to the specialist studies underway for the proposed Yzermyn Underground Coal Mine. The higher rates may also be influenced by deposition of particles from increased biomass burning activities which were evident within the region at this time.

As the proposed Yzermyn Underground Coal Mine is situated in a summer rainfall region, dust fallout rates recorded during October, November and December are substantially lower than those recorded during June, July and August as rainfall supresses dust entrainment.

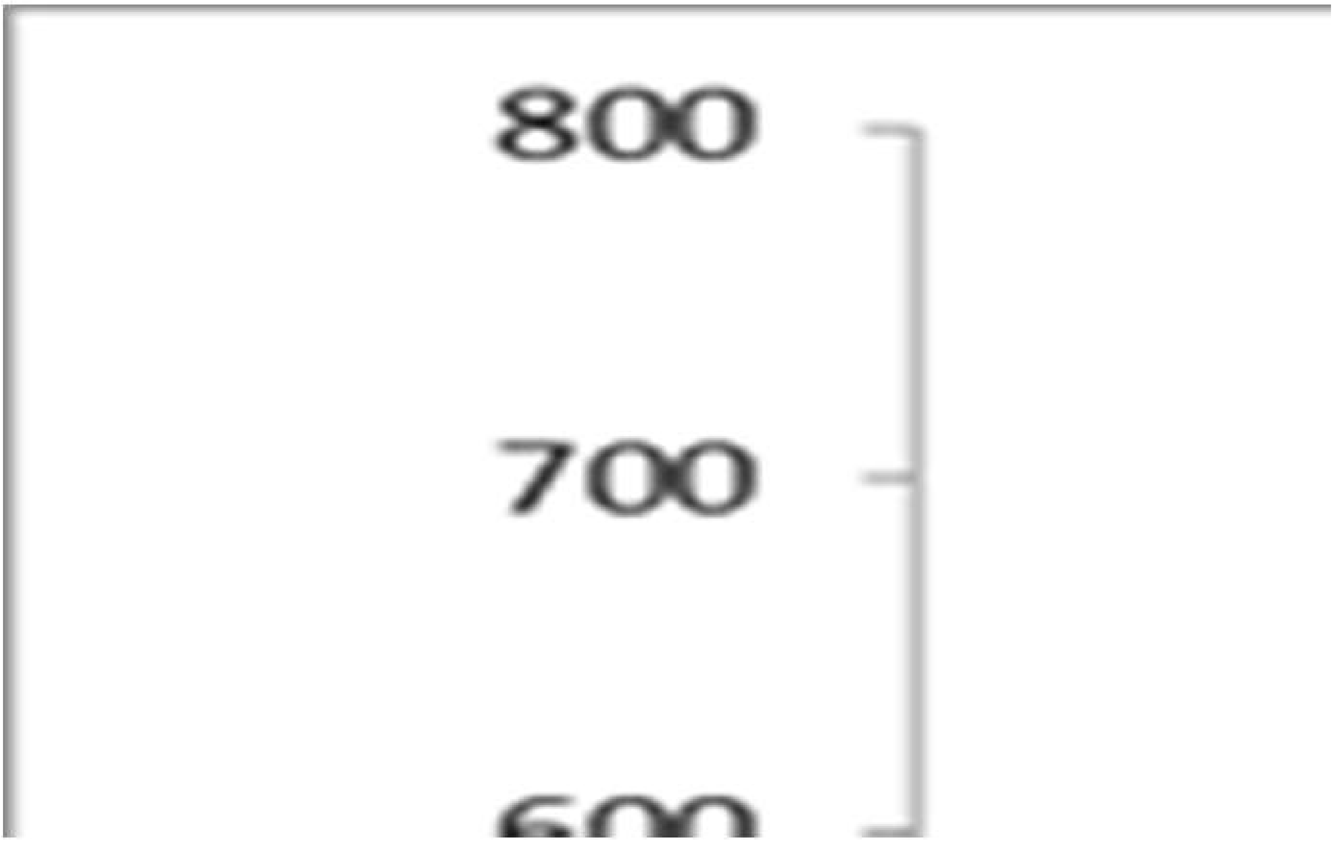


Figure 7-14: Dust fallout results for the proposed Yzermyn Underground Coal Mine for the winter (June, July and August) and summer (October, November and December) campaigns

- Particulate Matter

  PM refers to solid or liquid particles suspended in the air. PM varies in size from soot or smoke particles that are visible to the human eye, too much smaller particles that are only visible under an electron microscope. PM contributes greatly to deteriorations in visibility, as well as posing major health risks, as small particles can penetrate deep into lungs. Health effects include: respiratory problems, lung tissue damage, cancer and even premature death. Acidic particles may damage buildings, vegetation and acidify water sources (US EPA, 2011).

  To establish baseline PM concentrations, measurements were undertaken using an OsirisTM continuous dust monitor. The OsirisTM analyser is capable of measuring a number of size fractions simultaneously, including total suspended particulates (TSP), particles with a diameter less than 10 µm (PM10), particles with a diameter less than 2.5 µm (PM2.5) and particles with a diameter less than 1 µm (PM1). The instrument is also equipped with a wind monitor that allows for emissions to be correlated with wind speed and direction data, making it possible for recorded dust emissions to be traced back to the probable source of the emissions.

  PM concentrations were noted to be very low for the region, with an average PM10 concentration of 8.97 µg/m3 and an average PM2.5 concentration of 2.75 µg/m3. These concentrations are well below the NEM:AQA daily standard of 120 µg/m3 (PM10) and 65 µg/m3 (PM2.5), and the annual standard of 50 µg/m3 (PM10) and 25 µg/m3 (PM2.5). **Figure 7-15** represents a PM10 pollution rose for the region which indicates the highest PM10 concentrations originate from the south-west, where the proposed Yzermyn Underground Coal Mine will be located.

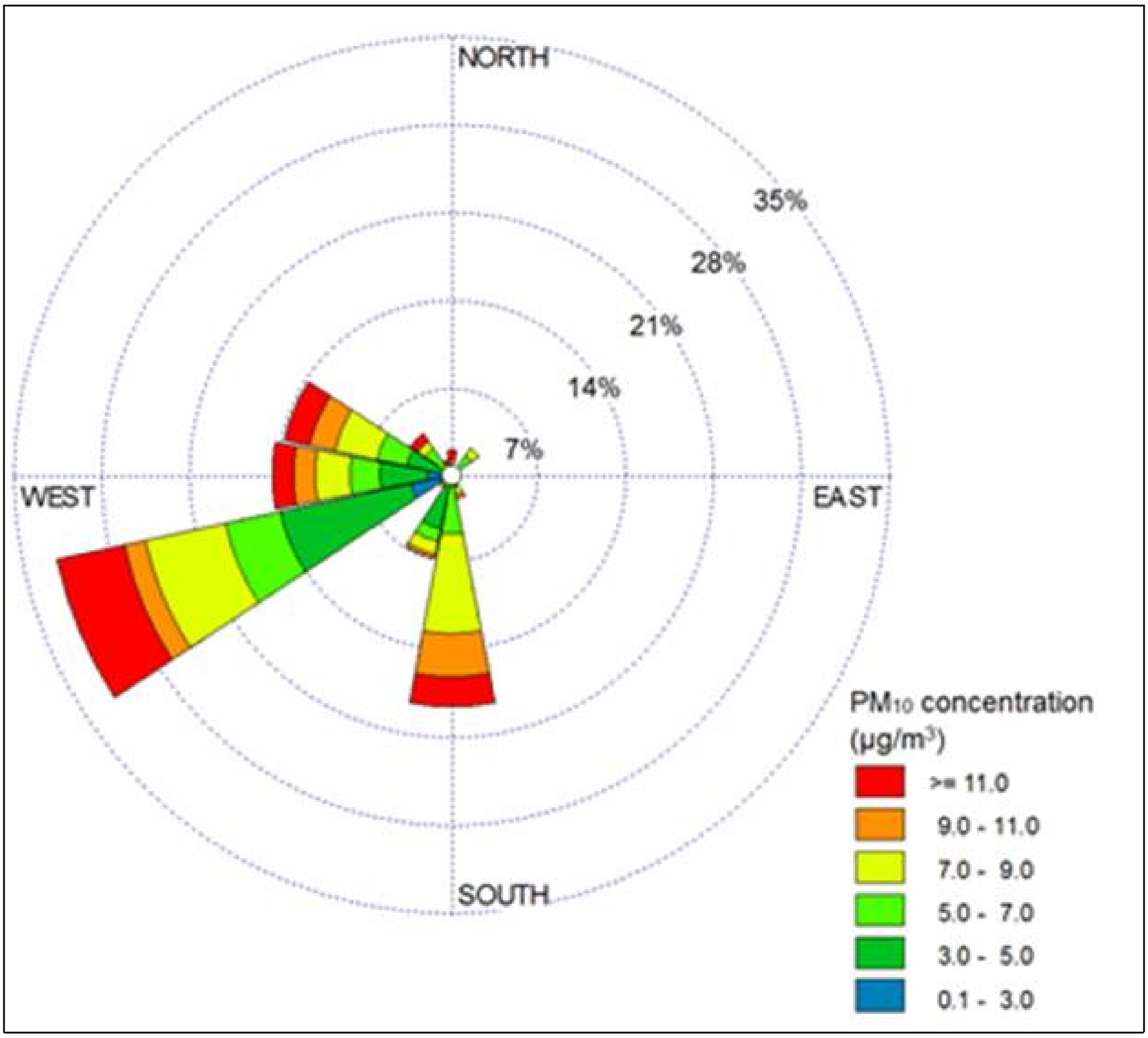


Figure 7-15: PM10 pollution rose for the proposed Yzermyn Underground Coal Mine

- Nitrogen Dioxide and Sulphur Dioxide

SO_2 and NO_2 concentrations in the region surrounding the proposed Yzermyn Underground Coal Mine were measured using Radiello passive samplers. Radiello passive diffusive samplers consist of three components: a support plate, a blue diffusive body in the case of SO_2 and NO_2 and a chemical absorbing cartridge. The chemical absorbing cartridge was placed within the diffusive body and then attached to the support plate. The support plate was then attached to a shelter to protect the samples from the elements.

The chemical absorbing cartridge consists of microporous polyethylene and is coated with triethanolamine (TEA) which absorbs chemicals from the air. The chemical absorbing cartridge consists of carbon and was analysed for SO_2 and NO_2 by spectrophotometry and ion chromatography.

Six passive samplers were placed with six of the dust fallout monitoring points at the proposed Yzermyn Underground Coal Mine area. Since the shelters containing the Radiello passive samplers need to be mounted above the ground, they were attached to the dust fallout units. The Radiello passive samplers were exposed for 28 days after which they were collected, sealed, kept in a temperature controlled environment and sent to a SANAS certified laboratory for analysis.

The results from the NO_2 and SO_2 winter and summer monitoring campaigns are presented in **Figure 7-16** and **Figure 7-17**. It was noted that both SO_2 and NO_2 concentrations remain low, below the NEMAQA standards, during the both the winter and summer campaigns.

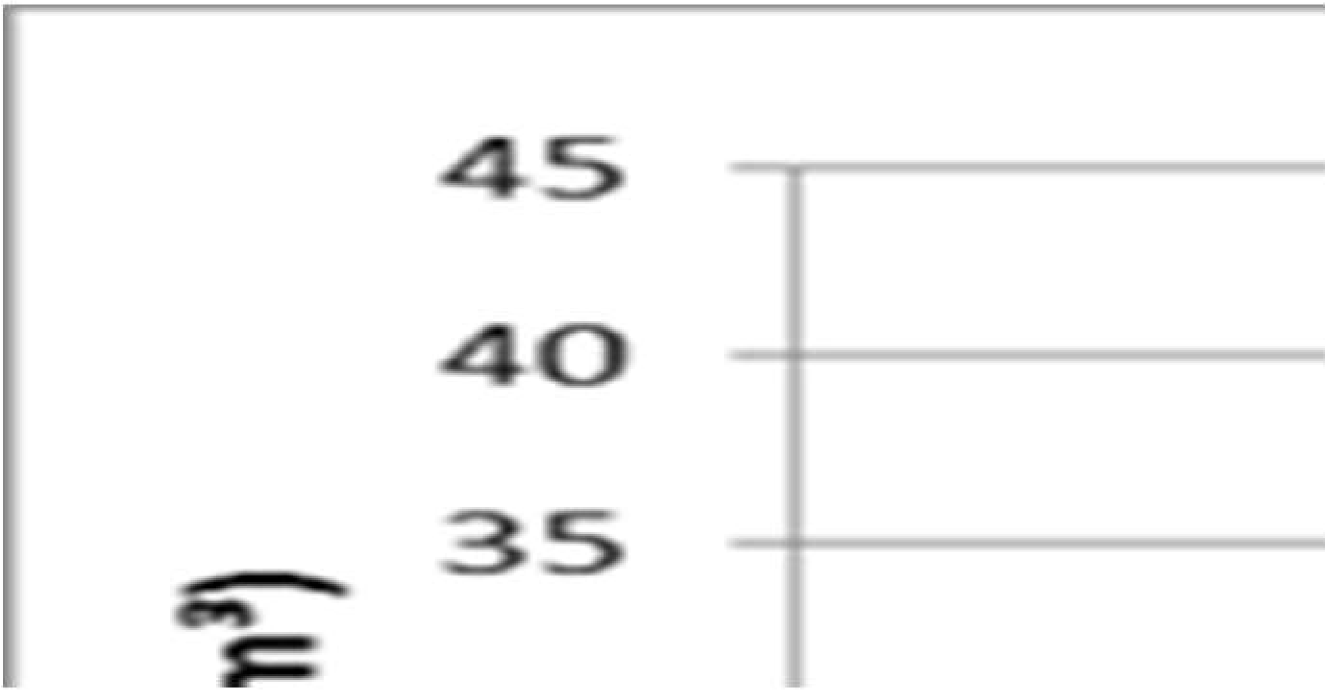


Figure 7-16: Results from the NO2 winter (July 2012) and summer (November 2012) monitoring campaigns at the Proposed Yzermyn Underground Coal Mine (BDL = Below Detectable Limit)

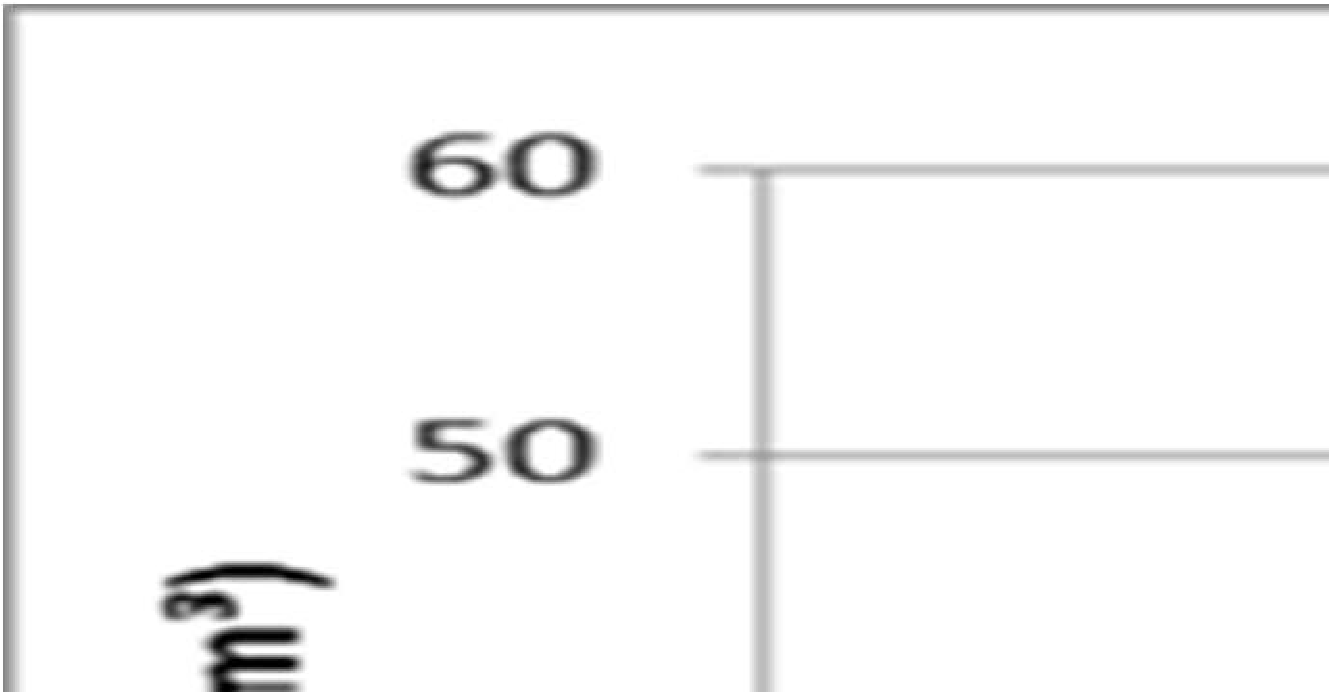


Figure 7-17: Results from the SO2 winter (July 2012) and summer (November 2012) monitoring campaigns at the Proposed Yzermyn Underground Coal Mine (BDL)

7.7 Noise

7.7.1 Regional Setting

The proposed Yzermyn Underground Coal Mine is located in an area with little to no anthropogenic influence and therefore the baseline noise levels (both night and day) are anticipated to be similar, with noise sources including insects, livestock, wind and the odd passing vehicle.

Following on from the above, the most representative daytime measurement occurred at monitoring point NS 05 (26.9 dBA) and therefore this value was utilised as the existing day time baseline noise level at all monitoring points. A night-time noise level of 25.7 dBA, the calculated average for all night-time measurements, was applied as the baseline noise level to all monitoring points.

These baseline levels were used to determine potential fluctuations in noise levels at each of the monitoring points during both day and night time as a result of construction and operational activities of the proposed Yzermyn Underground Coal Mine. The detailed noise monitoring results are provided in **7.7.1.1** (day time) and **7.7.1.2** (night time).

7.7.1.1 Existing Daytime Noise

The results from the daytime noise monitoring performed at the proposed Yzermyn Underground Coal Mine on 28 and 29 May 2012 are presented in **Table 7-3** and **Figure 7-18.** Noise levels at all locations are assessed against the SANS typical rating level for noise in rural areas (45 dBA).

The daytime noise levels ranged from 26.9 dBA to 50.8 dBA with the highest noise levels being recorded at monitoring points NS 04 and NS 08. Noise levels exceeded the SANS rural guideline at four of the eight monitoring points. These elevated noise levels could be attributed to moderate winds which were evident during monitoring period, thus resulting in wind interference with the microphone. The proposed Yzermyn Underground Coal Mine is located in a rural area with no anthropogenic noise sources and as such, elevated noise levels are not a representative of the daytime noise levels in the region. The noise levels at monitoring points NS 01, NS 02, Ns 05 and NS 06 are therefore more representative of the region, i.e. less skewed due to wind interference.

Table 7-3: Baseline Daytime 15 Minute Sound Levels for the Proposed Yzermyn Underground Coal Mine

Site ID	LAeq (dBA)	LAmax (dBA)	LAmin (dBA)	LA90 (dBA)	LZpk (dBA)
NS 01	28.30	39.90	24.30	32.30	86.00
NS 02	30.50	40.70	25.10	33.60	93.70
NS 03	46.50	72.10	24.50	59.70	86.00
NS 04	50.80	72.90	21.80	63.60	86.00
NS 05	26.90	45.30	24.20	32.50	80.70
NS 06	38.30	61.90	30.30	45.20	93.50
NS 07	49.20	73.80	23.90	62.10	86.00
NS 08	50.00	72.80	23.90	62.20	86.00

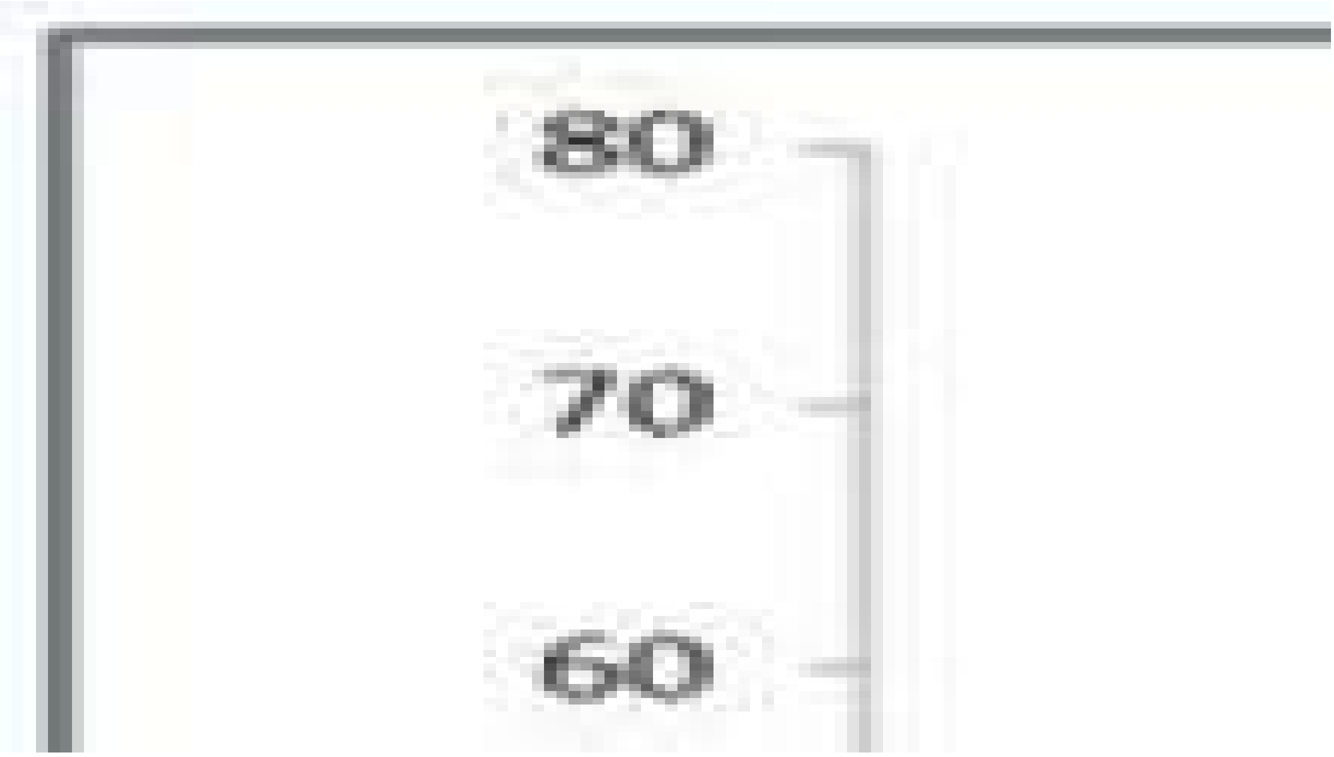


Figure 7-18: Baseline Daytime Noise Monitoring Results (LA_{eq} is compared to the SANS 10103 Guideline)

7.7.1.2 Existing Night-time Noise

The results from the night-time noise monitoring performed on 28 May 2012 are presented in **Table 7-4** and **Figure 7-19**. Access to monitoring points NS 02, NS 03 and NS 06 was not possible due to inhospitable terrain and poor visibility, and hence no measurements were recorded for the points. Night time noise levels at all the monitoring points well below the SANS rural night time guideline (35 dBA). The only discernible noise source at night was from insects and the results of this monitoring are considered representative of the night time noise levels in the region.

Table 7-4: Baseline Night-time 15 Minute Sound Levels for the Proposed Yzermyn Underground Coal Mine

Site ID	LAeq (dBA)	LAmax (dBA)	LAmin (dBA)	LA90 (dBA)	LZpk (dBA)
NS 01	26.8	36.7	24.2	31.1	74.0
NS 02	-	-	-	-	-
NS 03	-	-	-	-	-
NS 04	26.3	38.7	24.8	30.5	73.7
NS 05	25.0	29.0	24.3	25.9	60.3
NS 06	-	-	-	-	-
NS 07	25.4	43.4	24.0	30.7	73.1
NS 08	24.8	34.9	23.6	25.2	58.0

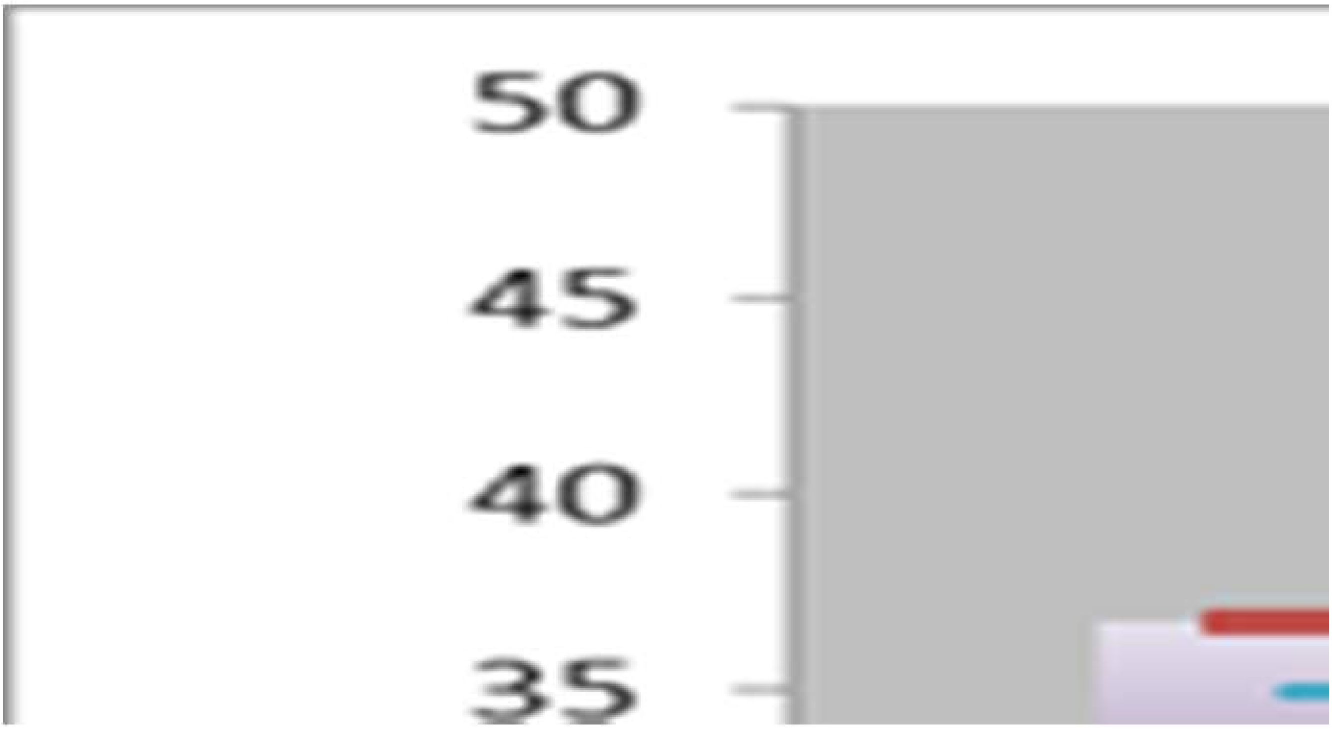


Figure 7-19: Baseline Night-time Noise Monitoring Results (LA_{eq} is compared to the SANS 10103 Guideline)

7.8 Hydrology

7.8.1 Regional Setting

It has been noted that the prospecting area is situated within the Pixley ka Seme Municipality which is located in the headwaters of three major rivers and Water Management Areas, namely the Upper Vaal, Thukela and Usutu to Mhlatuze.

7.8.2 Local Setting

The prospecting area is located within the W51A Quaternary Catchment (Midgley et al., 1994), located in the upper reaches of the Assegaai River catchment, which encompasses the Usutu catchment region (**Figure 7-20**). This river contributes to the Heyshope Dam located 15 km north-east of the prospecting right boundary. The Assegaai River confluences with the Ndlozane River 50 km east of the site, becoming the Mkhondvo River which confluences with the uSuthu River in Swaziland. The watercourses draining the catchments within the prospecting right are predominantly perennial in nature. According to the Pixley ka Seme EMF (2012), the prospecting area is located within the Usutu to Mhlatuze Water Management Area.

According to NSS (2012), the W51A catchment area is considered to have a very high ecological sensitivity based on the local diversity of habitats and species. It must be noted that the surrounding grasslands and terrestrial habitat types act as localised catchments for streams and rivers. Such quaternary catchments and rivers are generally highly sensitive to flow modifications and have no or limited capacity for commercial use. There are numerous streams and rivers that drain from the target area. Many of these are headwaters and mountain streams that flow into larger river systems, and ultimately into the Assegaai River. This area is considered a critical area for the generation of high quality water and has been included in the Freshwater Ecosystem Priority Areas (FEPA) which is discussed in detail in **Section 7.15.3**.

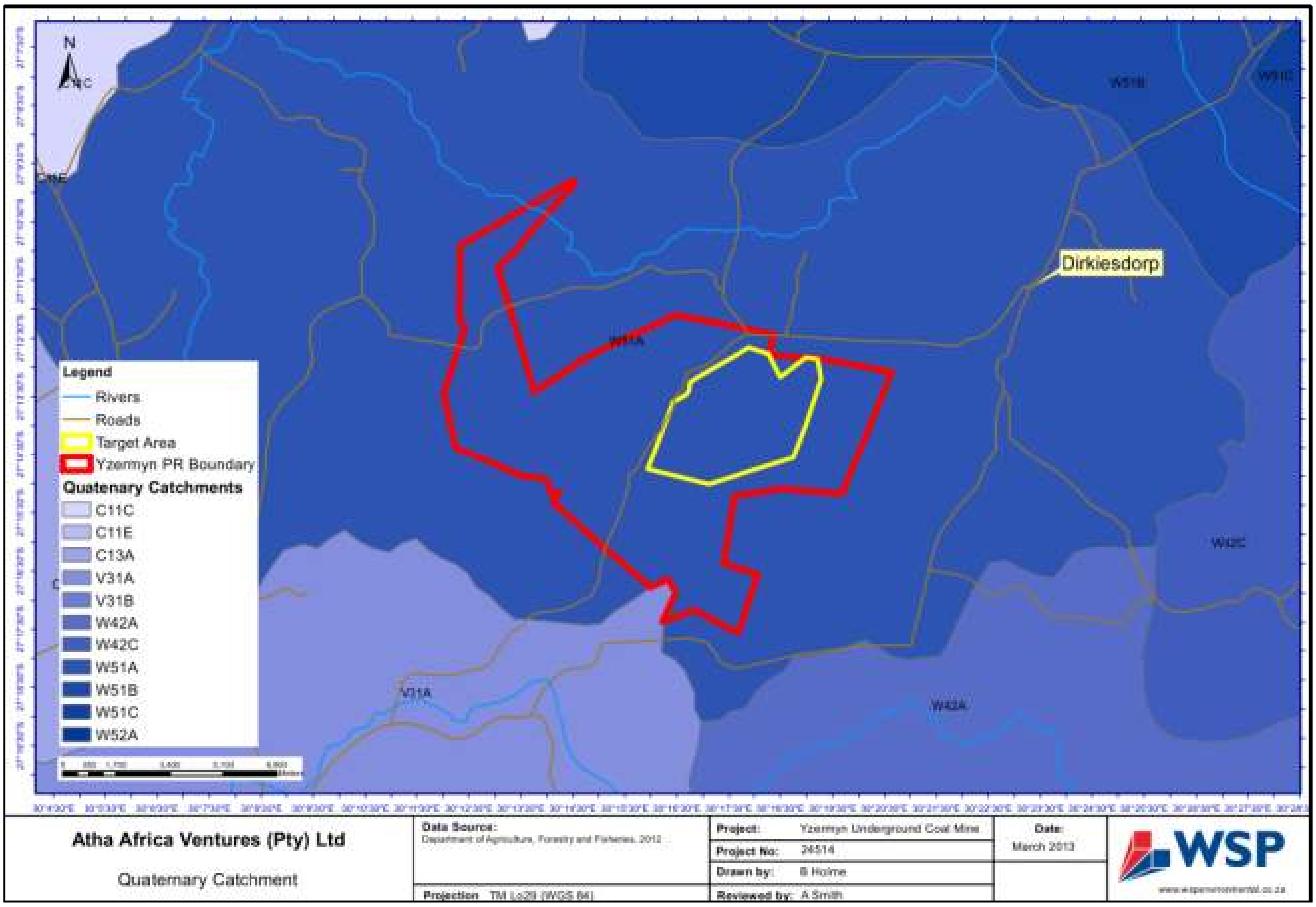


Figure 7-20: Yzermyn Mine Prospecting Boundary (Source: DAFF, 2012)

WSP calculated a hydrological model for the target area. For the purposes of the hydrological modelling, the watercourses originating within the prospecting right were divided into 21 contributing catchments based on the watercourse routing, topography, landuse and proposed developments. A hydrological model[9] has been developed for the prospecting area, which calculates the daily streamflow and peak flow at the outlet of Catchment 21 (for dry, median and wet conditions).

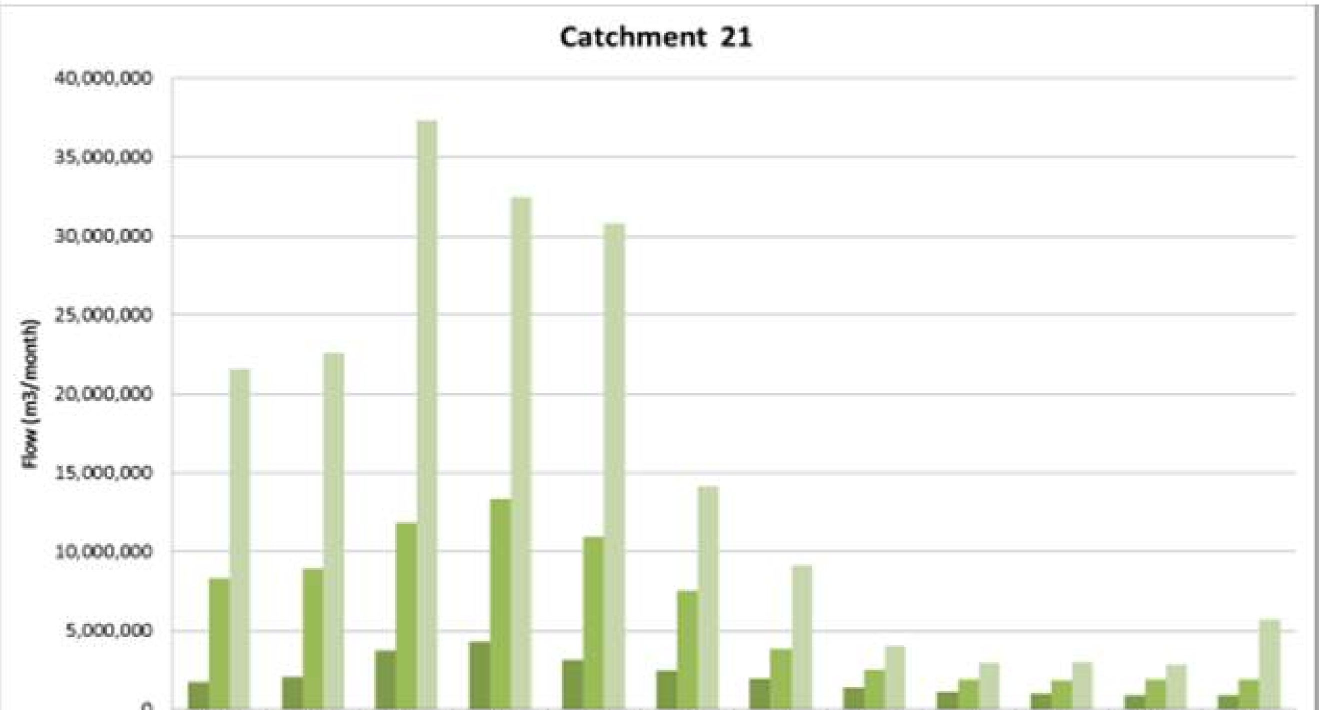
The monthly streamflow at the outlet of catchment 21 is represented in **Figure 7-21**. The monthly maximum peak flow is represented in **Figure 7-22**. Catchment 21 was selected since this represents the outlet of the contributing catchments. Based on the rainfall and runoff outputs, the following can be observed:

- The highest streamflow and peak flows are expected to occur in the summer months. The highest streamflows occur in December and January. The wet season maximum peak flows occur in February.
- Although there is a reduction in streamflow in the winter months, the flow is perennial under all climatic conditions indicating a sustainable baseflow contributing to the annual runoff from the area.
- Within all catchments, the dry and average rainfall is not as efficiently converted to runoff (both as streamflow and peak flow) as under wet climatic conditions. This is likely due to the clayey nature of the soils that promotes high runoff and peak flows during long duration or high intensity rainfall events.

9 WSP utilised the ACRU Agrohydrological modelling package which is a physical conceptual model that integrates various water budgeting and runoff producing components of the terrestrial hydrological system. The ACRU model revolves around daily multi-layer soil water budgeting. The model has been developed essentially into a versatile total evaporation model. It has therefore been structured to be highly sensitive to climate and to land cover/use changes on soil, water and runoff conditions.

Since the closest downstream streamflow gauge is on the Swaziland border, 66 km east of the site, the modelled streamflows and peak flows could not be verified based on observed data. However, the ACRU model incorporates “virgin” hydrological information for each of South Africa’s quaternary catchments, representing the catchment without anthropogenic impacts. Since the catchments included within the modelling exercise (i.e. catchments 1 to 21) comprise the W51A quaternary catchment, and the catchments include minimal anthropogenic impacts, a comparison to determine the representation of the model is possible.

To compare the default quaternary model output to the modelled catchment output, the rainfall/ runoff (MAP/ MAR) ratio was used. This ratio is indicative of the runoff response and takes into account the influence of the catchment in transforming rainfall into runoff. The comparison indicates that although the response was similar under dry conditions, under average and wet conditions the model underestimates the runoff response. This may be due to the quaternary catchment representing the catchment as a single unit, rather than comprised as subcatchments, which leads to reduced accuracy. However, the Yzermyn Mine model may also overestimate infiltration and evapotranspiration due to site specific differences in landuse, soils properties and vegetation. As a result, these factors need to be groundtruthed to confirm their accuracy.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
10%	1747601.1	2057917.0	3712116.1	4292806.3	3128353.4	2449959.7	1918428.5	1391198.6	1105462.1	1004686.3	927260.9	917429.1
50%	8272838.8	8940786.1	11821501.3	13328838.0	10932953.1	7511489.3	3831941.1	2512637.4	1891391.0	1837930.7	1874799.9	1882173.7
90%	21582627.6	22573180.7	37298747.6	32434468.4	30813451.6	14135659.4	9109155.6	4039637.7	2916969.9	2970430.3	2841388.0	5687691.9

Figure 7-21: Runoff Distribution in Catchment 21 (m^3/month) (Source: WSP, 2012)

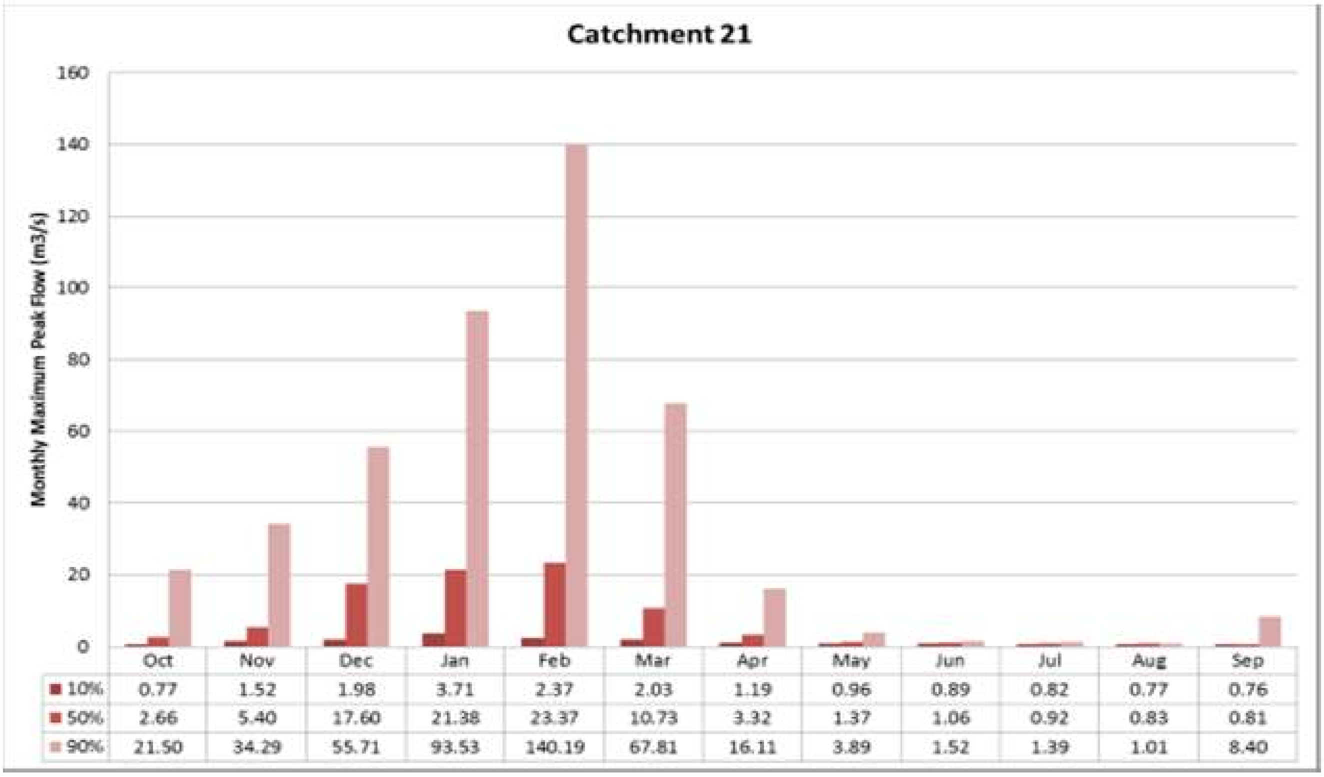


Figure 7-22: Monthly Maximum Peak Flow in Catchment 21 (m^3/s) (Source: WSP, 2012)

Water samples were taken at the four sites during NSS's initial site visit and analysed by Cleanstream Scientific Services. Nutrients, salts and metal variables were measured and compared to the South African Water Quality Guidelines where Target Water Quality Requirements (TWQR) were available for aquatic ecosystems (DWAF, 1996). The preliminary results indicate that all measured variables were within the TWQR for aquatic ecosystems, except that nitrate, ammonium and COD was slightly higher than specified by the TWQR, suggesting organic or nutrient enrichment.

7.9 Geohydrology

7.9.1 Regional Setting

It has been noted that the rocks of the Karoo Supergroup do not generally generate economic aquifers. High yielding boreholes are known to be located along dyke margins where alteration of the sandstones and shale has resulted in preferential pathways for groundwater.

Groundwater in the Karoo is commonly considered to occur in two distinct aquifers; a shallow intergranular and fractured upper aquifer in the weathering zone; and deep-seated fractured rock aquifers. The latter would include faults in the sandstone and shale.

Groundwater levels in Karoo aquifers are generally found to mimic surface topography. Groundwater tends to flow from elevated areas towards lower lying areas which are often associated with surface drainage and water courses. Surface water and groundwater interaction occurs along the river and stream courses

The shallow weathered aquifer occurs between 5 – 12 m, and up to 20 m, below the surface and is generally low yielding (1 – 10 m^3/day). The fractured rock aquifer developed variable yields and occurrence, with yields varying from 0.1 – 2 l/s. The deep-seated aquifer has been noted to have low hydraulic conductivity of approximately <0.001 m/day, although a higher hydraulic conductivity of 0.1 m/day could be expected along shallow coal seams (Pixley ka Seme EMF, 2012).

7.9.2 Local Setting

The upper weathered aquifer is recharged by rainfall with the estimated recharge expected to be 3% (22 – 180 mm per annum) of the annual rainfall (Hodgson and Krantz, 1998). The numerous shale layers in this level tend to restrict the downward filtration of rainwater into the aquifer. The largest accumulation of water may be confined to the contact between the weathered and 'fresh' bedrock. The borehole yields in this aquifer have been noted to be low due to the low aquifer parameters of the aquifer material (Environmental Screening Report, 2008). The groundwater quality in undisturbed areas may be good due to the dynamic recharge from rainfall. This aquifer is, however, likely to be affected by contaminant sources situated on surface (e.g. discard dump, etc.).

The deeper aquifers are often associated with the abundant dykes and sills that occur within the area, as the primary porosity of the Ecca Group do not allow significant groundwater flow, except where porosity has been increased by secondary structures. The dolerite intrusions have caused surrounding rock to fracture and although not all of these fractures may be water bearing, additional conduits have been developed. This aquifer may not constitute an economic aquifer able to sustain excessive pumping and irrigation. The quality of groundwater in the aquifer is of poorer quality that the shallower aquifer due to the concentration of salts resulting from the less dynamic system and larger residence time of rainfall recharge within the aquifer (Environmental Screening Report, 2008).

7.9.3 Borehole Siting

7.9.3.1 Phase 1

WSP undertook Phase 1 groundwater drilling during the scoping phase of the ESIA. Five boreholes were drilled in the northern portion of the resource area where the Alfred and Dundas coal seams were expected to be shallow (Error! Reference source not found.).

The boreholes were drilled to depths of approximately 70m bgl and intersected both Alfred and Dundas coal seams. All five boreholes proved to be poor sources of groundwater. Only one borehole had an estimated yield greater than 0.5 l/s. Water strikes in these boreholes were confined to shallow depths between 10 and 20m bgl in the weathered shallow aquifer.

Table 7-5: Boreholes Installed During Scoping Phase

Borehole ID	Latitude (WGS 84)	Longitude (WGS 84)	Total Depth (m bgl)	Fractures (m bgl)	Water Level (m bgl)	Estimated Yield (l/s)
ATHA-BH1	-27.216343	30.301979	62	Seepage	23.64	<0.1
ATHA-BH3	-27.223212	30.314948	61	12	4.03	<0.1
ATHA-BH4	-27.222509	30.315511	67	11, 62	4.54	0.13
ATHA-BH5	-27.221349	30.282341	70	Seepage	9.87	<0.1
ATHA-BH6	-27.221882	30.316052	67	16, 33, 39	3.02	0.25

7.9.3.2 Phase 2

The geological model developed for the Yzermyn Underground Coal Mine resource includes inferred faults from significant elevation differences on the coal seam. Drilling records from exploratory boreholes indicated several boreholes had encountered groundwater, generally on geological contacts. This data was used to identify five target locations for drilling of groundwater exploration/monitoring boreholes. Shallow and deep boreholes were recommended for each borehole location to allow separate access to the shallow and deeper aquifers for the purposes of testing and sampling.

Boreholes were advanced by air percussion drill with a diameter of 165 mm. Solid steel casing was installed at the top of the deeper boreholes to prevent groundwater from the shallow weathered aquifer impacting on the deeper fractured aquifer. Solid steel casing and slotted steel casing were installed in shallow boreholes to target water strikes observed in the shallow aquifer. Due to site access issues not all of the target locations could be reached by the drill rig. Additional locations and boreholes were added to the initial programme at the request of Atha. Table xx details the additional 14 boreholes that were drilled for the project.

Table 7-6: Boreholes Installed During ESIA Phase

Borehole ID	Latitude (WGS 84)	Longitude (WGS 84)	Total Depth (m bgl)	Fractures (m bgl)	Water Level (m bgl)	Estimated Yield (l/s)
CBH 1	-27.23156	30.31597	94	20	2.64	<0.5
CBH 2 S	-27.22868	30.28051	34	24	15.16	<0.5
CBH 2 D	-27.22878	30.28053	130	25, 85	15.49	3.5
CBH 3 S	-27.23360	30.30128	70	10, 18	1.63	2.6
CBH 3 D	-27.23360	30.30128	208	10, 44, 75	44.75	<0.5
CBH 4 S	-27.22252	30.30956	36	None	11.75	Seepage
CBH 4 D	-27.22253	30.30956	214	29, 191	37.95	<0.5
CBH 5 S	-27.22661	30.29597	49	38	12.7	<0.5
CBH 5 D	-27.22608	30.29530	214	40	24.99	Seepage
CBH 6	-27.21990	30.30590	82	19	30.95	<0.5
CBH 7 S	-27.22672	30.30639	40	10	8.97	3.8
CBH 7 D	-27.22668	30.30630	202	10, 16	57.77	Seepage
CBH 8 S	-27.22597	30.29018	49	None	14.6	<0.5
CBH 8 D	-27.22597	30.29016	214	None	38.75	<0.5

Following the pump testing and slug testing to identify the baseline groundwater conditions, it was noted that the hydraulic conductivity of the shallow weathered aquifer is higher than the deeper aquifer. Constant discharge testing indicates the presence of low permeability aquifer boundaries consistent with the presence of water-bearing fracture systems of limited extent. Based on the test data the geometric average hydraulic conductivity for the shallow boreholes is 0.72 m/ d and for the deeper fractured rock aquifer 0.05 m/d. Estimated transmissivities vary between 1 and 5 m^2/ d. Discussions of the aquifer pump testing, quality of borehole water and expected flow is summarised in **Section 8**.

The drilling and analysis of the boreholes assisted WSP in identifying the groundwater flow which correspond with the topography and flows in a northeasterly direction across the project area. This is expected as groundwater regionally will drain towards the Assegaai, Mawandlane and Mabola Rivers.

7.9.4 Hydrocensus

It appears that water in the project area is generally not sourced from boreholes. This was suggested by a search of the Department of Water Affairs: National Groundwater Database. No registered boreholes were found within a 30 km radius of the target area.

WSP conducted a hydrocensus to identify local boreholes and water sources from 3 to 5 March 2013. Surrounding farmers were approached and asked for information regarding the installation and locations of boreholes on their farms. WSP were informed that water is generally not sourced from boreholes but from springs (locally referred to as “fonteins”). Known locations of springs are listed in **Table 7-7** and displayed in **Figure 7-22**. The springs are used for both domestic and livestock watering purposes. Most of the springs occur high up near the sources of water courses and appear to be associated with dolerite intrusions.

No boreholes were identified in the project area.

Table 7-7: Springs identified during the 2013 hydrocensus

Spring	Latitude (WGS 84)	Longitude (WGS 84)	Elevation
Fountain 1	-27.23077	30.30374	1582.00
Mawandlane	-27.24912	30.30864	1718.00
Fountain 2	-27.23433	30.30409	1560.00
Fountain 3	-27.21399	30.29832	1475.00
Fountain 4	-27.22309	30.30504	1520.00
Fountain 5	-27.22588	30.29819	1590.00
Fountain 6	-27.24592	30.23894	1679.00
Fountain 7	-27.24136	30.23899	1700.00
Fountain 8	-27.23876	30.2375	1705.00
Fountain 9	-27.22106	30.22846	1695.00
Fountain 10	-27.2499	30.24822	1695.00
Fountain 11	-27.25129	30.25583	1715.00
Fountain 12	-27.28924	30.24068	1854.00
Fountain 13	-27.29062	30.24373	1905.00
Fountain 14	-27.2281	30.27492	1605.00
Fountain 15	-27.25047	30.27026	1730.00
Fountain 16	-27.24958	30.26935	1736.00
Fountain 17	-27.24495	30.27021	1734.00
Fountain 18	-27.24184	30.27103	1727.00
Fountain 19	-27.25528	30.26039	1734.00
Fountain 20	-27.26601	30.26277	1767.00
Fountain 21	-27.2665	30.26087	1757.00
Fountain 22	-27.26722	30.25529	1726.00
Fountain 23	-27.27641	30.25215	1785.00

7.9.5 Water Quality

Baseline water quality of the deep and shallow aquifer were sampled and analysed in order to ascertain the existing water quality within the two aquifers. The details of the sampling procedure and locations of boreholes are provided in Section 8 of this report. The groundwater samples obtained were sampled for the following:

- **Indicator Parameters:** pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Alkalinity.
- **Inorganic Compounds:** Anions F, Cl, NO_2, NO_3, and Sulphate (SO_4); and cations Na, K, Ca, Mg, including trace metal scan.

The groundwater samples were screened against the DWAF Water Quality Guidelines for Domestic Water Use. The target water quality ranges associated with domestic water use are considered applicable to the proposed Yzermyn Underground Coal Mine project water use and provide a conservative indicator of suitability for environmental uses. Baseline water quality results of the shallow aquifer is summarised in **Table 7-8** and **Table 7-9** details the results of the deep aquifer.

Table 7-8: Water Quality Results for Shallow Boreholes

Parameter	TWQG Domestic Use	CBH2S	CBH3S	CBH4S	CBH5S	CBH7S	CBH8S	Shallow groundwater baseline quality range
Alkalinity,	--		BDL	BDL	BDL	BDL	BDL	BDL
Conductivity	7000		0.326	0.259	0.186	0.245	0.17	0.17 - 0.326
Total Dissolved Solids	45000		257	201	132	196	140	132 - 256
Aluminium (µg/l)	300	BDL	13.4	11.2	9.98	3.21	17.1	3.21 - 17.1
Arsenic (µg/l)	10	0.279	0.355	9.08	0.132	1.2	BDL	BDL - 9.08
Chromium (µg/l)	50	1.5	1.87	1.52	1.43	2.02	2	1.43 - 2.01
Lead (µg/l)	10	BDL	0.509	0.471	0.362	0.8	0.224	BDL - 0.8
Manganese (µg/l)	500	66.4	**776**	37.9	55.6	121	259	37.9 - 776
Nickel (µg/l)	70	1.23	1.63	2.7	0.959	1.34	3.37	1.23 - 3.37
Selenium (µg/l)	10	BDL	BDL	0.522	BDL	0.467	BDL	BDL - 0.522
Vanadium (µg/l)	200	0.314	BDL	1.36	BDL	0.375	0.413	BDL - 1.36
Zinc (µg/l)	5000	0.555	6.47	13.5	2.5	5	7.36	0.555 - 13.5
Nitrite as NO_2 (mg/l)	0.9	0.05	BDL	BDL	BDL	0.119	BDL	BDL - 0.119
Chloride (mg/l)	300	BDL	4.3	6.3	2	BDL	BDL	BDL - 6.3
Phosphate as PO_4 (mg/l)	--	BDL	BDL	BDL	BDL	0.095	BDL	BDL - 0.095
Nitrate as NO_3 (mg/l)	11		BDL	1	BDL	3.31	BDL	BDL - 3.31
Calcium (mg/l)	--	48.4	34.9	33.4	18.6	39.3	17.7	17.7 - 48.4
Sodium (mg/l)	200	18.9	15	19.3	14.7	7.32	6.36	6.36 - 19.3
Magnesium (mg/l)	70	14.2	20.9	8.92	11.6	10.4	12.3	8.92 - 20.9
Potassium (mg/l	50	1.61	BDL	2.68	1.05	1.13	BDL	BDL - 2.68
Iron (mg/l)	2	BDL	**11.8**	0.0362	0.0782	BDL	**11.4**	BDL - 11.8
pH	6-9		**8.34**	**8.31**	7.98	7.94	7.06	7.06 - 8.34

Table 7-9: Water Quality Results for Deep Boreholes

Parameter	TWQG Domestic Use	CBH1	CBH6	CBH2 D	CBH3 D	CBH4 D	CBH5 D	CBH7 D	Deep groundwater baseline quality range
Alkalinity,	--	185					BDL	BDL	
Conductivity	7000	2.84					0.172	0.447	
Total Dissolved Solids	45000	2220					133	**351**	
Aluminium (µg/l)	300	7.75	16.1	3.66	12.8	BDL	4.75	30.2	BDL - 30.2
Arsenic (µg/l)	10	1.8	1.73	0.149	3.56	0.939	0.401	1.84	0.149-3.56
Chromium (µg/l)	50	3.46	1.83	1.37	4.64	1.64	2.67	2.3	1.37-4.64
Lead (µg/l)	10	0.186	0.2	BDL	0.189	0.905	0.313	0.606	BDL-0.905
Manganese (µg/l)	500	13.6	11.9	45.6	13.3	55.1	6.18	12.7	6.18-55.1
Nickel (µg/l)	70	1.28	0.375	0.898	0.566	2.22	1.05	3.47	0.375-3.47
Selenium (µg/l)	10	3.08	BDL	BDL	1.84	BDL	BDL	BDL	BDL-3.08
Vanadium (µg/l)	200	0.625	0.386	0.265	0.887	0.361	13.1	0.342	0.265-13.1
Zinc (µg/l)	5000	2.54	BDL	0.717	BDL	8.04	12.4	12.9	BDL-12.9
Nitrite as NO_2 (mg/l)	0.9	BDL	BDL	BDL	BDL	BDL	BDL	0.356	BDL-0.356
Chloride (mg/l)	300	**367**	22.2	BDL	103	BDL	BDL	BDL	BDL-367
Phosphate PO_4 (mg/l)	--	BDL	0.131	BDL	0.096	0.128	0.109	0.05	BDL-0.131
Nitrate NO_3 (mg/l)	11	BDL					2.03	**28.1**	
Calcium (mg/l)	--	10.3	3.19	23.7	2.42	59.2	19	11.4	2.42-59.2

Parameter	TWQG Domestic Use	CBH1	CBH6	CBH2 D	CBH3 D	CBH4 D	CBH5 D	CBH7 D	Deep groundwater baseline quality range
Sodium (mg/l)	200	828	118	41	477	22	7.66	105	7.66-828
Magnesium (mg/l)	70	4.37	0.721	7.3	1.09	10.4	10.2	4.12	0.721-10.2
Potassium (mg/l	50	6.73	2.24	2.14	2.96	2.19	BDL	BDL	BDL-6.73
Iron (mg/l)	2	0.0281	0.091	BDL	BDL	BDL	BDL	0.0716	BDL-0.091
pH	6-9	**8.79**					8.06	7.9	

Groundwater quality in both the shallow and deep boreholes largely falls within the drinking water guideline values. The results have been used to develop a groundwater quality baseline for future reference.

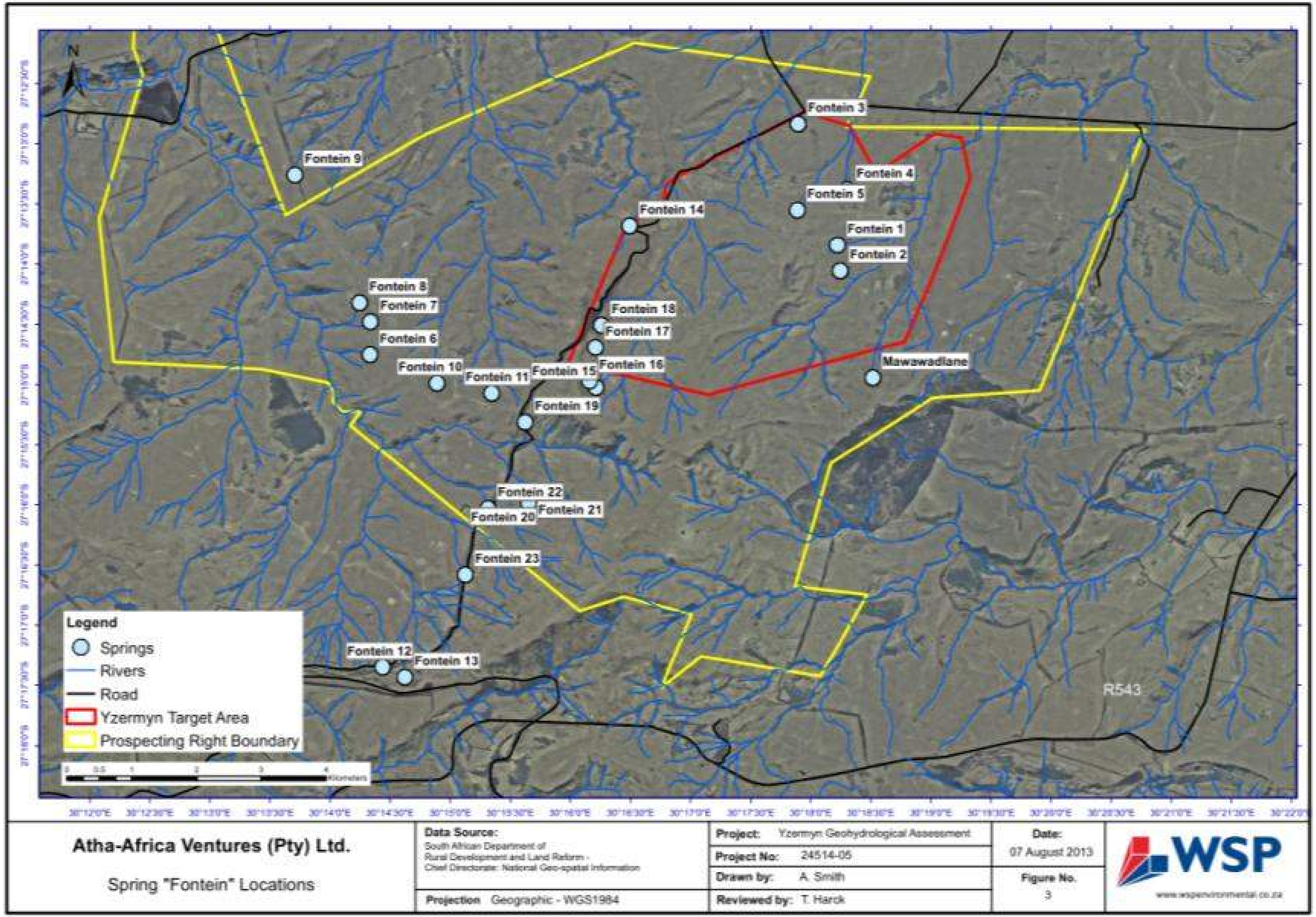


Figure 7-23: Location of Springs Identified during Hydrocensus

7.9.5.1 Acid Mine Drainage Potential

When mined materials *viz.* underground mines, waste rock dumps, discard dumps, etc. are excavated and exposed to oxygen and water, acid can form if iron sulphide minerals (material rich in pyrite) are abundant and there is an insufficient amount of neutralising material to counteract the acid formation. The acid may leach or dissolve metals and other contaminants from the mined material and form a solution that is acidic, high in sulphate and metal-rich (including elevated concentrations of cadmium, copper, lead, zinc, arsenic, etc.) (Environmental Law Alliance, 2010).

Most coal contains pyrite, leading to the potential for the formation of acid mine drainage. This can contaminate both groundwater and surface water. Many coal deposits have high sulphur contents, with the potential to lead to a significant hazard. Coal dumps are also important acid generators and sites of spontaneous combustion if not constructed properly.

The soil and rock excavated to expose the coal ore, in addition to the waste rock formed during the processing of coal product, often contain sulphide minerals such a pyrite (FeS_2) that when exposed to air and water, will oxidize and release large quantities of iron and sulphate into solution. In addition, H^+ ions are liberated during the oxidation process producing an acidic solution that readily weathers and releases other trace minerals (i.e. copper and zinc) into solution. The acidic solution formed, characteristic of high metals and sulphate and low pH, is generally termed acid mine drainage.

7.10 Biodiversity and Ecosystems

The following section provides a description of the baseline biodiversity within the region and on site. The results of the detailed on-site investigations are included in **Appendix C: Biodiversity Impact Assessment**.

In terms of the National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEMBA), the term biodiversity is defined as the *variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems*.

This report provides an analysis of the receiving environment, with regards to biodiversity, based on the data that has been obtained. The baseline conditions are required in order to establish a high-level understanding of the sensitivity of (specifically) the target area.

Figure 7-24 provides a graphical representation of the biodiversity within the Pixley ka Seme's municipal boundary and indicates which areas are irreplaceable, highly significant, important and necessary, least concern and no natural habitat remaining. The areas within the municipal boundary that were rated as protected or irreplaceable for terrestrial ecosystem were the high lying areas on the eastern side of the study area, including the Paardeplaats Nature Reserve, Wakkerstroom vlei, Kastrol Nek and surrounding areas.

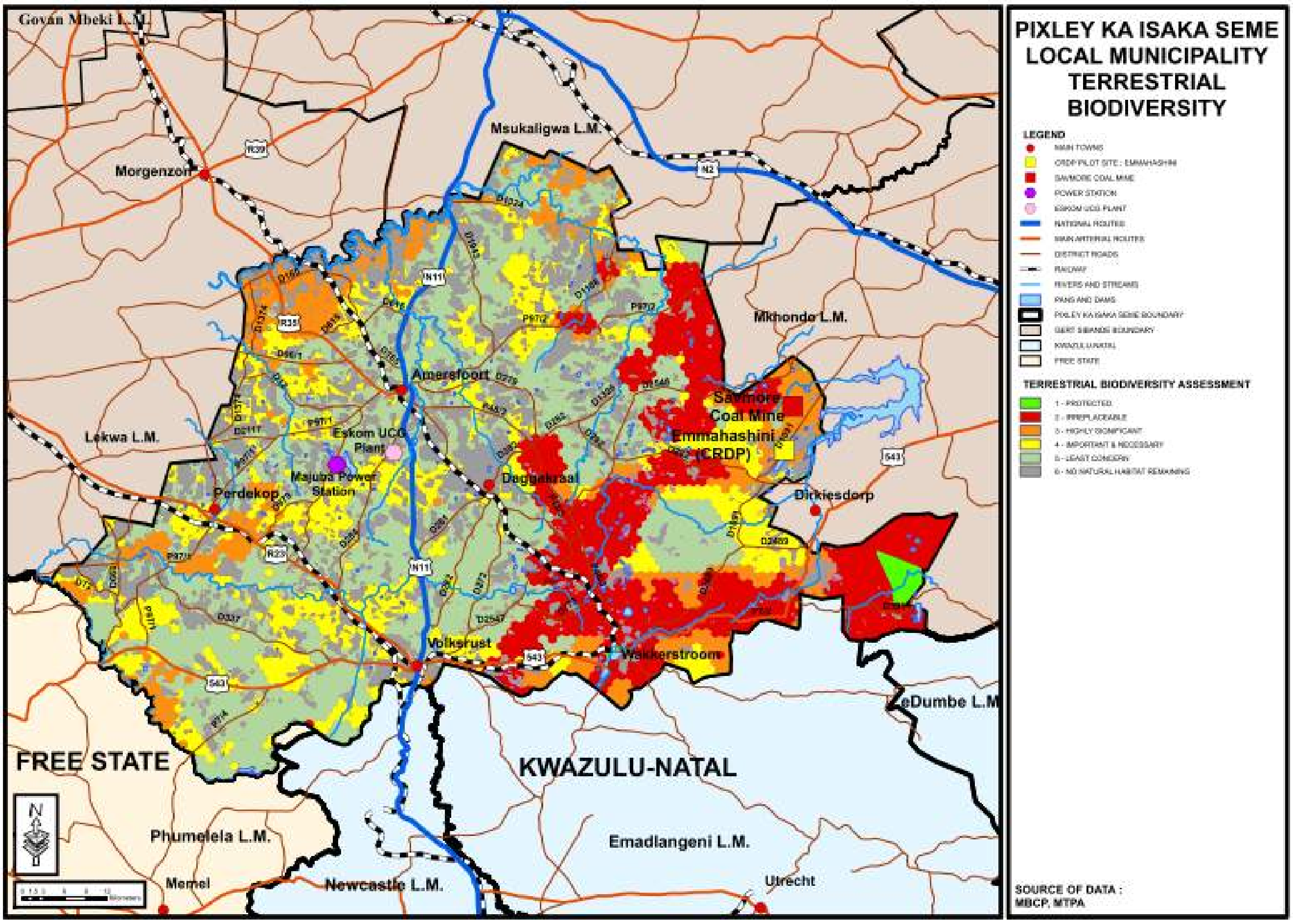


Figure 7-24: An overview of the Terrestrial Biodiversity within the Pixley ka Seme Local Municipality (Pixley ka Seme Local Municipality Spatial Development Framework, 2010)

The Pixley ka Seme Social Development Framework (SDF, 2010) further indicates that a small portion of the municipal area is under formal or semi-formal protection as illustrated in **Figure 7-25**. The Paardeplaats Nature Reserve is the only provincial nature reserve in the area and the Wakkerstroom Wetland Reserve is under municipal protection. Other conservancies include the Bloukop and Rietvaal Conservancies and the newly proposed Mhlangampisis and Baltrasna conservancies. The south-eastern parts of the municipal area are most important and identified as a hotspot area for Red Data taxa as indicated in **Figure 7-26**. This area includes mainly Mountain grassland and Escarpment grassland as well as the Wakkerstroom wetland area.

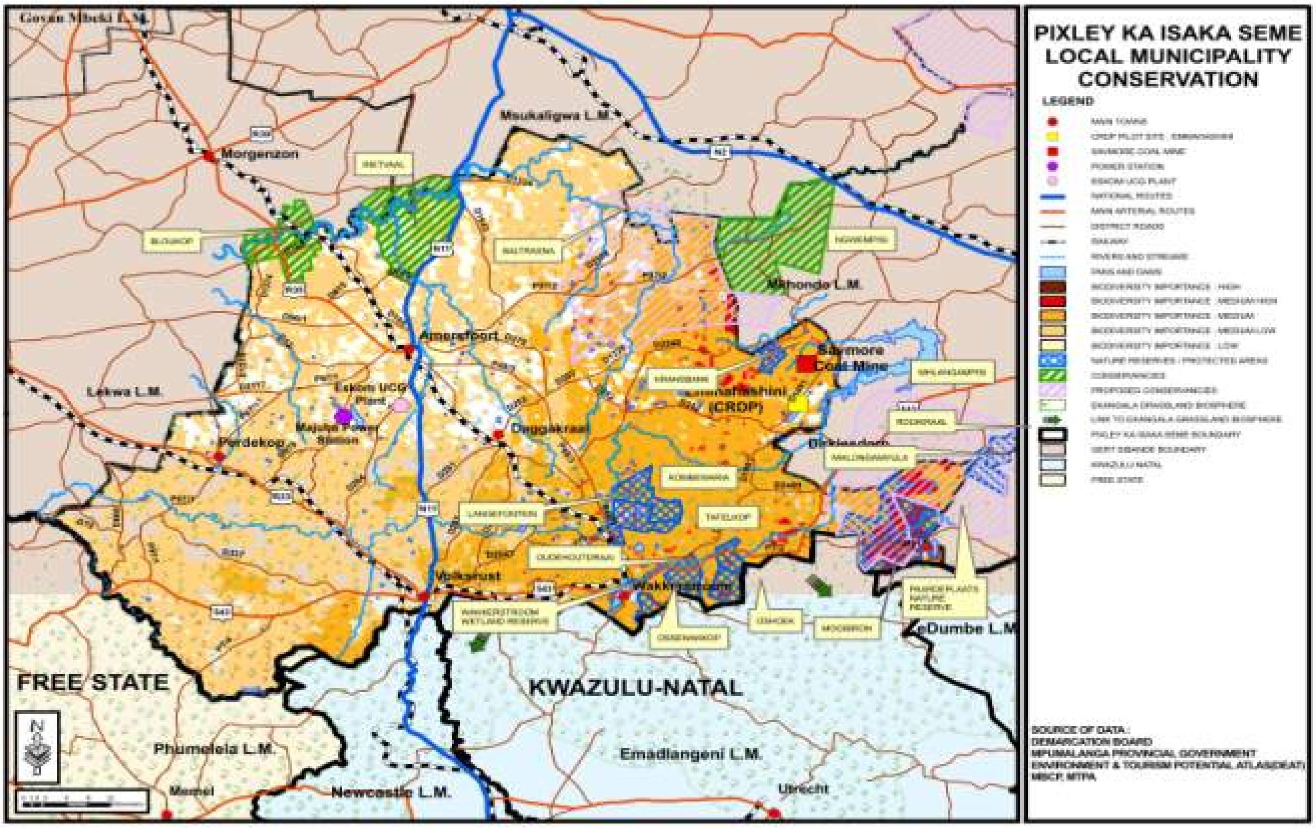


Figure 7-25: Conservation areas within the Pixley ka Seme Local Municipality (Pixley ka Seme Local Municipality Spatial Development Framework, 2010)

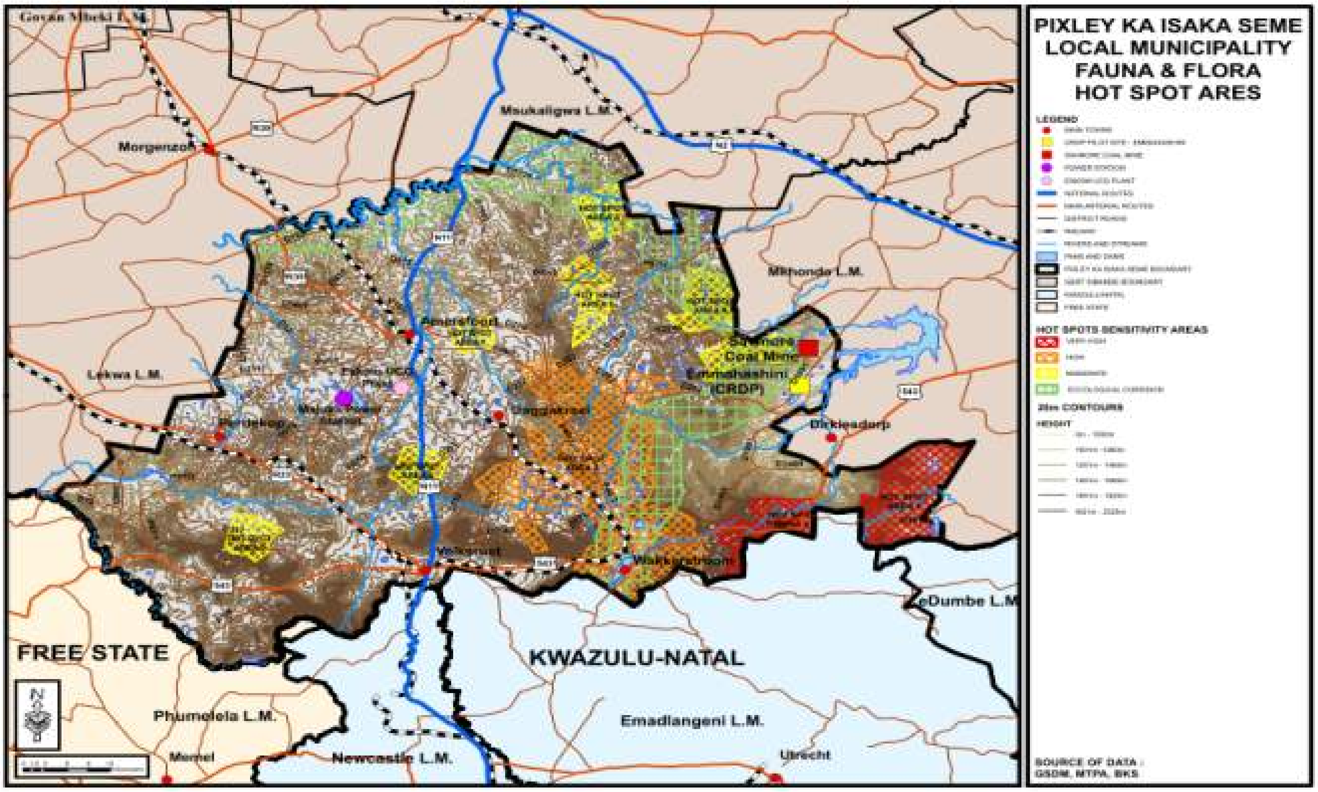


Figure 7-26: Fauna and Flora Hot Spot Areas within the Pixley ka Seme Local Municipality (Pixley ke Seme Local Municipality Spatial Development Framework, 2010)

7.11 Flora

7.11.1 Regional Setting

The Pixley ka Seme Local Municipality SDF (2010) notes that the most important environmental factors influencing the distribution of plant communities (flora) within the municipal boundary are terrain morphology and soil wetness. The vegetation types found in the municipal area include the western plains grassland, central plains grassland, Wakkerstroom plains grassland, eastern plains grassland, escarpment grassland, mountain grassland, forests and wetlands. Most of the grassland areas are endangered due to agricultural activity and are poorly conserved except in the conservancy areas. The remaining grassland of the eastern plains should be regarded as endangered and therefore sensitive. The escarpment grassland is better preserved due to the mountainous terrain that restricts agriculture. The grassland is only 2% transformed and in good condition, rich in forbs species and with some scattered shrubs and bush on the rocky outcrop. The mountain grassland is considered pristine with only 6% transformed. It is very rich in species and therefore has a high conservation status and sensitivity. Parts north of Wakkerstroom are considered as least concern due to inaccessibility although some areas are considered as important or even irreplaceable according to the Mpumalanga Biodiversity Conservation Plan (C Plan).

7.11.2 Local Setting

The prospecting area is situated within Rutherford and Westfall's (1994) Grassland Biome, which occurs mainly on the high central plateau of South Africa, the inland regions of KwaZulu-Natal and the Eastern Cape. The majority of plant species within grasslands are non-grassy herbs (forbs), most of which are perennial plants with large underground storage structures. Tree species are limited due to frost, fire and grazing, which maintains the herbaceous grass and forb layer and ultimately prevents the establishment of tall woody plants (Tainton, 1999).

The Grassland Biome has an extremely high biodiversity, second only to the Fynbos Biome. At the 1000 m2 scale, the average species richness of the Grassland Biome is even higher than that of most Fynbos communities (Cowling et al., 1997; van Wyk, 2002), being surpassed only by the Renosterveld. As the majority of rare and threatened plant species in the summer rainfall region of South Africa are restricted to high-rainfall grassland, this vegetation type is in most urgent need of protection (60% destroyed and only 2.2% conserved).

Based on Mucina and Rutherford (2006) (**Figure 7-27**), the general natural vegetation within the study area is dominated by Wakkerstroom Montane Grassland. In the lower lying areas adjacent to watercourses Paulpietersburg Moist Grassland is present.

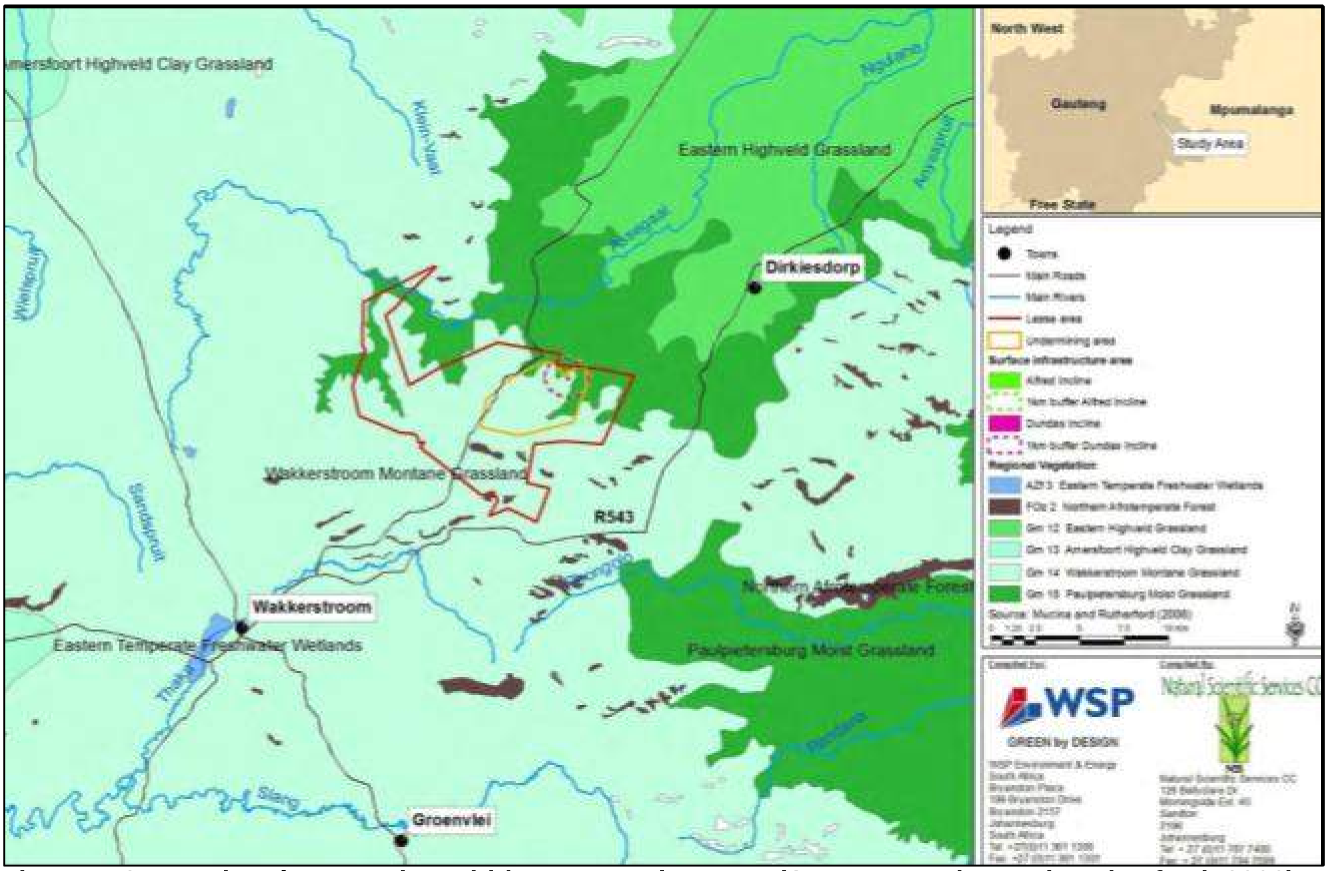


Figure 7-27: Regional Vegetation within Prospecting Area (Source: Mucina and Rutherford, 2006)

The three key vegetation units from Mucina and Rutherford (2006) within which the prospecting area is situated are described in **Table 7-10**.

Table 7-10: Vegetation Units within the Prospecting area (Source: Mucina and Rutherford, 2006)

Vegetation Unit	Characteristic Features
Northern Afrotemperate Forest (Least Threatened)	Restricted to mountain kloofs and low ridges such as within the Drakensberg, Low Escarpment, Waterberg, Magaliesberg, Witwatersrand, Suikerbosrand, Strydpoortberg, Sekhukhuneland and similar areas. Altitudes of 1500 – 1900 m.
Wakkerstroom Montane Grassland (Least Threatened)	Located between the escarpment and the southeast of Utrecht and extends from Volksrust eastwards to Kwa Mandhlangampisi Mountain. Comprised of low mountains and undulating plains. Drakensberg escarpments at an altitude of 1440 – 2200 m. Vegetation comprised mostly of short mountain grassland on plateaus and flatter areas. Small forest and *Leucosidea* thickets occur along drainage areas and steep eastward facing slopes.
Paulpietersburg Moist Grassland (Vulnerable)	Restricted to the highest catchments of the Pongolo River which encompasses the areas surrounding Piet Retief, Paulpietersburg, Vryheid and westwards to the east of Wakkerstroom at an altitude of 920 – 1500 m. Landscape includes moderately steep slopes and mountainous regions towards the northern and eastern boundaries but mostly undulating except for valley basins which are wide and flat.

The SANBI's PRECIS data indicates that 72 plant families including 562 plant species have been previously recorded in the area comprising 2730AA, AB, AC and AD topography maps wherein the prospecting area is situated. The most dominant plant families are listed in **Table 7-11.**

Table 7-11: Top Ten Dominant Plant Families Occuring in the Prospecting Area and Surrounds (SANBI)

Family	No. of Species
Asteraceae	141
Apocynaceae	47
Poaceae	42
Fabaceae	21
Apiaceae	20
Amaryllidaceae	17
Iridaceae	14
Anacardiaceae	12
Cyperaceae	12
Acanthaceae	9

7.11.2.1 Target Area Specific Vegetation

Natural Scientific Services CC (NSS) was appointed to undertake a comprehensive biodiversity assessment for the proposed Yzermyn Underground Coal Mine. During the initial fieldwork (26 – 30 March 2012 and 14 – 18 January 2013), a minimum number of 215 plant species from 70 families were identified in the target area and surrounds. These were found in 6 broad habitats which are listed in **Table 7-12**. Examples of some of the habitats are shown in **Figure 7-28**. Specific vegetation communities will be identified within each of the six broad habitats following the second period of fieldwork at the site.

Table 7-12: Broad Habitats Identified in the Yzermyn Mine Target Area

Broad Community	Description
Forest Area and Bushclumps	The forest area occurred at the top of the site and consisted of an assemblage of shrubs and trees with an understory of grasses and some herbaceous species such as *Berkheya setifera* and *Eragrostis curvula.* Bushclumps occurred on rocky slopes with deeper soils that were surrounding by grassland. Species included: *Cussonia spicata*, *Myrsine africana* and *Rhamnus prinoides*.
Riparian Vegetation	Occurring along river banks, providing habitat for woody species such as *Buddleja salvifolia* and *Searsia dentata*, high moisture-tolerant grasses such as *Leersia hexandra*, as well as herbaceous species *Persicaria lapathifolia* and *Freesia grandiflora*. Also with some species of fern occurring.
Short Montane Grassland	This short variety of grassland occurred on steep slopes that were without rocks and provided habitat for grass species such as *Digitaria eriantha*, *Microchloa caffra* and *Monocymbium ceresiiforme.*
Spongy Wetland	Sponge wetlands typically support a high diversity of uniquely-adapted plant species, and are important for maintenance of flow in the downstream drainage systems. Some of the species identified here included: *Cyperus* spp., *Kyllinga erecta* and *Schoenoplectus corymbosus*.
Steep Rocky Grassland	Steep slopes with rocky outcrops and sandy soils comprised: *Aristida junciformis*, *Melinis nerviglumis* and *Melinis repens.* Herbaceous *Berkheya* spp. were also common along these slopes.
Tall Lower Grassland	Tall-growing grassland occurred on the lower slopes and was dominated by *Eragrostis curvula*, *Hyparrhenia hirta* and *Themeda triandra*.

Bush Clump

Spongy Wetland

Riparian Vegetation

Figure 7-28: Examples of Broad Habitats Identified in the Yzermyn Mine Target Area

7.11.2.2 Conservation Important Species of Flora

Data on Conservation Important Species (CIS) of flora in South Africa were accessed from SANBI's online PRECIS database (accessed: April 2012). Six floral CIS are listed for the four topographical maps wherein the prospecting area is situated. In addition to this, a schedule of Protected Species was sourced from the Mpumalanga Conservation Act (No. 10 of 1998), which was adapted from the Old Transvaal Nature Conservation Ordinance (1983). 19 protected, three vulnerable and three rare flora species may potentially occur within the project site. A provisional list of potentially occurring and observed CIS of flora is given in **Appendix C: Biodiversity Impact Assessment**.

7.11.2.3 Alien Invasive Species of Flora

Names of alien plant species that have previously been found in the four topographical map areas wherein the prospecting area is situated were accessed from the PRECIS database and are given in **Appendix C: Biodiversity Impact Assessment**. Alien plant infestations in the target area were not extensive and were generally restricted to lower elevations at the bottom of hill slopes. The four main invasive plant species were identified during the initial site assessment which included plantations of Category 2 *Acacia mearnsii* and *A. melanoxylon* as well as the Category 3 *Ipomoea purpurea*, and bush clumps of *Eucalyptus spp*.

7.12 Fauna

The Grassland biome is characterised by a high diversity of fauna (animals) including many threatened taxa. NSS used a scale in assigning the likely occurrence (LoO) of species within the target area. Species that were identified and observed on site have been assigned a LoO = 1, and species with a low LoO that are unlikely to occur within the site have been excluded from the study. The following fauna taxa were assessed:

- Birds;
- Mammals;
- Reptiles;
- Amphibians; and
- Butterflies.

7.12.1 Bird Species

7.12.1.1 Regional Setting

According to the Mpumalanga Tourism and Parks Agency (MTPA) database 17 Red Data listed bird species have been recorded in the municipal area of which some of these species are rare and protection of grasslands and wetlands is critical for their survival.

7.12.1.2 Local Setting

It must be noted that data from the second Southern African Bird Atlas Project (SABAP 2) were used to develop a list of Red Data bird species that have been recorded in the past five years within the nine pentads (5' x 5' atlassing grid-cells, illustrated in **Figure 7-29**) wherein the proposed target area is situated. Personal observations of threatened bird species in the area which pre-date the start of the current atlas project were also referenced and included in this report.

According to NSS (2012) 186 bird species have been recorded during the past five years in the nine pentads within which the target area site is situated. Of these, 78 species were personally observed by NSS during initial fieldwork (26 – 30 March 2012). 61 bird species have a moderate or high likelihood of occurrence on the target area, of which 14 were observed during initial fieldwork. The number of potentially occurring species in different bird families are shown in **Appendix C: Biodiversity Impact Assessment**.

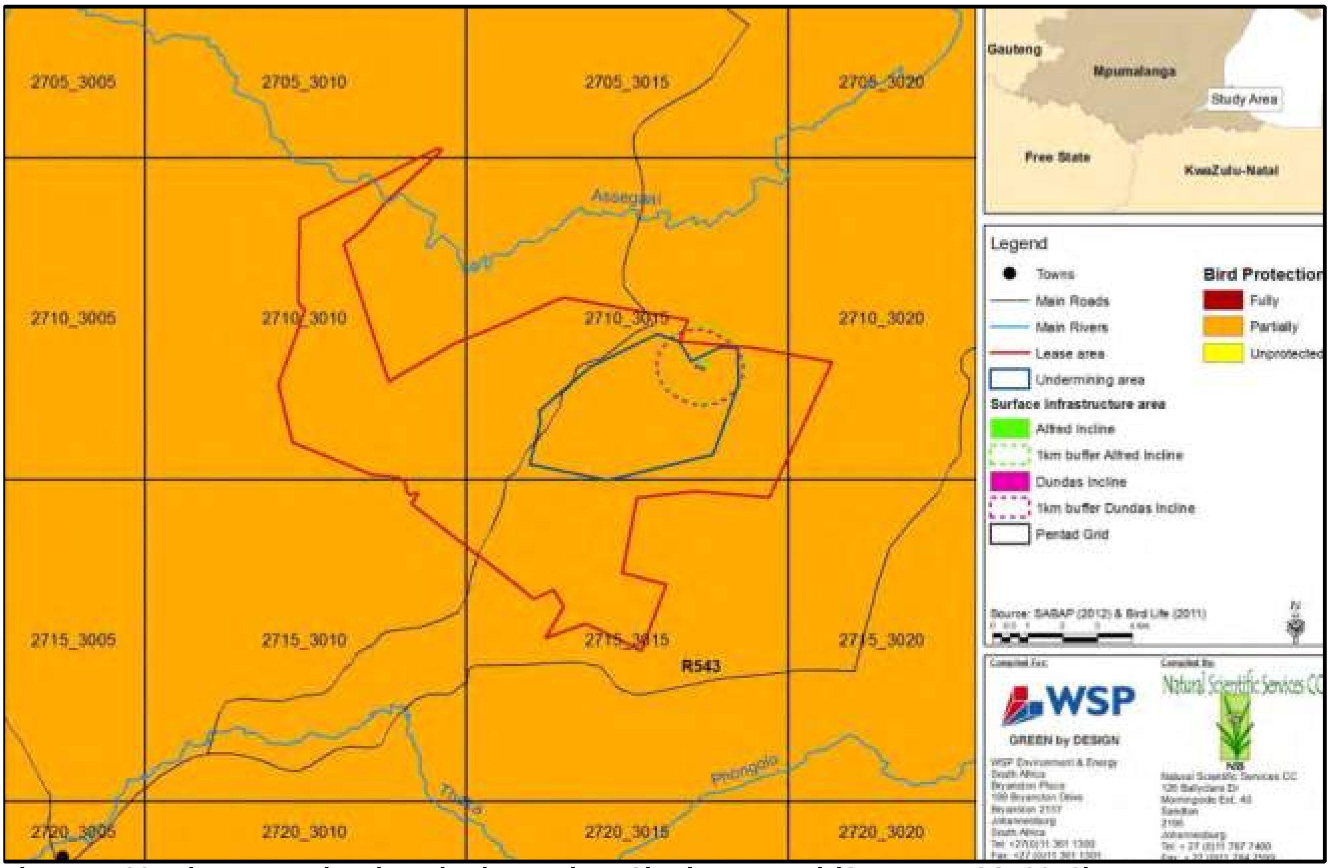


Figure 7-29: Nine Pentads wherein the Project Site is Located (Source: NSS, 2012)

7.12.2 Mammal Species

7.12.2.1 Regional Setting

The Pixley ka Seme Local Municipality SDF (2010), notes that the municipal area contains 76 mammal species which excludes animals found in the nature reserves or game farms. Red data listed mammals species include 12 species such as the *Ourebia oribi* (Oribi), and possibly *Poecilogale albinucha* (African Weasel), *Lutra maculicollis* (Spotted-necked Otter) as well as shrew species of the genera *Crocidura* and *Myosorex.*

7.12.2.2 Local Setting

According to NSS (2012) 86 mammal species have a moderate or high likelihood of occurrence on the prospecting area, of which nine were observed during initial fieldwork within the target area. Potentially occurring species in different mammalian orders are shown in **Table 7-13**.

Table 7-13: The Number of Potentially Occurring Species per Mammalian Order in the Target Area (Source: NSS, 2012)

Order	Common Name	No. of Species
AFROSORICIDA	Golden Moles	2
MACROSCELIDEA	Elephant-shrews	1
EULIPOTYPHLA	Hedgehog & shrews	10
CHIROPTERA	Bats	12
PRIMATES	Baboon & monkeys	3
LAGOMORPHA	Hares & rabbits	4
RODENTIA	Squirrels, mice, porcupine, etc.	23
CARNIVORA	Cats, dogs, mongeese, etc.	22
TUBULIDENTATA	Aardvark	1
HYRACOIDEA	Hyraxes	1
SUIFORMES	Pigs	2
RUMINANTIA	Buffalo, giraffe & antelope	4
Source: Friedmann & Daly (2004); Stuart & Stuart (2007)		

7.12.3 Reptile Species

7.12.3.1 Regional Setting

The Pixley ka Seme Local Municipality SDF (2010), notes that 60 reptile species (snakes, lizards, geckos, tortoises etc.) have been recorded in the municipal area of which eight of these are possibly Red Data species.

7.12.3.2 Local Setting

NSS (2012) has noted that 61 reptile species have a moderate or high likelihood of occurrence in the target area, of which 14 were observed during the initial fieldwork. The number of potentially occurring species in the difference reptile families are shown in **Table 7-14**.

Table 7-14: Number of Potentially Occurring Species per Reptile Family in the Target Area (Source: NSS, 2012)

Family	Common Name	No. of Species
TYPHLOPIDAE	Blind snakes	1
LEPTOTYPHLOPIDAE	Thread snakes	1
ATRACTASPIDIDAE	African burrowing snakes	3
COLUBRIDAE	Typical snakes	22
ELAPIDAE	Cobras & mambas	4
VIPERIDAE	Adders	2
AGAMIDAE	Agamas	2
CHAMAELEONIDAE	Chameleons	1
VARANIDAE	Monitors	2
LACERTIDAE	Lacertids	3
SCINCIDAE	Skinks	8
CORDYLIDAE	Girdled lizards	4
GERRHOSAURIDAE	Plated lizards	1
GEKKONIDAE	Geckos	5
PELOMEDUSIDAE	Terrapins	1
TESTUDINIDAE	Tortoises	1
Source: SARCA; Branch (1998)		

7.12.4 Amphibian Species

7.12.4.1 Regional Setting

The Pixley ka Seme Local Municipality SDF (2010), notes that 22 frog species occur within the municipal area but none are currently listed as threatened.

7.12.4.2 Local Setting

NSS (2012) has noted that 22 amphibian species have a moderate or high likelihood of occurrence in the target area, of which five were observed during initial fieldwork. Potentially occurring species in different amphibian families are shown in **Table 7-15**.

Table 7-15: Number of Potentially Occurring Species per Amphibian Family in the Target Area (Source: NSS, 2012)

Family	Common Name	No. of Species
BREVICIPITIDAE	Rain frogs	2
BUFONIDAE	Toads	4
HELEOPHRYNIDAE	Cascade and ghost frogs	1
HYPEROLIIDAE	Reed frogs	3
PHRYNOBATRACHIDAE	Puddle frogs	1
PTYCHADENIDAE	Grass frogs	1
PIPIDAE	African clawed frogs	1

Family	Common Name	No. of Species
PYXICEPHALIDAE	River, stream and bullfrogs	9
Source: Minter *et al.* (2004); Du Preez & Carruthers (2009)		

7.12.5 Butterfly Species

7.12.5.1 Regional Setting

The Pixley ka Seme Local Municipality SDF (2010), noted that a number of butterfly species were recorded in the municipal area however most of them are widespread and not considered to be threatened. The only Red Data species in this group is the *Lepidochrysops swanepoeli*.

7.12.5.2 Local Setting

140 butterfly species have a moderate or high likelihood of occurrence on the target area, of which >10 species were observed during initial fieldwork. Potentially occurring species in different butterfly families is shown in **Table 7-16**.

Table 7-16: Number of Potentially Occurring Species per Butterfly Family in the Target Area (Source: NSS, 2012)

Family	Common Name	No. of Species
HESPERIIDAE	Skippers and relatives	21
LYCAENIDAE	Blues, Coppers, Opals and relatives	62
NYMPHALIDAE	Charaxes, Acraeas and relatives	42
PAPILIONIDAE	Swallowtails and relatives	4
PIERIDAE	Whites, Vagrants, Tips and relatives	11
Source: SABCA; Williams (1994)		

7.12.6 Conservation Important Species of Fauna

A provisional list of potentially occurring and observed conservation important species (CIS) of fauna in the prospecting area is given in **Appendix C: Visual Impact Assessment**. The list includes one critically endangered (CR), one endangered (EN), seven vulnerable (VU) and 20 near threatened (NT) species. Preliminary fieldwork indicates that at least five CIS species occur in or near the target area, including the NT Serval (*Leptailurus serval*), NT Secretarybird (*Sagittarius serpentarius*), NT Bush Blackcap (*Lioptilus nigricapillus*), NT Half-Collared Kingfisher (*Alcedo semitorquata*) and NT Transvaal Grass Lizard (*Chamesaura aenea*) illustrated in **Figure 7-30**.

Serval Transvaal Grass Lizard Bush Blackcap

Figure 7-30: Examples of Conservation Important Species of Fauna Identified within the Target Area

7.13 Aquatic Ecology

According to the Pixley ka Seme Local Municipality SDF, the present ecological state of the aquatic ecosystems within the municipal area was rated as Largely Natural to Moderately Modified (Category B to C) which can be considered as acceptable and not critical. Systems that were in a natural or near-natural condition included the Hlelo River and its tributaries, the wetlands and streams in the Paardeplaats Nature Reserve and the Wakkerstroom area (see **Figure 7-31** and **Figure 7-32**).

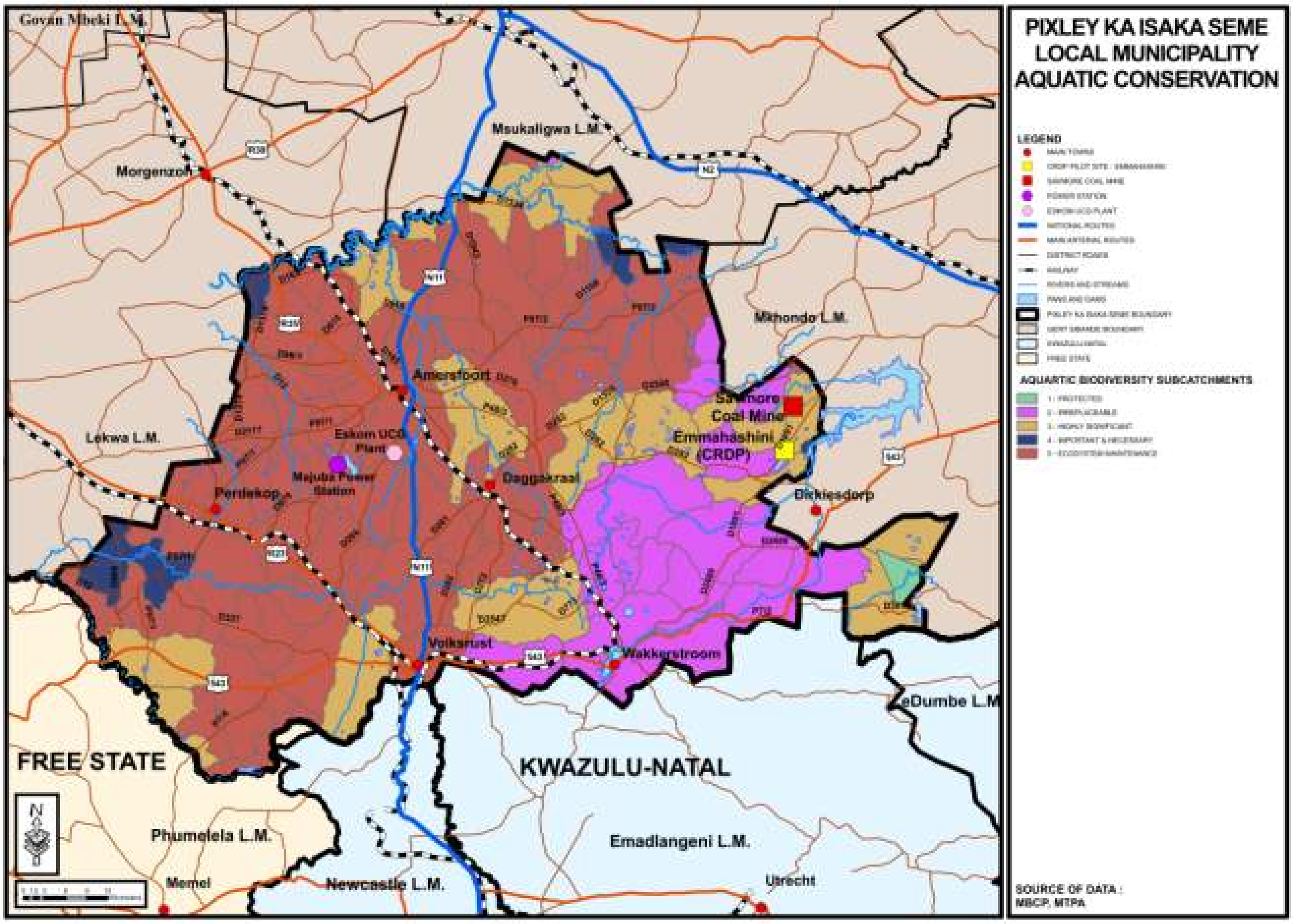


Figure 7-31: Aquatic Conservation in the Pixley ka Seme Local Municipality (Source: Pixley ka Seme Local Municipality Spatial Development Framework, 2010)

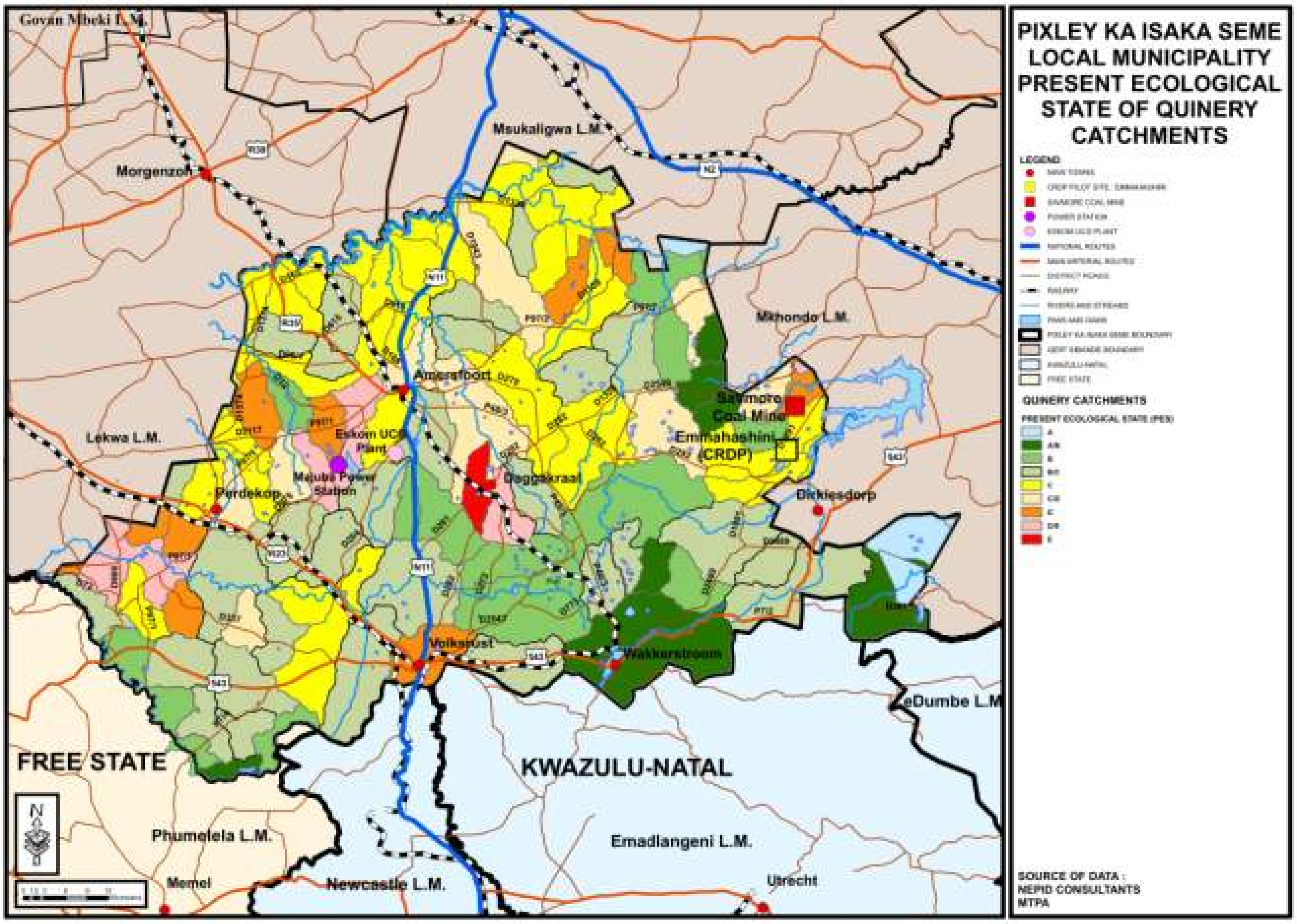


Figure 7-32: The Present Ecological State of the Quaternary Catchments in the Pixley ka Seme Local Municipality (Source: Pixley ka Seme Local Municipality Spatial Development Framework, 2010)

7.13.1 Macro-invertebrates

7.13.1.1 Local Setting

The standard SASS5 protocol (Dickens and Graham, 2002) was followed to collect invertebrate samples, and three biotopes were investigated including stones, vegetation (marginal and aquatic), and gravel, sand and mud (GSM). Preliminary results suggest that the aquatic systems sampled were largely natural, as indicated by the presence of sensitive taxa like *Heptageniidae*, *Leptophlebiidae*, *Tricorythidae*, *Athericidae* and *Ecnomidae*, or moderately modified due to sedimentation and exotic vegetation

7.13.2 Fish

7.13.2.1 Regional Setting

The fish species that are expected to occur within the municipal area are mainly located in the Usutu Catchment and less so in the Thukela River Catchment. There are no highly sensitive fish species in the Upper Vaal River Catchment.

7.13.2.2 Local Setting

10 fish species potentially occur at varying frequencies within the Assegaai River and its tributaries (**Appendix C: Biodiversity Impact Assessment**). The preferred habitat of these species ranges from clear fast-flowing water (e.g. *Amphilius uranoscopus*) to more turbid, pooled aquatic habitat (e.g. *Pseudocrenilabrus philander*). The River Health Programme (RHP; Mangold, 2001) and Fish Response Assessment Index (FRAI; Kleynhans, 2008) were used to assess the fish populations in Mkusaze and Mawandlane Rivers, which are both tributaries of the Assegaai River, and which may be potentially impacted upon by the proposed Yzermyn Mine activities. The sampling techniques included electro-shocking (Meador et al., 1993; Barbour et al., 1999) and use of fyke nets.

Preliminary results indicate that at the various aquatic sampling sites fish habitat availability was good with numerous flow types, substrate size classes, velocity depth classes and marginal vegetation present. Of the 10 potentially occurring fish species, three were observed. Although these did not include any CIS, there is no reason to believe that these CIS species are absent from the target area as fish habitat conditions were good at the sampled aquatic sites.

7.13.2.3 Conservation Important Species of Fish

Three CIS of fish potentially occur in the project area including *Chiloglanis emarginatus, Barbus brevipinnis* and *Varicorhinus nelpsruitensis*. Engelbrecht et al. (2007) classified *V. nelspruitensis* and *B. brevipinnis* as NT while the Mpumalanga Conservation Authority considers *C. emarginatus* of conservation importance in the area. All three CIS of fish have previously been sampled in the Assegaai River catchment.

7.14 Wetlands

7.14.1.1 Regional Setting

The National Water Act (No. 36 of 1998) defines a wetland as: "*Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*".

The wetlands in the Pixley ka Seme Local Municipality were delineated and are depicted in **Figure 7-33** (Pixley ka Seme Local Municipality SDF, 2010). The total area occupied by wetlands, including dams is estimated at 124,734 ha or 18.9% of the area. According to the Pixley ka Seme Local Municipality SDF (2010) hill slope seepage wetlands (67%) are by far the most common wetland type in the municipal area followed by valley bottom wetlands (31%) and floodplains (2%). There were 656 farm dams identified within the municipal area most of which were 0.4 to 1.2 ha in extent.

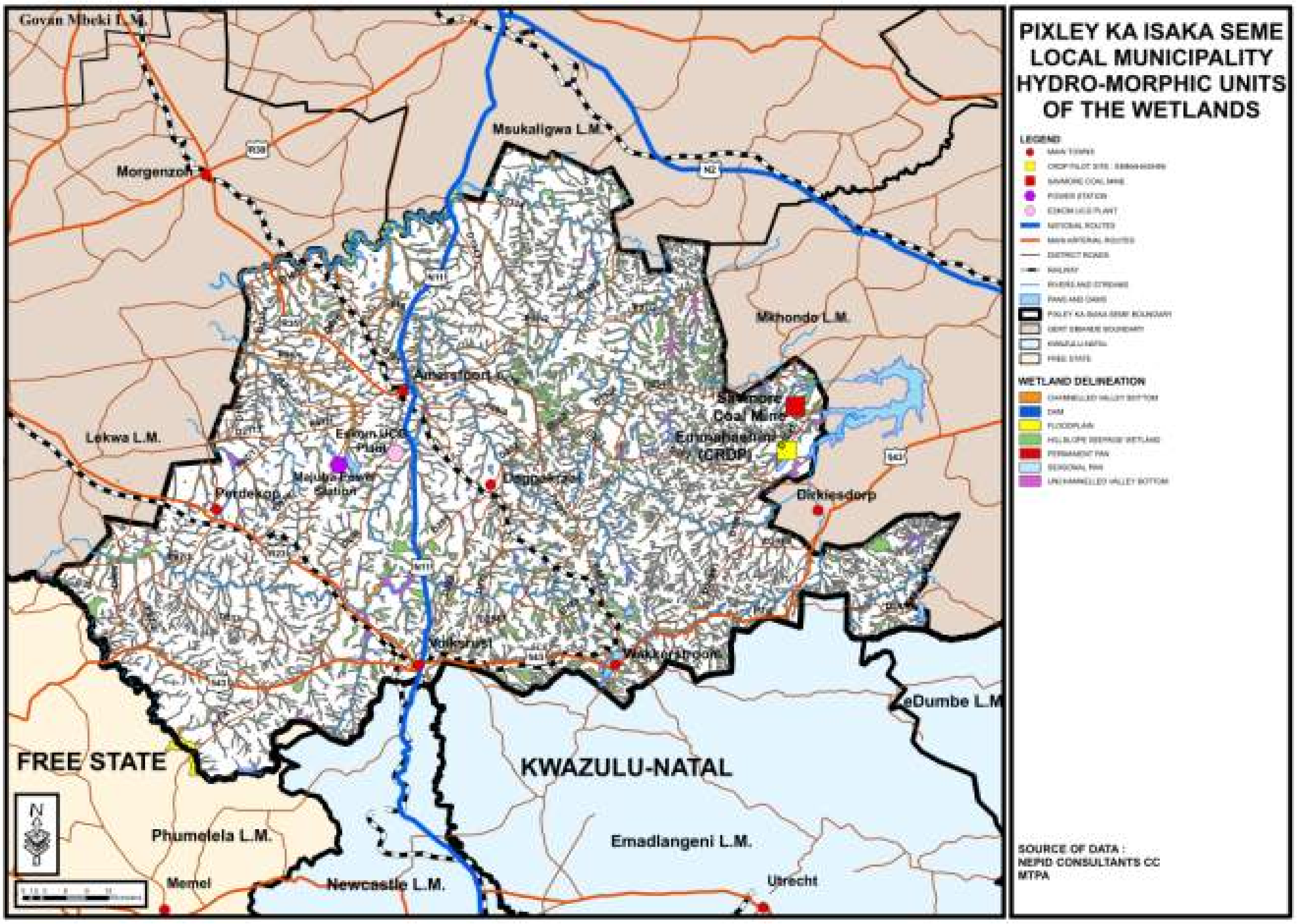


Figure 7-33: The Delineated Wetlands within the Pixley ka Seme Local Municipality (Source: Pixley ka Seme Local Municipality Spatial Development Framework, 2010)

7.14.1.2 Local Setting

NSS undertook a wetland assessment focusing only on the proposed location for the surface infrastructure and adit portal. Wetlands within this area were classified based on their hydro-geomorphic (HGM) unit developed by Kotze et al. (2007) for use in wetland assessments. This method focuses on the hydro-geomorphic determinants of wetlands, and incorporates geomorphology, water movement into, through and out of the wetland, and the landscape/ topographic setting.

An approximate desktop delineation of wetlands in the target area was performed using Google Earth imagery and observations made during initial fieldwork. Using the HGM descriptions described above, two types of wetlands were identified in the target area including a single Hillslope Seepage linked to a Stream Channel, and a number of Isolated Hillslope Seepages.

NSS undertook a wetland delineation assessment during July 2013 in order to identify the baseline settings for the potential wetlands that may occur onsite. Three types of inland wetlands were identified within the study area. These include

- Rivers
- Channelled valley bottom systems associated with rivers
- Seeps – a wetland which is located on gently to steeply sloping land dominated by colluvial, unidirectional movement of water down-slop. Two types of seep wetland exist
  - Seep without a channel outflow
  - Seep with a channelled outflow

Wetlands onsite were found to be fed by the shallow weathered aquifer as well as from seepage from surface water runoff (rain). The shallow and deep aquifers are hydraulically connected where faults and dykes intersect both aquifers. It is assumed that where faults are not present, these aquifers can be considered independent. According to the conceptual geohydrological model flow from the shallow aquifer is considered to recharge the deep aquifer. Therefore, drawdown in the deep aquifer will also draw down water level in the shallow aquifer. Springs/ fountains were also identified onsite which are linked to the deeper fractured aquifer. Springs/ fountains were noted to be a source for a number of wetlands and are associated with dolerite intrusions. NSS recorded wetlands within 1 km radius of the adit which was calculated to be approximately 180 ha, which equates to approximately 42% of the surface infrastructure footprint area comprising wetlands. Two types of wetlands occur on the site, which are illustrated in **Figure 7-34** below:

- System 1 – seep wetlands;
- System 2 – channelled valley bottom wetlands.
- Ecological importance and sensitivities of wetlands

According to NSS, both wetlands are considered to have high ecological importance and sensitivity due to the protected areas proposed within the vicinity of the site, current integrity of the site and the numerous CI species identified on the site. Additional detail is included in **Section 8** and **Appendix C**.

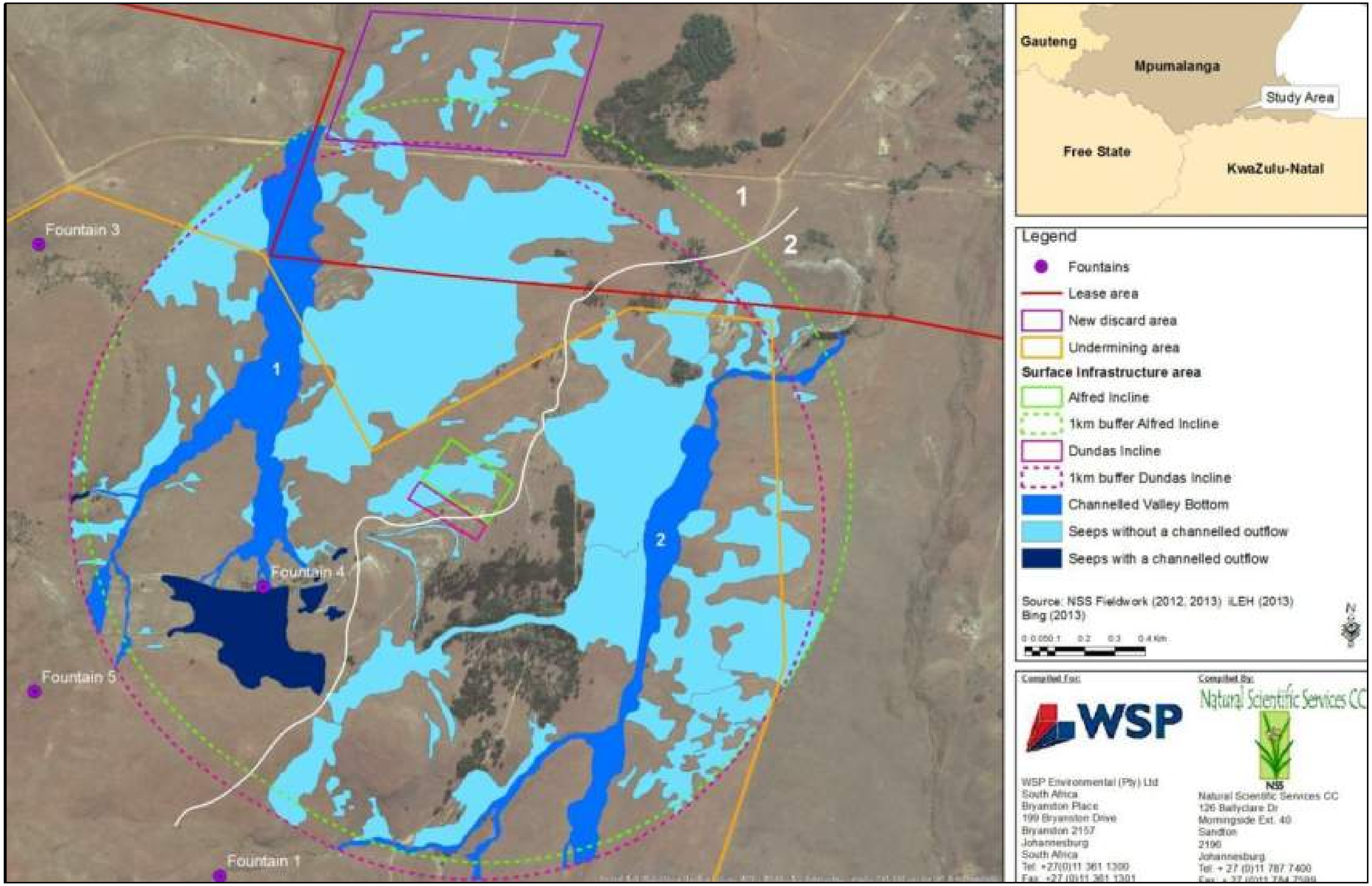


Figure 7-34: Approximate Wetland and Stream Delineation within the Target Area (Source: NSS, 2013)

7.15 National and Regional Conservation Initiatives

Land cover data supplied by Fairbanks *et al*. (2000) suggests that 30% of the Grassland biome has been permanently transformed by cultivation (23%), forestry (4%), urbanisation (2%) mining (1%), erosion and other disturbances (7%). Most (80% of) natural grassland in South Africa may represent old fields suggesting that only 15% of grassland is truly natural. Today, most remaining grassland is highly fragmented. Many (approximately 8.8 million) people live within the biome, which also supports a large abundance of livestock (6.4 million cattle and 13 million sheep). The economy derives 33.9% of its national gross domestic product (GDP) with a total annual output of more than R5.4 billion as a result of forestry in the biome (Grasslands Programme, 2010). Coal mining, which is rapidly expanding across the area, poses a major threat to grassland biodiversity. Wetlands are particularly at risk as mining resources often lie beneath wetlands.

7.15.1 National Water Act (NWA, Act 36 of 1998)

All wetlands are protected within South Africa, with their legal protection extended to include buffer zones (Ferrar & Lotter, 2007). South Africa has various pieces of legislation governing activities in and around wetlands under International, Regional and National legislation and Guidelines. The National Water Act, 1998, (Act 36 of 1998) (NWA) is the principle legal instrument relating to water resource management in South Africa. All wetlands are protected under the NWA. The NWA acknowledges

> *"the National Government's overall responsibility for and authority over the nation's water resources and their use, including the equitable allocation of water for beneficial use, the redistribution of water, and international water matters"*

As per Chapter 3 of the NWA: Protection of Water Resources:

> "*The protection of water resources is fundamentally related to their use, development, conservation, management and control. Parts 1, 2 and 3 of this Chapter lay down a series of measures which are together intended to ensure the comprehensive protection of all water resources".*

7.15.2 Protected Areas

The proposed Yzermyn Underground Coal Mine Project borders the Kwamandhlangampisi Protected Environment to the east, and the MTPA has recently gazetted an intention to proclaim the Mabola Protected Environment, which includes several farms within and around the proposed Yzermyn Underground Coal Mine Project lease area (**Figure 7-35**). The existing Paardeplaats and Pongola Nature Reserves are both situated <15 km east of the proposed Yzermyn Underground Coal Mine Project lease area.

Given this and other considerations (e.g. FEPAs and the MBSP), the MTPA has applied to the DMR to have several farms, which are situated in and around the proposed Yzermyn Underground Coal Mine Project lease area, excluded from future mining or prospecting in terms of Section 49 of the MPRDA (**Figure 7-36**).

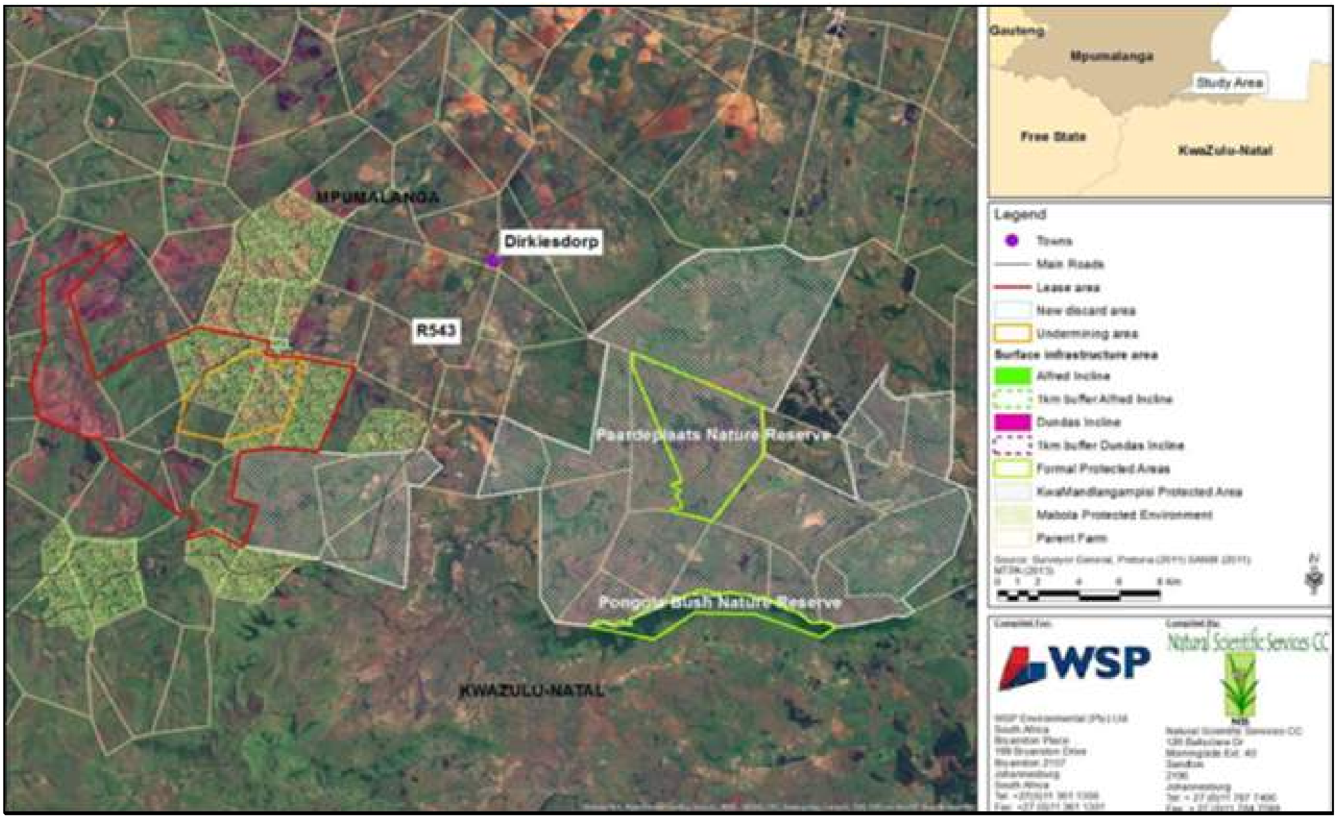


Figure 7-35: Existing and proposed Protected Areas in the Study Area

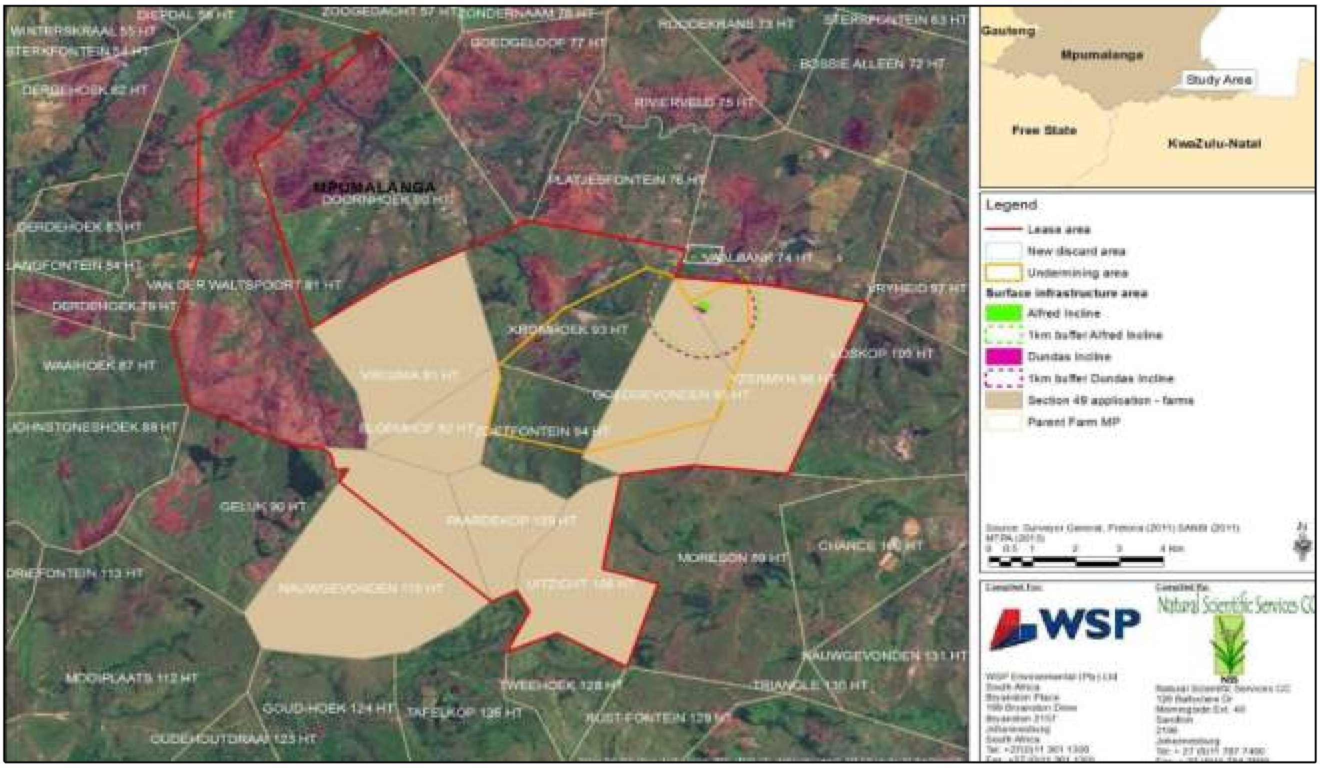


Figure 7-36: Farms in proposed Yzermyn Underground Coal Mine Project Study Area that are included in the MTPA's (pers comm. 2013) Section 49 Application to the DMR

7.15.2.1 KwaMandlagampisi Protected Environment

The KwaMandlangimpisi Protected Environment has been recently proclaimed near the prospecting area (WWF, 2010) and falls within the greater Ekangala Grassland Biodiversity Stewardship Initiative (**Figure 7-37**). The exact boundaries of the KwaMandlangimpisi Protected Environment could not be confirmed when this report was compiled, but reportedly extend over 23 000 ha of privately owned farms and include threatened high altitude grassland, wetlands and indigenous mistbelt forest. Within the greater project study area, other conservation projects have focused on specific threatened species and their habitat including several crane and southern barred minnow, the Critically Endangered Blue Swallow (Hirundo atrocaerulea) and Rudd's Lark (Heteromirafra ruddi).

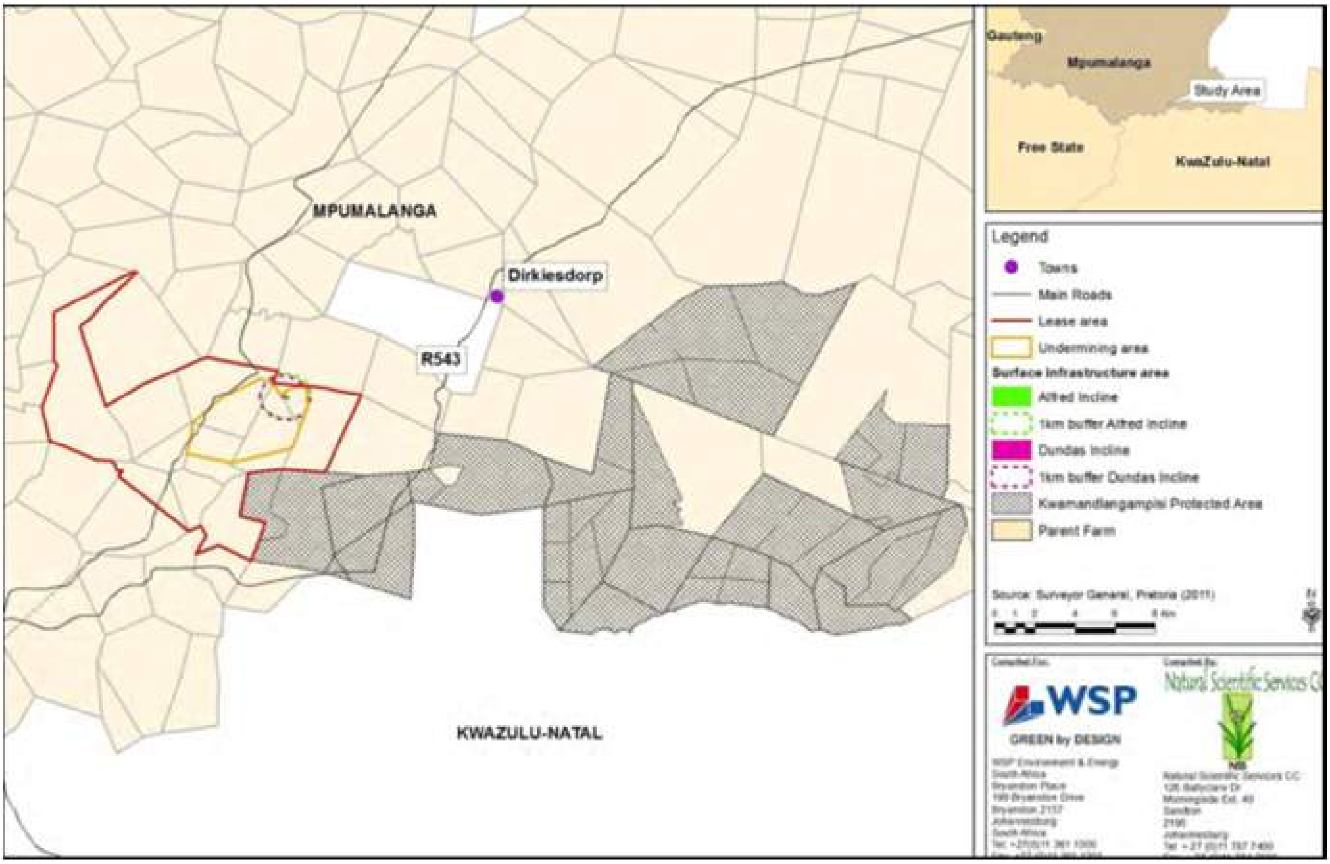


Figure 7-37: Provisional Boundaries of the KwaMandlangimpisi Protected Environment (Source: NSS, 2012)

7.15.2.2 Proposed Mabola Protected Environment

According to the MTPA, areas comprising privately-owned farms within and surrounding the prospecting right (and target area) have been included into an application for the proposed Mabola Protected Environment. It was noted in the public consultation meeting, held in Wakkerstroom of 27 September 2012 that the area may be declared as protected by December 2013. **Figure 7-38** below illustrates the prospecting boundary with the existing LPE and proposed Mabola Protected Environment. Impacts resulting from the proposed project on these areas will be assessed in detail during the ESIA phase of the project.

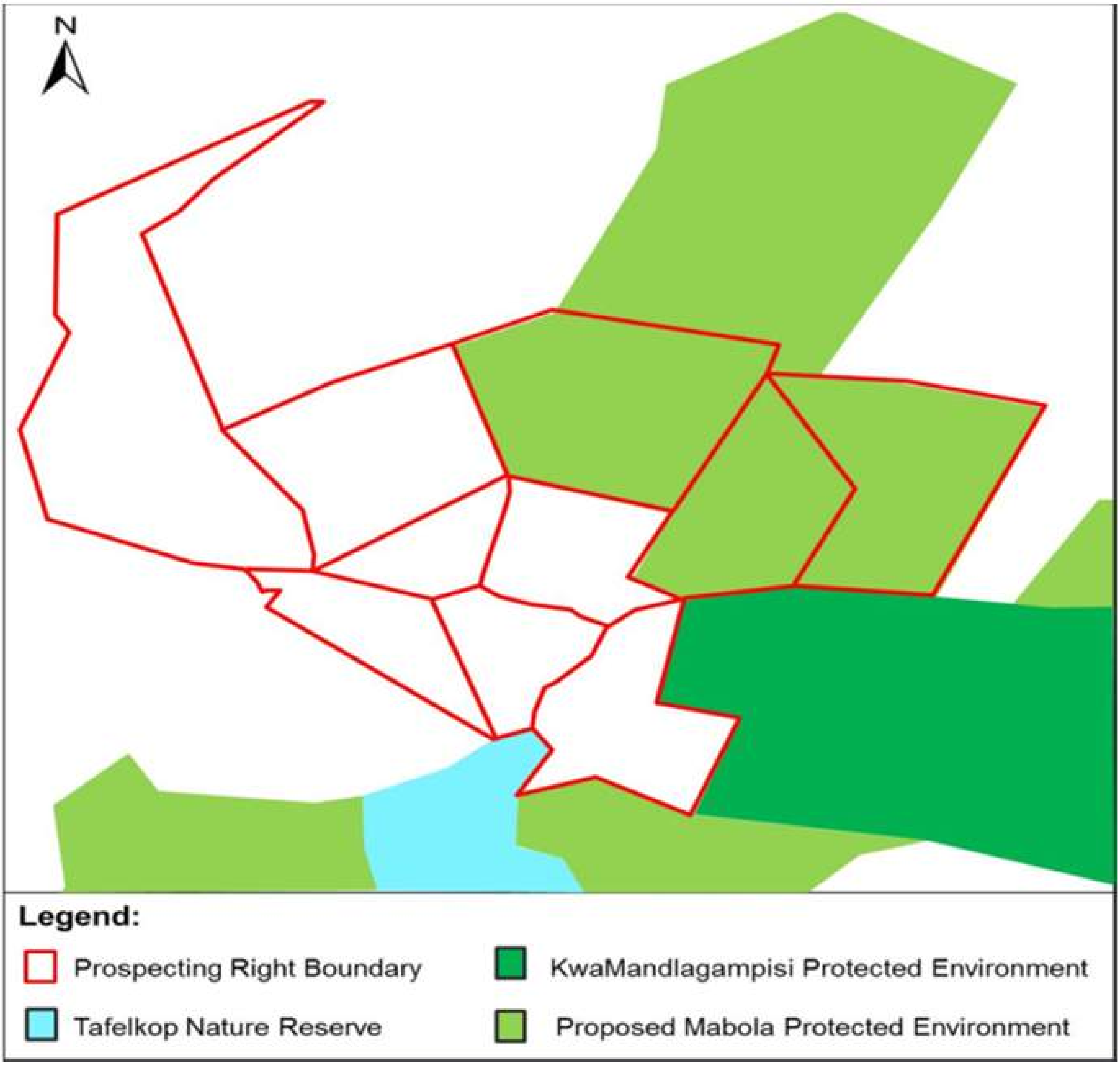


Figure 7-38: Boundaries of Existing and Proposed Protected Environments (Source: WWF-SA, 2012)

7.15.3 National Freshwater Ecosystem Priority Area

The National Freshwater Ecosystem Priority Area (NFEPA) project (Driver et al. 2011) was a three-year partnership between SANBI, CSIR, WRC, DEA, DWA, WWF, the South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). "Freshwater ecosystems" refer to all inland water bodies whether fresh or saline, including rivers, lakes, wetlands, sub-surface waters and estuaries. Consistent with global trends, high levels of threat have been reported for South African freshwater ecosystems, with over half of the country's river and wetland ecosystem types considered threatened. The NFEPA provides strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources in South Africa.

Freshwater Ecosystem Priority Areas (FEPAs) were determined through a process of systematic biodiversity planning and involved collaboration of over 100 freshwater researchers and practitioners. FEPAs were identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries. The proposed Yzermyn Underground Coal Mine Project lease area is situated in a FEPA river catchment, and includes several Category 1 Wetland FEPAs. Two FEPA Wetland Clusters are also situated near the eastern boundary of the lease area (**Figure 7-39**). The catchment supports the Near Threatened Incomati Chiselmouth (Varicorhinus nelspruitensis), Shortfin Barb (Barbus brevipinnis) and Phongolo Rock Catlet (Chiloglanis emarginatus) (Kleynhans, 1997; Engelbrecht et al. 2007).

FEPAs should be regarded as ecologically important and as generally sensitive to changes in water quality and quantity, owing to their role in protecting freshwater ecosystems and supporting sustainable use of water resources. FEPAs that are in a good condition, such as those identified within the study area, should remain so, and FEPAs that are not in a good condition should be rehabilitated to their best attainable ecological condition. Land-use practices or activities that will lead to deterioration in the current condition of a FEPA are not acceptable, and land-use practices or activities that will make rehabilitation of a FEPA difficult or impossible are not acceptable.

“Applications for mining and prospecting in FEPAs and associated sub-quaternary catchments should be subject to rigorous environmental and water assessment and authorisation processes, as mining has a widespread and major negative impact on freshwater ecosystems”. Furthermore, Mining in any form should not be permitted in wetland FEPAs, or within 1km of a wetland/riverine FEPA buffer. No prospecting should occur in wetland FEPAs or within 1 km of a wetland/riverine FEPA buffer. Care should be taken to reduce the risks of aquifer penetration when drilling, wherever this occurs.

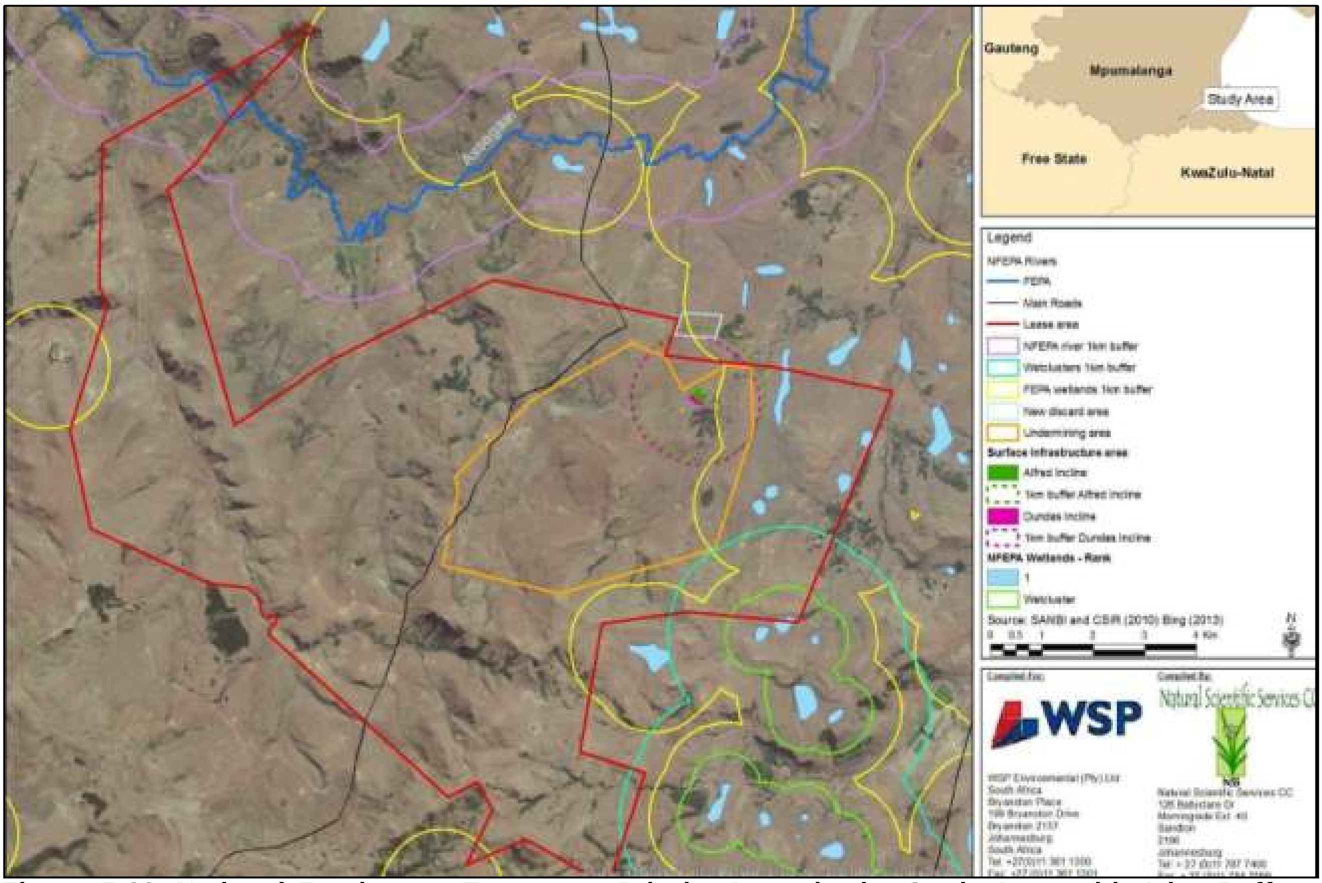


Figure 7-39: National Freshwater Ecosystem Priority Areas in the Study Area, with 1 km Buffers (Source: NSS, 2013)

7.15.4 NSBA Priority Areas and Threatened Ecosystems

During the National Spatial Biodiversity Assessment (NSBA), nine Priority Areas were identified for conservation in South Africa (Driver *et al*., 2004). Priority Areas were allocated where broad-scale habitat remained unprotected or was inadequately conserved. The Yzermyn prospecting area falls within the South Eastern Escarpment Priority Area (**Figure 7-40**).

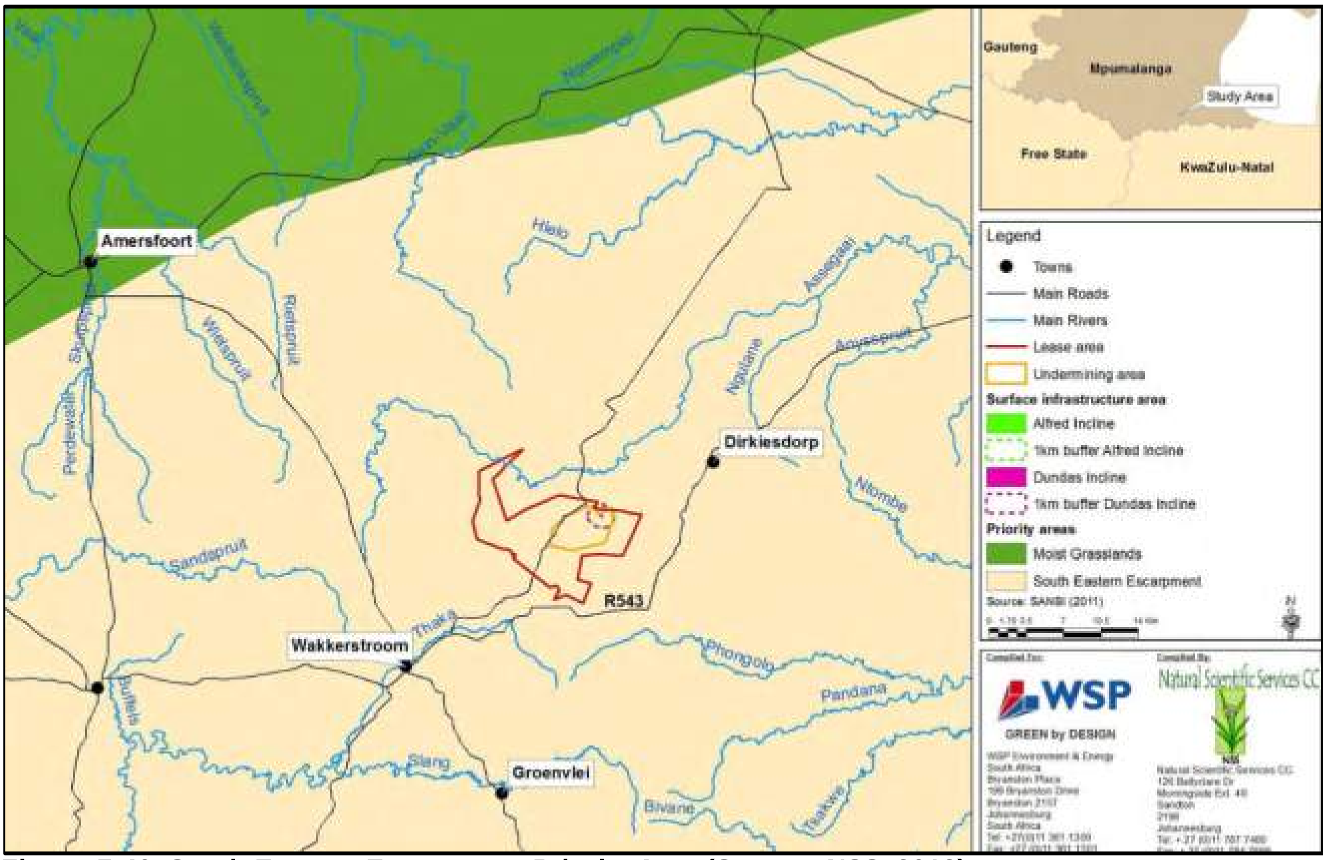


Figure 7-40: South Eastern Escarpment Priority Area (Source: NSS, 2012)

A list of Threatened Ecosystems within the Priority Areas was gazetted on 9 December 2011 in the National Environmental Management: Biodiversity Act (No. 10 of 2004): National list of ecosystems that are threatened and in need of protection. The identified Threatened Ecosystems occupy 9.5% of South Africa and were selected according to six criteria including:

- irreversible habitat loss;
- ecosystem degradation;
- rate of habitat loss;
- limited habitat extent and imminent threat;
- threatened plant species associations; and
- threatened animal species associations.

The project site falls completely within the Wakkerstroom/ Luneburg Grasslands (MP 11) Threatened Ecosystem (**Figure 7-41**). This ecosystem is listed as Endangered and is only 2% conserved.

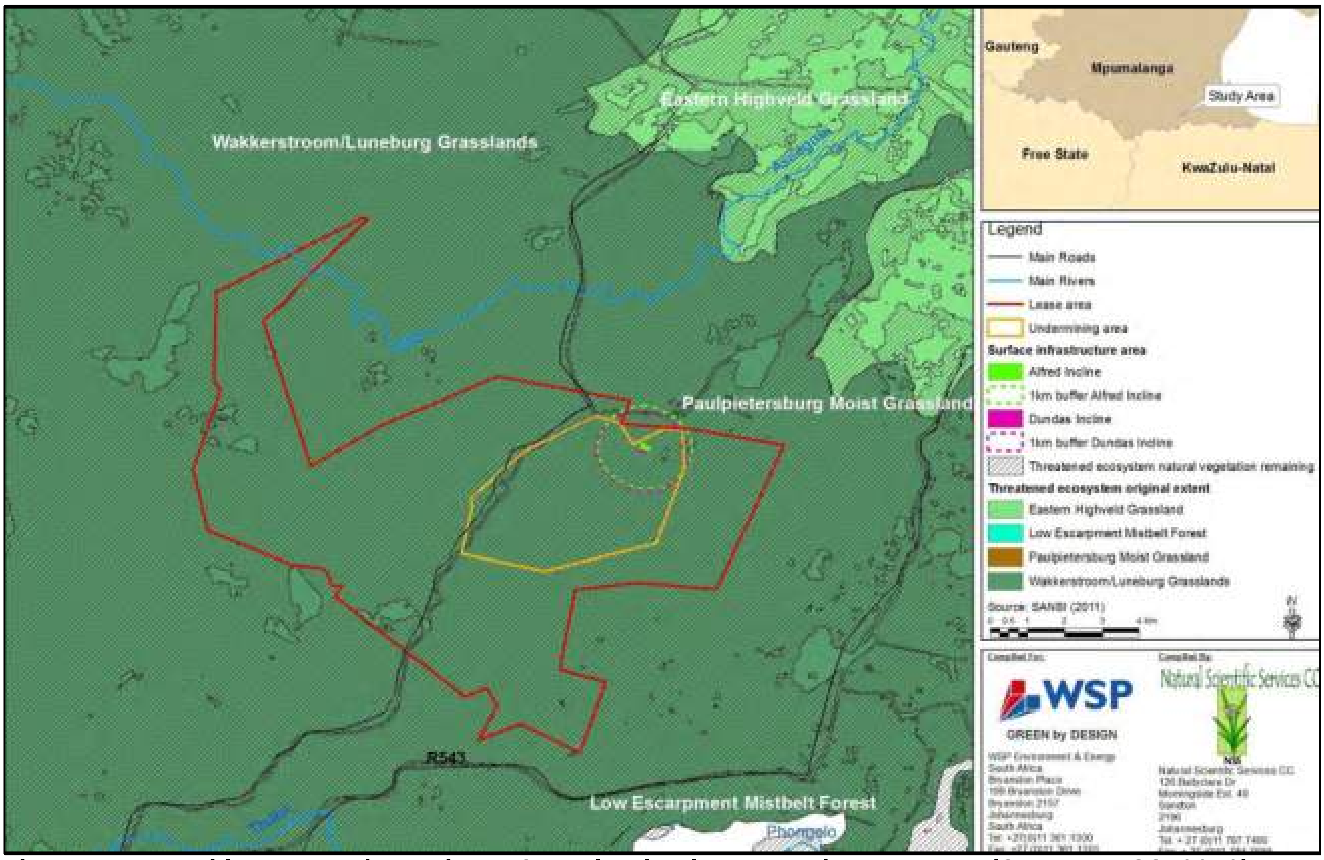


Figure 7-41: Wakkerstroom/ Luneburg Grasslands Threatened Ecosystem (Source: NSS, 2012)

7.15.5 SANBI Grasslands Programme

The South African National Biodiversity Institute (SANBI) established the Grasslands Programme as a partnerships-based approach to securing the biodiversity and ecosystem services of the Biome. The Programme has been implemented in part by the World Wildlife Fund (WWF) South Africa, through the Grasslands Steering Committee and the Wakkerstroom Agriculture and Conservation Demonstration Project. The initial phase of the Programme aims to ensure that major production sectors, including mining, are directly contributing to the achievement of Biodiversity conservation priorities in the Grassland Biome.

In the mining sector, the Programme and its partners are:

- Piloting biodiversity stewardship with mining companies;
- Developing tools for mainstreaming biodiversity into the mining sector, including the national Mining and Biodiversity Guideline and Atlas of Sensitive Areas for Mining, and Wetland Offset Guidelines; and
- Enabling the use of biodiversity information by the DMR, DWA, DEA and mining companies in the assessment and decision-making processes for the prospecting or mining of coal, and for the authorisation of associated activities.

7.15.6 Mining and Biodiversity Guideline

Virtually the entire proposed Yzermyn Underground Coal Mine Project lease area comprises habitat that has been zoned by the national Mining and Biodiversity Guideline (DEA et al. 2013) as having the Highest Importance for Biodiversity and thus the Highest Risk for mining (**Figure 7-42**). Only small, isolated patches of habitat in the lease area have a non-important rating. As mentioned earlier, the lease area also borders a Legally Protected area, where “Mining is Prohibited.”

The Mining and Biodiversity Guidelines stipulate that in areas of Highest Importance for Biodiversity, “Environmental screening, EIAs and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licences, and environmental authorisations.

If they are confirmed, the likelihood of a fatal flaw for new mining projects is very high because of the significance of the biodiversity features in these areas and the associated ecosystem services. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being. Authorisations may well not be granted. If granted, the authorisation may set limits on allowed activities and impacts, and may specify biodiversity offsets that would be written into licence agreements and/or authorisations.”

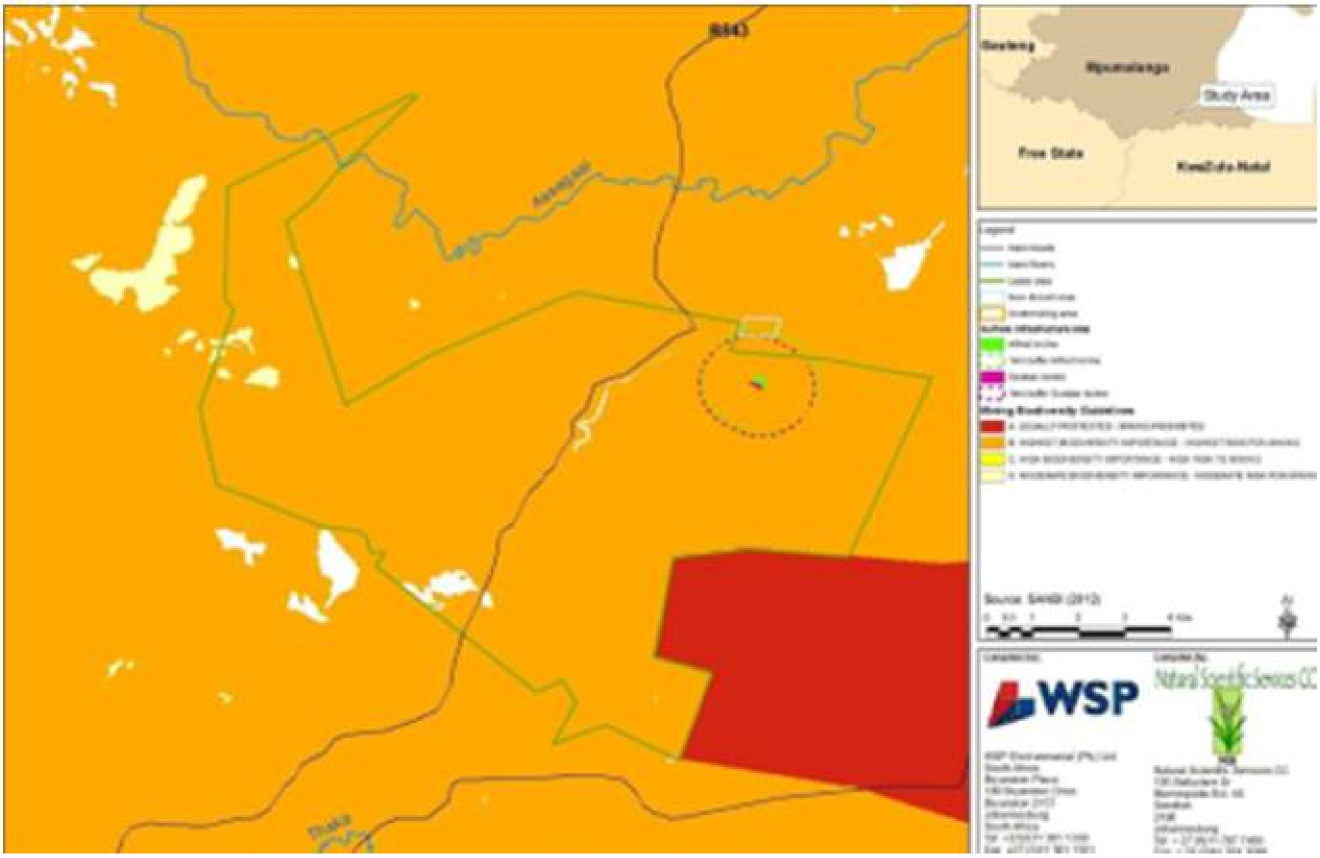


Figure 7-42: Map showing that the proposed Yzermyn Underground Coal Mine Project Study Area has the Highest Biodiversity Importance and Highest Risk for Mining According to the Mining and Biodiversity Guideline (DEA et al. 2013)

7.15.7 Mpumalanga Biodiversity Conservation Plan

The biodiversity of Mpumalanga has been recorded and catalogued by the MPTA for approximately 10 years in the Provincial Biobase Project. This data has been analysed to produce a spatial plan for biodiversity conservation, which serves as an environmental decision support tool. Information for the Mpumalanga C Plan has been sourced from a draft of the Landuse Guidelines for Biodiversity Conservation Categories in Mpumalanga (Ferrar and Lötter, 2007). This spatial plan groups the Province’s biodiversity assets into six conservation categories:

- Protected Areas - currently under formal biodiversity protection.
- Irreplaceable areas - in urgent need of Protected Area status.
- Highly Significant areas - requiring strict land-use controls.

- Important and Necessary areas - requiring special care.
- Least Concern - providing sites for development.
- No Natural Habitat remaining - providing preferred sites for all forms of development.

Mpumalanga C Plan spatial plan data for the project site is shown in **Figure 7-43**. The project site's north-western section is largely regarded as Least Concern, while significant portions of the site's south-eastern section are considered Important and Necessary, Highly Significant or Irreplaceable. The target area contains a mixture of these four conservation categories. Brief descriptions, for the relevant categories are given below.

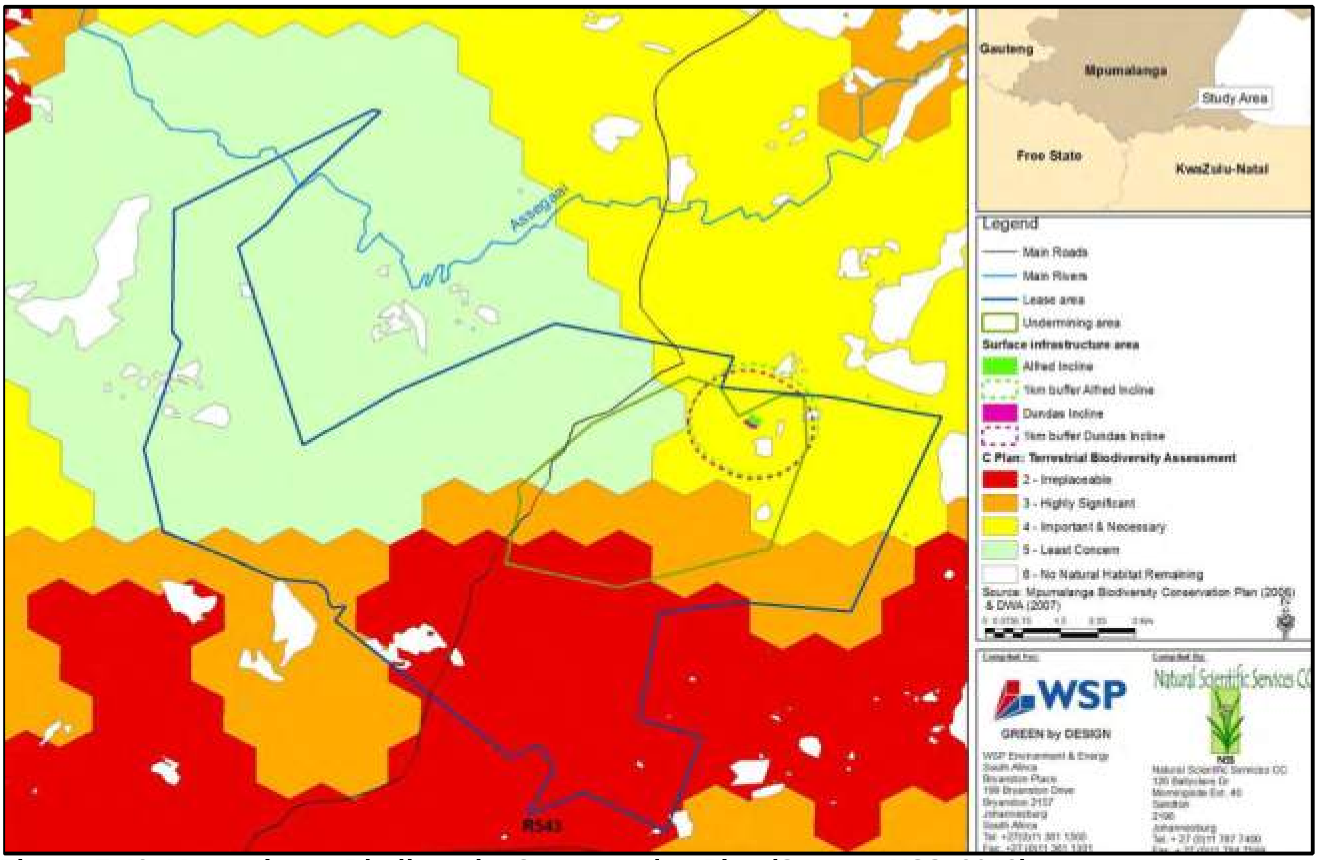


Figure 7-43: Mpumalanga Biodiversity Conservation Plan (Source: NSS, 2012)

- **Least Concern**

  At a provincial level these areas have biodiversity value in the form of natural vegetation cover. Although they are not currently required in order to meet biodiversity targets, they do contribute significantly to functioning ecosystems, including ecological connectivity.

- **Important and Necessary**

  At a provincial level biodiversity in this category is relatively intact. It represents the areas, which most efficiently contribute to meeting biodiversity targets and minimise land use conflict. If biodiversity is lost from these areas, larger areas will be required elsewhere for targets to be met. This category allows some flexibility and there are options for development. However, approved developments or changes in land use must still be compatible with conservation objectives. Decisions on land-use changes will require a biodiversity specialist study as part of the ESIA. Developments most antagonistic to biodiversity should be discouraged.

- **Highly Significant**

  Highly significant areas are those where biodiversity has been heavily compromised and very few options remain to meet biodiversity targets. Natural vegetation cover in these areas should be maintained or restored. Any significant habitat loss may cause these areas to become irreplaceable. Approved developments or changes in land use must be compatible with conservation objectives, e.g. well managed livestock grazing. If development is unavoidable, such land uses must be made sufficiently dispersed and/or small scale, so as to be biodiversity friendly. Decisions on land use changes will require a biodiversity specialist study as part of the ESIA.

- **Irreplaceable**

  Irreplaceable areas are those of highest biodiversity value outside the formal Protected Area network. They support unique biodiversity features, such as endangered species or rare habitat patches that do not occur anywhere else in the province. These features have already been so reduced by loss of natural habitat, that 100% of what remains must be protected to achieve biodiversity targets. All land in this category must be managed for biodiversity conservation to meet the targets set. All development must be strictly controlled in line with biodiversity conservation objectives.

7.15.8 Mpumalanga Biodiversity Sector Plan

The Mpumalanga Biodiversity Sector Plan (MBSP) is the outcome of recent systematic conservation planning by the Mpumalanga Tourism and Parks Agency (MTPA 2013) for improved conservation of biodiversity in this province. Significant portions of the proposed Yzermyn Underground Coal Mine Project lease area are recognized in the MBSP as Irreplaceable and Optimal Critical Biodiversity Areas (CBAs). Most remaining habitat has been ear-marked for Landscape Corridors, Local Corridors and Species Specific Ecological Support Areas (ESAs). Small, scattered patches of Modified Habitat in the lease area include mainly old agricultural lands (**Figure 7-44**).

"CBAs are areas of high biodiversity value which are usually at risk of being lost and usually identified as important in meeting biodiversity targets." Irreplaceable CBAs are "considered critical for meeting biodiversity targets and thresholds which are required to ensure the persistence of species and the functioning of ecosystems." Optimal CBAs have an irreplaceability of less than 80%, but collectively these areas incorporate the most biodiversity in the smallest area and, therefore, provide the most cost-effective options for biodiversity conservation.

ESAs "are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of CBAs and/or in delivering ecosystem services." Landscape Corridors provide the best landscape connectivity to support and enable biodiversity to adapt to the impacts of climate change. Local corridors represent "fine scale connectivity pathways that contribute to connectivity between climate change focal areas." Species-specific ESAs are "required for the persistence of specific species" (MTPA 2013).

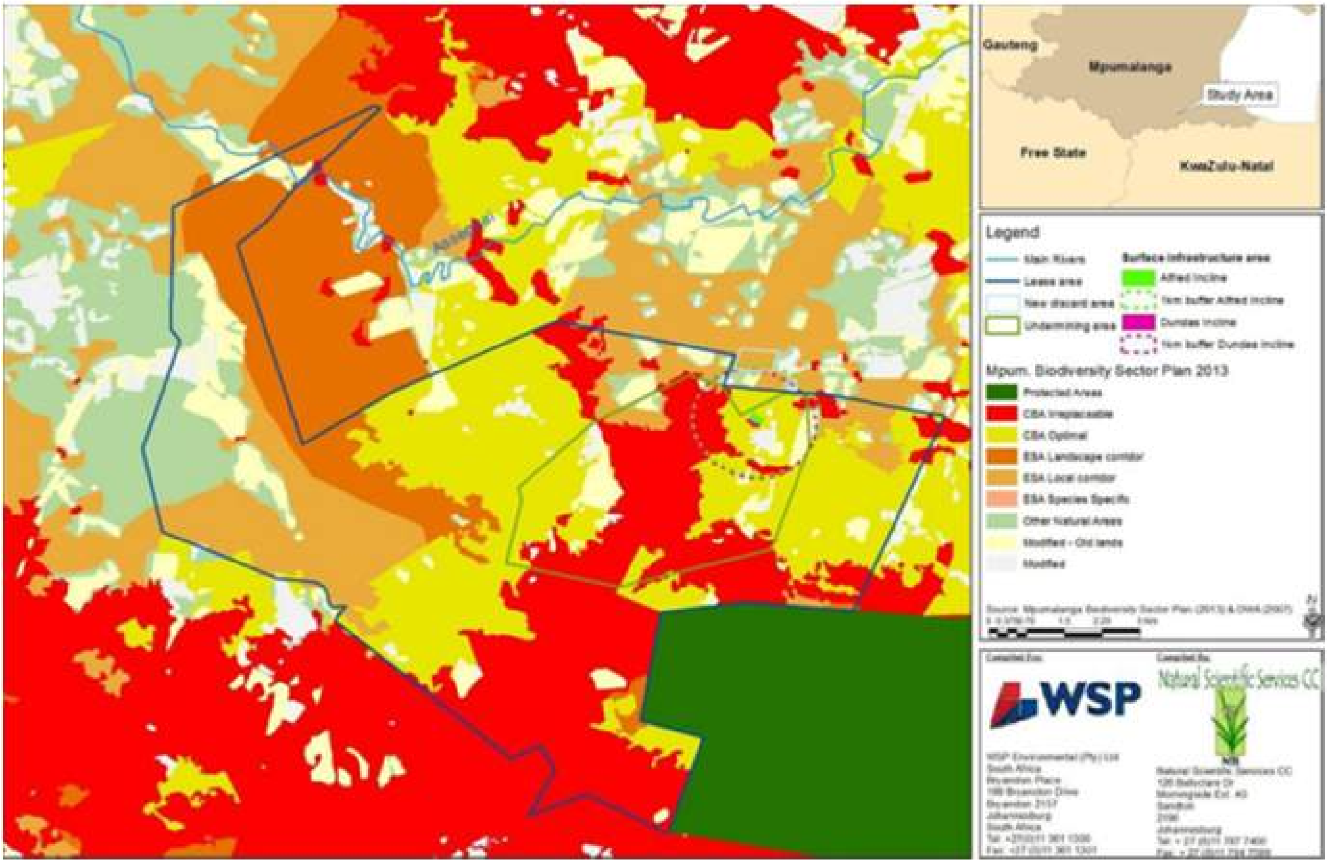


Figure 7-44: Mpumalanga Biodiversity Sector Plan for the Study Area

7.15.9 Section 49 Motivation for the Consideration of the Wakkerstroom Wet Grassland

The MPTA, along with key NGO's (World Wide Fund, Working for Wetlands, Birdlife South Africa, etc.) in the Wakkerstroom area have lodged an application for the consideration of the Wakkerstroom Wet Grassland to be declared an 'exclusion area' under Section 49 of the MPRDA. Section 49 of the MPRDA allows for the Minister (DMR) to restrict or prohibit mining in certain areas as the Minister has the power to "prohibit or restrict the granting of any reconnaissance permission, prospect and mining permits under Section 49". **Figure 7-45** illustrates the proposed area included in the Section 49 Motivation, which is pending decision by the DMR.

According to the Motivation (2009), the primary basis for the consideration of the Wakkerstroom Wet Grassland under Section 49 of the MRPDA is the high biodiversity value of the area that provides valuable ecosystem services to the people of South Africa.

It is understood that further correspondence between key stakeholders, the DMR and DEA is required prior to the motivation being declared. It must be noted that existing prospecting and mining rights that have been granted within this area may not be revoked (Section 49(2) of the MPRDA), although should the Section 49 Motivation be declared prior to Atha their mining right, the DMR may not grant authorisation for the project.

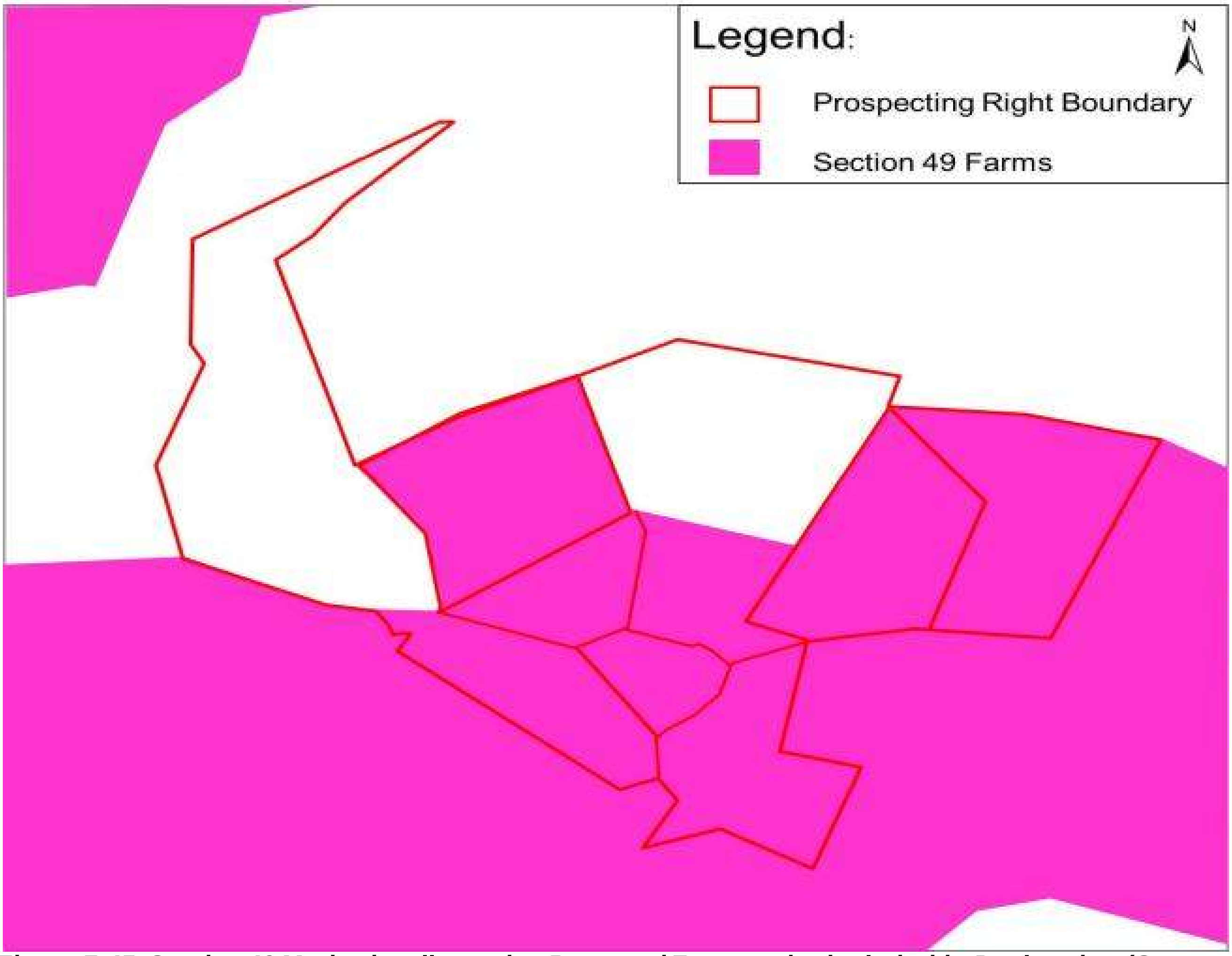


Figure 7-45: Section 49 Motivation Illustrating Proposed Farms to be included in Declaration (Source: WWF-SA, 2012)

7.15.10 Ekangala Grassland Biodiversity Stewardship Initiative and Important Bird Area

WWF has been supporting the Grasslands Project for several years in partnership with the Botanical Society of South Africa. The WWF Grassland Programme focuses their work, including but not limited to Biodiversity Stewardship, on the Enkangala Grassland Project. The Project is focussed on protecting biodiversity and water in the remote catchment areas of the Vaal, Pongola and Thugela Rivers from threats, including poorly planned mining. Initially, the Project was focused on piloting biodiversity stewardship approaches with private and communal/ land reform landowners. Through a new partnership with BHP Billiton, WWF is also undertaking ecosystem services studies to determine, in more detail, the water and carbon value of high altitude moist grasslands. The long-term project vision is to secure the biodiversity and ecosystem services of this critical grasslands area, in partnership with the various landowners and the relevant conservation, agricultural and water authorities.

Over one hundred partner organisations of BirdLife International have used standard assessment criteria to identify global priority areas for bird conservation, called Important Bird Areas (IBAs). IBA status does not offer formal protection to an area, but any proposed changes to established land-use patterns within an IBA will be closely scrutinised by BirdLife South Africa and other conservation NGOs. The proposed Yzermyn Underground Coal Mine Project falls in the Enkangala Grassland Project area as well as the Grassland IBA (IBA SA125; **Figure 7-46**), which spans >800 farms, several conservancies and state-owned land. It is described by Barnes (1998) as one of the most important IBAs in Africa and is considered vital for the conservation of a number locally-, and globally-threatened bird species, as well as for the conservation of other fauna and flora. Conservation Important (CI) bird species that are known to occur in the Grassland IBA are listed in **Table 7-17**.

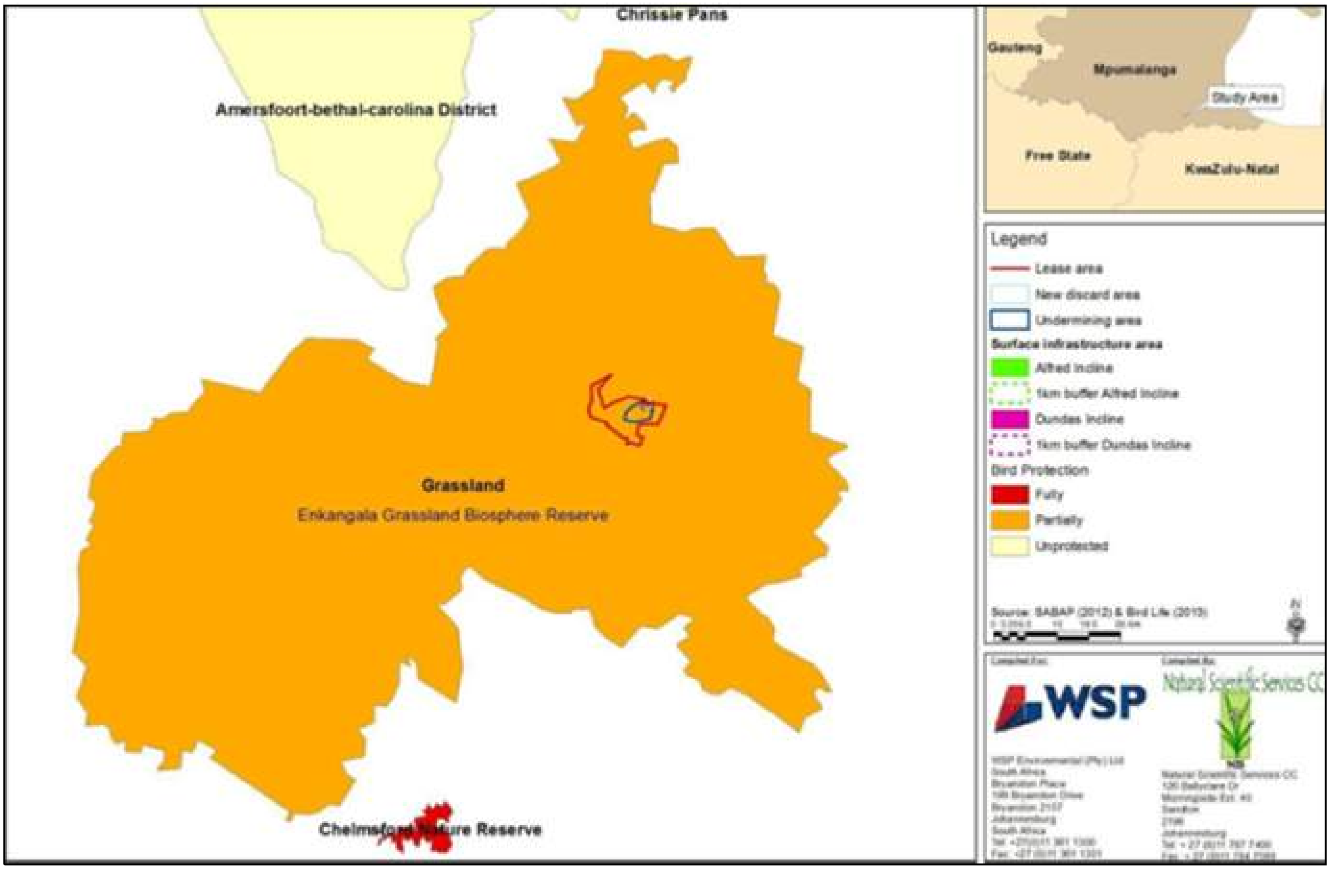


Figure 7-46: Enkangala Grassland Biosphere Reserve and Important Bird Area

Table 7-17: Threatened Bird Species in the Enkangala Grassland Important Bird Area

Common Name	Common Name	Common Name
Little Bittern (LC)	Black Stork (NT)	Southern Bald Ibis (VU)
Greater Flamingo (NT)	Secretarybird (NT)	Cape Vulture (VU)
Peregrine falcon (NT)	Lanner Falcon (NT)	White-backed Vulture (VU)
Martial Eagle (VU)	Bearded Vulture (EN)	Lesser Kestrel (VU)
Pallid Harrier (NT)	Black Harrier (NT)	African Marsh-harrier (VU)
White-winged Flufftail (CR)	Striped Flufftail (VU)	Corn Crake (VU)
Wattled Crane (CR)	Blue Crane (VU)	Grey Crowned Crane (VU)
White-bellied Korhaan (VU)	Blue Korhaan (NT)	Denham's Bustard (VU)
Chestnut-banded Plover (NT)	Black-winged Lapwing (NT)	Greater Painted-snipe (NT)
Caspian Tern (NT)	African Grass-owl (VU)	Black-winged Pratincole (NT)
Botha's Lark (EN)	Rudd's Lark (CR)	Ground Woodpecker (LC)
Buff-streaked Chat (LC)	Broad-tailed Warbler (NT)	Bush Blackcap (NT)
Yellow-breasted Pipit (VU)	Blue Swallow (CR)	Short-tailed Pipit (VU)
Conservation status: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened Source: Barnes (1998)		

7.15.11 Threatened Grassland Species & Other EWT Programmes

The Endangered Wildlife Trust's (EWT's) Threatened Grassland Species Programme is focussed on highly-threatened grassland faunal species as indicators of grassland health and conservation. These species include e.g. the Critically Endangered Blue Swallow (Hirundo atrocaerulea), Endangered Oribi (Ourebia ourebi), Vulnerable Giant Sungazer (Cordylus giganteus), Vulnerable Yellow-breasted Pipit (Anthus chloris), Near Threatened Giant Bullfrog and highly-threatened Golden Moles. The African Crane Conservation Programme is a collaborative programme between the International Crane Foundation and the EWT, which aims to improve the conservation of the Critically Endangered Wattled Crane (Bugeranus carunculatus), and the Vulnerable Blue Crane (Anthropoides paradiseus) and Grey-crowned Crane (Balearica regulorum). The EWT Birds of Prey Programme is focussed on the conservation of diurnal and nocturnal raptors, vultures and their habitats in southern Africa. EWT Field Workers for these programmes visit the proposed Yzermyn Underground Coal Mine Project study region on a regular basis.

7.16 Archaeological, Cultural and Heritage

7.16.1 Regional Setting

It has been noted that the Pixley ka Seme region has been inhabited by humans since Early Stone Age times (2 million – 150 000 years ago). Although considering the relatively flat landscape that contains very little tree cover meaning that Stone Age people would probably not have settled in this region. The good grazing afforded by the grassland in the area may have encouraged hunting. It is probable that cattle outposts may have been situated within the region during the Iron Age (1840 – 240 A.D). In more recent times, early white farmers would also have settled in the region due to good grazing available for their cattle (Van Vollenhoven, 2010).

7.16.2 Local Setting

The environment of the area is mostly undisturbed. However, some disturbance are seen in certain areas, mainly agriculture, grazing and previous mining activities. The vegetation cover is dominated by grassland with here and there some indigenous trees as well plantations with foreign trees in certain instances. During the survey the grass cover was reasonably long, making archaeological visibility difficult. The area consists of high mountains with valleys in between. The topography therefore varies throughout the surveyed area. A number of rock outcrops are visible as well as a few cliffs. Different rivers and streams also cut through the landscape. Here and there some homesteads of farm workers are found. No farm house or other farm infrastructure is visible since the farm is only used by the farmer during the winter months for grazing of livestock (Personal Communication: Johan Uys, 2012).

A survey of the proposed site was conducted by Archaetnos Culture and Cultural (Archaetnos). 18 sites of cultural heritage significance were identified. The sites are detailed in **Table 7-18** and illustrated in the aerial image (**Figure 7-47**). It must however be noted that poor visibility was encountered due to a high level of grass cover; and that the possibility exists that more sites may be encountered at a later stage that may need to be dealt with in accordance with the relevant legislation.

Table 7-18: Summary of Initial Findings (Archaetnos Heritage Impact Report, 2012)

Site	Description	Photograph
1	The site consists of two small circular structures made from stone. The stones are nothing more than a foundation and the size thereof is approximately 2,5 m in diameter. It may have been used for ritual initiation purposes during the Late Iron Age, but it also may have another, yet unknown function. **Significance: Medium** Based on its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	
2	The site consists of a semi-circular stone wall of approximately 4 m long and 0,5 m high. It is on a high vantage point and a flat stone on top gives the impression that it may have a defensive purpose. It is therefore suggested that it may be a fortification wall erected during the Anglo Boer War. **Significance: Medium** Based on its historic value, it has a general local significance and is therefore given a rating of Grade B. A phase II study is recommended. This should entail the drawing of the structure after which it may be demolished.	
3	This is a Late Iron Age/ Historical structure. It is a circular stone enclosure used for keeping cattle. The structure is approximately 30 m in diameter and the walls still 0,5 m high. Since no other structure is found nearby, this is a cattle outpost. **Significance: Low** Based on its low cultural significance, it is not considered unique; it has a general local significance and is therefore given a rating of Grade C. This report is seen as ample mitigation and it may therefore be demolished during site development.	
4	This is another Late Iron Age/ Historical site consisting of one circular stone wall. The structure is approximately 30 m in diameter and 0,30 m high. Again this is probably a cattle outpost. It is situated in one of the saddles between the high ridges. **Significance: Low** Based on its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	

Site	Description	Photograph
5	This is another Late Iron Age/ Historical site consisting of one circular stone wall. The structure is approximately 20 m in diameter and 0,30 m high. Again this is probably a cattle outpost. It is situated in one of the saddles between the high ridges and reasonably close to sites 4 and 6. **Significance: Low** Due to its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development	
6	This is a Historical site consisting of a rectangular enclosure. The structure has measurements of approximately 6 x 4 m and 0,80 m high. Again this is probably a cattle outpost. It is situated in one of the saddles between the high ridges and reasonably close to sites 4 and 5. **Significance: Low** Based on its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	
7	This is another Late Iron Age/ Historical site. It consists of one circular stone wall with a diameter of about 3 m and 0,50 m high. This is a hut most likely used by the cattle herder at one of these outposts (it is reasonably close to these). **Significance: Low** Based on its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	
8	This is another Late Iron Age/ Historical site consisting of a circular stone walled enclosure. The structure has a diameter of approximately 25 m and 0,50 m high. Again this is probably a cattle outpost. **Significance: Low** It has a general local significance based on its historic and social value and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	

Site	Description	Photograph
9	This is a small grave yard consisting of at least six graves. It is found at the site of a local homestead. The graves are stone packed and have no headstones or information. **Significance: High** These graves are of a local significance and are therefore given a rating of Grade IIIB. It may therefore be mitigated. There are two options when dealing with graves. The first would be to fence it in and write a management plan for the preservation thereof. This option will come into play if there is no direct impact on the graves. It should be kept in mind that there always is a secondary impact on graves since families may not have access thereto once a mine comes into operation. The second option is to have the graves exhumed and the bodies reburied. This option is preferred when graves cannot be avoided by the development. Before exhumation can be done a process of social consultation is needed in order to find the associated families and obtain permission from them. For graves younger than 60 years only an undertaker is involved in the process, but for those older than 60 years or with an unknown date of death, an undertaker and archaeologist should be involved.	
10	This is another Late Iron Age/ Historical site. It consists of two structures. The first one is similar to the hut remains (site 7) made of stone. The second one consists of a circular stone walled structure with an L-shaped wall attached thereto (second figure in this block). This first structure is a hut most likely used by the cattle herder at the outposts. The second is the cattle kraal linked thereto. **Significance: Medium** It has a general local significance based on its historic value and is therefore given a rating of Grade B. A phase II study will be needed if the site is to be demolished. This would entail drawing a plan of the site.	 

Site	Description	Photograph
11	This is the ruins of a house and outbuildings from the Historical period. It is found within a wattle and eucalyptus plantation and may therefore possibly be linked to the forestry history of the area. There are two main structures, the first being a house and the second a rondavel. The structures are built from stone. **Significance: Low** It has a general local significance based on its historic value (as it is not considered unique) and is therefore given a rating of Grade C. This report is seen as ample mitigation and it may therefore be demolished during site development.	
12	The site consists of stones packed in an L-shape. The function thereof is unknown, but it may have something to do with the outline of a farm road. **Significance: Low** It has a general local significance based on its historic value and is therefore given a rating of Grade C. This report is seen as ample mitigation and it may therefore be demolished during site development.	
13	This is a recent site inside of the riverbed of one of the streams in the surveyed area. It consists of stone walls which seem to have the function of damming up the river. According to the farmer this was done by the previous farmer (J Uys: Personal communication). **Significance: Low** It has a general local significance based on its historic value and is therefore given a rating of Grade C. This report is seen as ample mitigation and it may therefore be demolished during site development.	
14	Site 14 consists of three structures. It is the remains of three buildings built from stone. All of these are connected to the early mining history of the area. Two of these probably are houses, but the third is quite large. It may be communal accommodation or it may have been used for offices. **Significance: Medium** It has a general local significance based on its historic and aesthetic value and is therefore given a rating of Grade B. The buildings should be documented if it is going to be demolished.	

Site	Description	Photograph
15	Site 15 consists of a number of shafts and related features linked to the early mining history of the area. The shafts are cut into the rock face and seem to run in a horizontal direction. **Significance: Medium** It has a general local significance based on its historic value and is therefore given a rating of Grade B. This report is seen as ample mitigation in this regard and it may therefore be demolished if needed.	
16	This is a small grave yard (amatuna) consisting of at least six graves. Two of these are fenced in by a stone wall. It is found at the site of a homestead. This most likely means that one will find some family graves at all the homesteads in the surveyed area. The graves are stone packed and have headstones made from stone, but without any information. The graves therefore have an unknown date of death, but is seems as if the homestead was abandoned fairly recently. Therefore the graves are more than likely younger than 60 years. It should however be regarded as heritage graves until this can be confirmed. **Significance: High** These graves are of a local significance based on their cultural significance and are therefore given a rating of Grade IIIB. It may therefore be mitigated. There are two options when dealing with graves. The first would be to fence it in and write a management plan for the preservation thereof. This option will come into play if there is no direct impact on the graves. It should be kept in mind that there always is a secondary impact on graves since families may not have access thereto once a mine comes into operation. The second option is to have the graves exhumed and the bodies reburied. This option is preferred when graves cannot be avoided by the development. Before exhumation can be done a process of social consultation is needed in order to find the associated families and obtain permission from them. For graves younger than 60 years only an undertaker is involved in the process, but for those older than 60 years or with an unknown date of death, an undertaker and archaeologist should be involved.	

<table>
<tr><th>Site</th><th>Description</th><th>Photograph</th></tr>
<tr><td>17</td><td>Site 17 is a rock shelter with rock paintings against the back wall. No sign of Stone Age artifacts have been found, but these may be concealed under a layer of soil and rodent droppings on the floor of the shelter. The whole rock face have been weathered and there probably were much more paintings originally. It also is possible that the paintings may have been damaged by people who tried to remove it.

The panel consists of two sections. On the left hand side one figure is visible and on the right a number of at least eight figures. These are divided by red ochre lines in between. All the figures are monochrome – only red ochre has been used. The figure on the left hand side may be that of a woman.

Rock art are usually linked to the San people. It dates to the Late Stone Age.

Significance: High

Every rock art site is unique. The painting has a local significance due to its aesthetic, historical, scientific and social value and is therefore given a rating of Grade IIIB. It may therefore be mitigated. (Normally a site such as this one would be given a rating of Grade IIIA. However, this site is exposed to such an extent that the rock art will not last for very long.) It should therefore be mitigated by having it documented by drawing thereof. It should however never be demolished on purpose (the site should be avoided) and should be preserved as long as natural factors allow.</td><td>
</td></tr>
<tr><td>18</td><td>This is another area containing two to three adits and related features linked to the early mining history of the area. The adits are cut into the rock face and seem to run in a horizontal direction.

Significance: High

The site has a high cultural significance based on its historic and scientific value. The site is given a higher grading as site no 15 for two reasons. Firstly the site is aesthetically more pleasing and accessible which means it should be much easier to utilise for research purposes. Secondly some artefacts close to the entrance were found indicating that this particular shaft dates back to the late 19th/ early 20th century.

The site receives a field rating of provincial significance, meaning Grade II. The site may therefore not be demolished and should be managed as part of the provincial estate.</td><td></td></tr>
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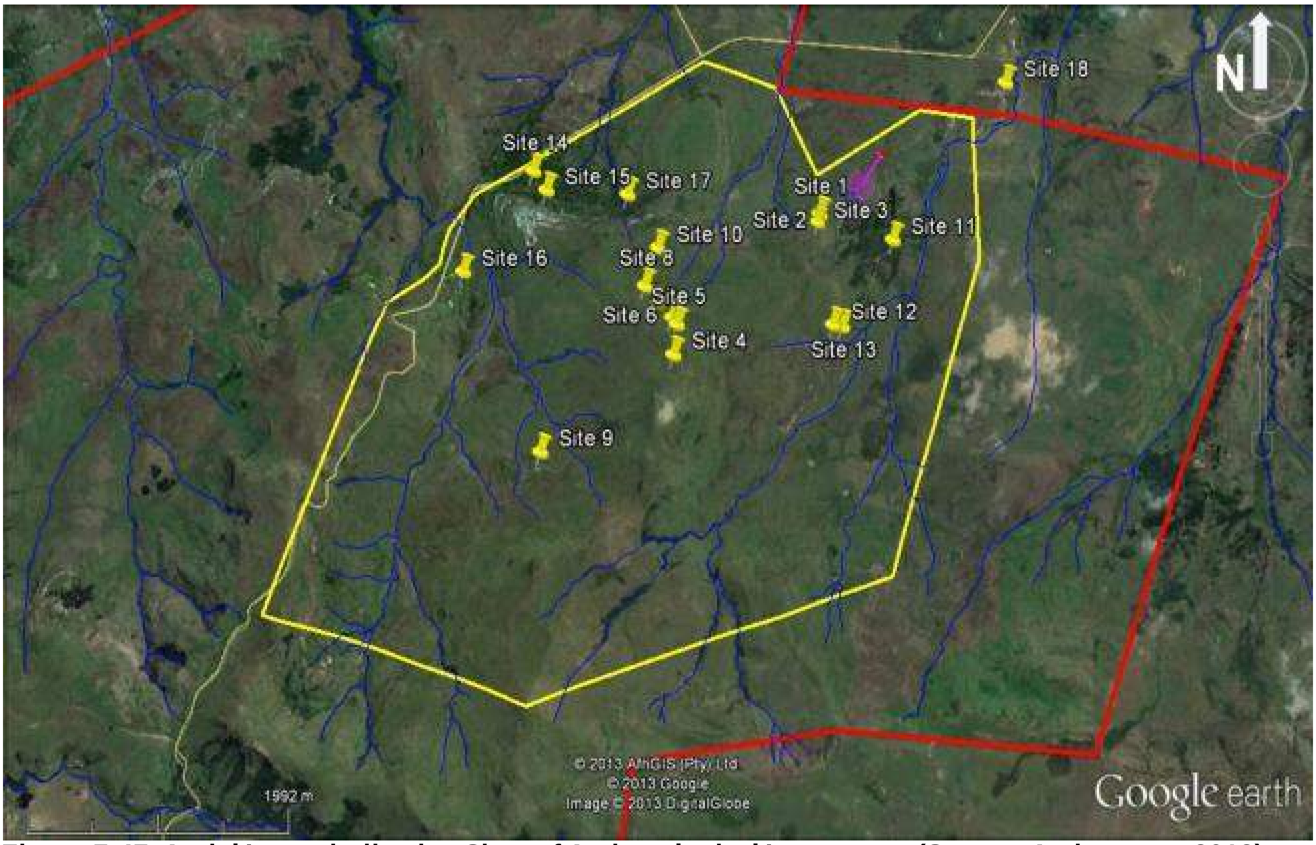

Figure 7-47: Aerial Image indicating Sites of Archaeological Importance (Source: Archaetnos, 2012)

7.17 Visual

7.17.1 Regional Setting

Landscape character is defined by the U.K. Institute of Environmental Management and Assessment (IEMA) as the 'distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, land form, soils, vegetation, land use and human settlement'. It creates the specific sense of place or essential character and 'spirit of the place' (Spon Press, 2002). The first step in the VIA process is determining the existing landscape context of the region and of the site(s) where the project is proposed.

Mpumalanga lies in eastern South Africa, north of Kwazulu-Natal and bordering Swaziland and Mozambique. The province of Mpumalanga can be divided into four primary landscapes which formed as a result of the topography, underlying geology, soils, elevation, rainfall and climate. The proposed mine site falls within Southern Mpumalanga which is a site of rich floral and faunal endemism, an IBA and the source of major river systems, namely the Usutu and Pongola Rivers (www.wwf.org.za).

The Gert Sibande District is comprised mainly of Highveld grasslands, and drops into the Lowveld regions towards the south and east. The area has a strong mineral potential, as well as tourism and biodiversity attributes. The municipality plays host to a number of large economic activities, including mining, agriculture and tourism. The key economic sectors of the district are: Manufacturing (SASOL); Mining (coal, gold, quarry); Energy Generation and Supply; Agriculture (crops and livestock); and Services (WSP, 2013).

The site is situated between Wakkerstroom and Piet Retief within the eMkhondo Local Municipality which is part of the Gert Sibande District Municipality in Mpumalanga Province. The Project Mine Area is situated in the Dirkiesdorp district of the Mpumalanga province of South Africa. The Area lies approximately 58 kilometres (km) South West of Piet Retief. The small rural village of Dirkiesdorp is approximately 15 km from the proposed site. **Figure 7-48** provides the local landscape context of the proposed Yzermyn Underground Coal Mine project.

The Piet Retief siding can be accessed primarily by gravel road from the town of Dirkiesdorp, which is currently being utilised by Jindal Mining SA. This siding is not fully utilized at present and The Client is recommended to utilise the siding as it is served with a tarred provincial road from Dirkiesdorp to Piet Retief.

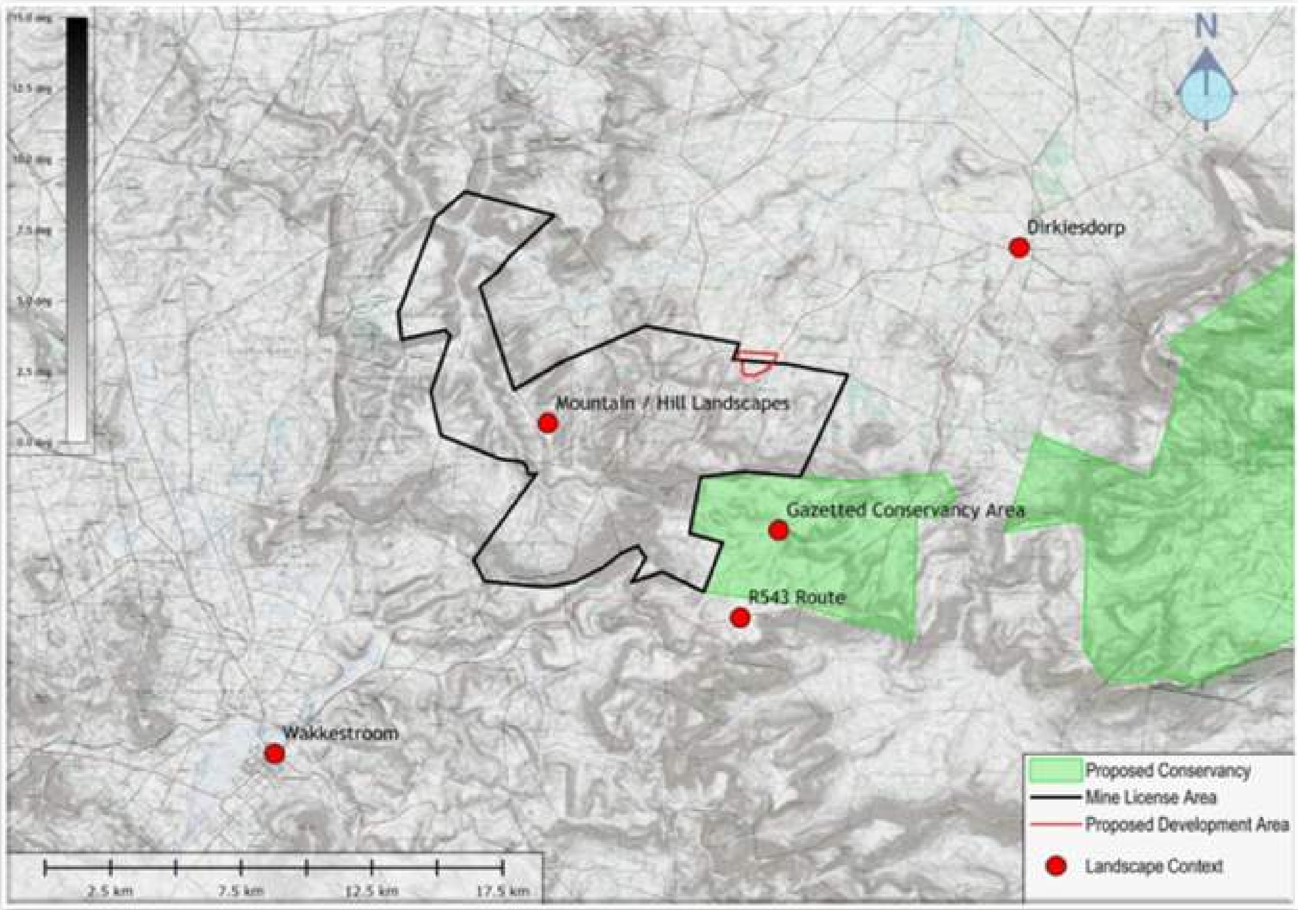

Figure 7-48: Local Landscape Context Feature Location Map

7.17.1.1 Wakkerstroom Tourism Context

Wakkerstroom is a small rural centre, located on the R543, which performs a service function to the agricultural and tourism sectors in the immediate area. The town comprises approximately 344 households. Adjacent to town of Wakkerstroom is the eSizameleni Township, which is comprised of approximately 1642 households (Pixley Ka Seme IDP, 2011). This settlement is characterised by high-density, low to middle income housing (predominantly RDP housing), limited formal and informal businesses (retail), and limited social services (WSP Environmental (Pty) Ltd. 2013)

The main industry in Wakkerstroom is focused around agriculture and tourism and is situated in a beautiful valley, 27 km from the town of Volksrust, and lies at an altitude of 1760m. Newcastle and Piet Retief (eMkhondo) are the closest large towns, both lying 80km away. The Wakkerstroom district is a major farming area, with the main crops being maize. Cattle and sheep are the main livestock farmed in the area. (www.wakkerstroomtourism.co.za). Wakkerstroom is one of the key birding sites on the Mpumalanga Birding

Route due to the significance of the wetlands and vlei's surrounding Wakkerstroom (**Figure 7-49**), as well as the importance of the area as an IBA.

Figure 7-49: View of vlei and open pans adjacent to Wakkerstroom approximately 21 km northeast from the proposed mining site

7.17.1.2 Existing Piet Retief Context

Piet Retief is situated in the extreme South East corner of the Mpumalanga Province on the N2, roughly 100km from Vryheid. It is a medium-sized town, with a forestry related industrial context (**Figure 7-50**), forestry being the dominant surrounding land use. It is ideally situated halfway between the Gauteng metropolis (Johannesburg and Pretoria) and the Natal coast (Richards Bay and Durban). It forms part of the Gert Sibande District Municipality and is the main link of both industrial and commercial transport from Gauteng to the import/export harbour at Richards Bay. (www localgovernment co za). Piet Retief plays a significant role in the local and regional context in terms of service provision, including a logistics and transport hub (road and rail), and the seat of local branches of national businesses (specifically forestry and agriculture related). eThandakukhanya, the township associated with Piet Retief, is located on the outskirts of the town, on south western side. (WSP Environmental (Pty) Ltd. 2013).

Figure 7-50: Photograph of surrounding industrial sense of place

7.17.1.3 Existing surrounding context

Within the 20 km area of direct influence are the Yzermyn Farm Community (0 – 2 km), Dirkiesdorp, KwaNgema, Wakkerstroom and Volksrust. The Yzermyn Farm Community is approximately eight scattered homesteads, occupied by Black low-income families as well as several other similar homesteads scattered on the farms outside of the target area, along access roads. Dirkiesdorp is a sprawling formal rural centre with an agricultural, rural sense of place (**Figure 7-51**). There are no municipal services except electricity. The Sinethemba Agricultural Secondary School, set up by the Themba Trust, is situated in the area. The extended Dirkiesdorp area is comprised predominantly of large family (traditional Zulu) homesteads, with some individual houses. The KwaNgema settlement is a large, sprawling community, without a key central point. It is comprised predominantly of scattered traditional homesteads. KwaNgema, however, appears to be more established, with larger, cohesive homesteads, which include visible small-holdings for subsistence crop farming. This community appears to have a stronger focus on agriculture activities, specifically crop and cattle rearing. (WSP Environmental (Pty) Ltd. 2013) Volksrust and the associated township, Vukuzakhe, form the largest urbanised area within the Pixley Ka Seme Local Municipality. Volksrust is a medium-sized town, with 2819 households, and 3709 households in Vukuzakhe (Pixley Ka Seme IDP, 2011).

Figure 7-51: Photograph of Dirkiesdorp

7.17.1.4 Existing Gazetted conservation Area

As indicated in **Figure 7-53**, due to the significant biodiversity of the region, a large number of farms to the east of the site, adjacent to the mine license area, have been gazetted as conservation areas (**Figure 7-52**). 23 600 hectares of privately-owned farmland extending from Wakkerstroom to Luneberg in the high altitude grasslands of southern Mpumalanga is a Protected Environment. Called the KwaMandlangampisi Protected Environment it is a critical water catchment area for South Africa that includes the headwaters of the Pongola River and the Assegaai River, which feeds the Heyshope Dam and provides clean water for national power generation.

Ranging from 1400 metres to 2000+ metres above sea level, it spans threatened high altitude grasslands, wetlands and indigenous mist belt forest, and is home to threatened and endemic plant, bird and animal species, including the Oribi and South Africa's three Crane species (Wattled, Grey Crowned and Blue) (www.wwf.org.za). "The need to carefully manage our water and water production areas in South Africa is self-evident, especially as coal-prospecting rights were granted on farms in the most water sensitive areas between Wakkerstroom and Luneburg, which include the headwaters of several river catchments" (WWF. 2010).

Figure 7-52: View of Gazetted conservation areas (KPE located approximately 3 km from adit entrance)

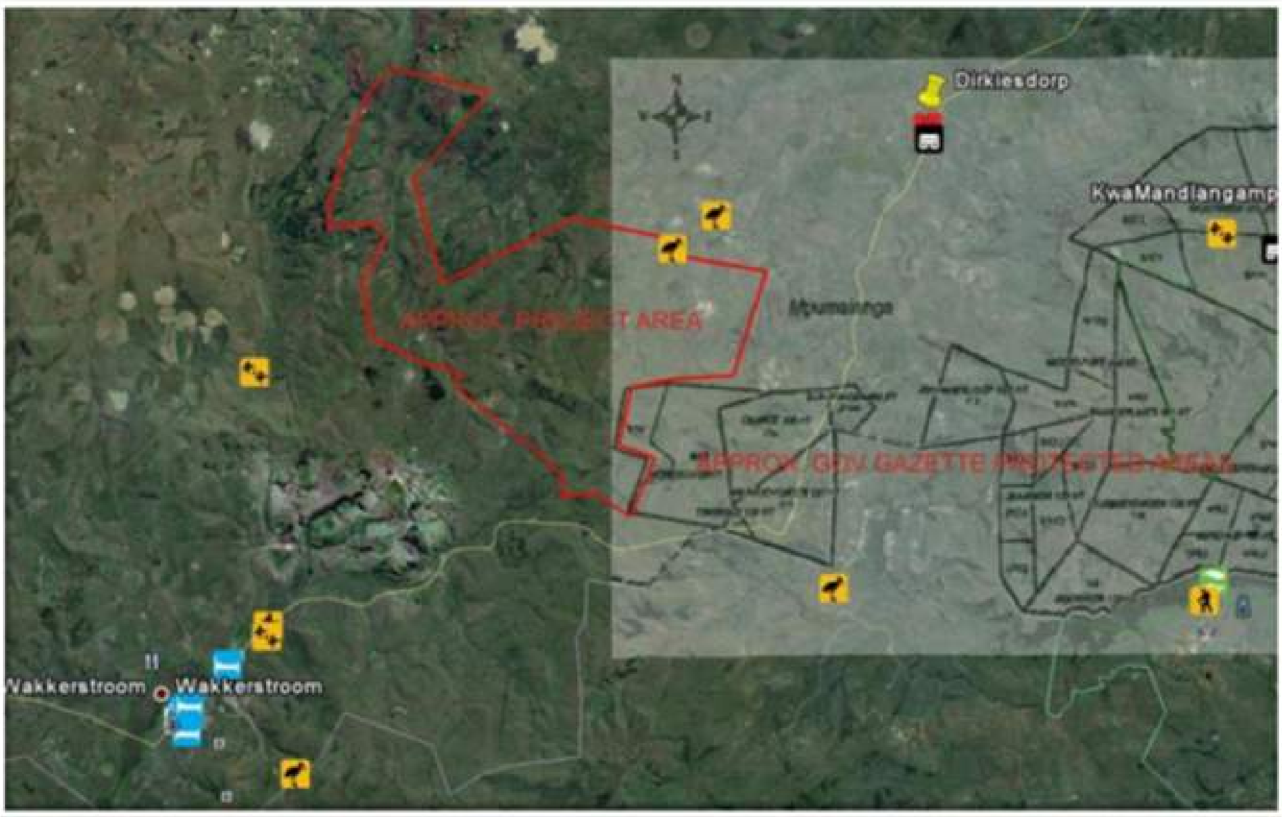

Figure 7-53: Approx. location of gazetted conservation areas in relation to mine licence area

7.17.1.5 Topography

As can be seen from **Figure 7-55**, the terrain in the vicinity of the mine is mountainous, with elevations ranging from 1200m to 2142m (**Figure 7-54**). The mountains form part of the Great Escarpment which runs from the Mozambique border in the north-east all the way around the southernmost boundary of South Africa to the Roggeveld near the Namibian border in the south-west, separating the coast from the high inland plateau. The mountain escarpment is also a boundary feature between Mpumalanga province in the north and Kwazulu-Natal in the south. The proposed site is located in the northern foothills of the mountain range, with the tourist town of Wakkerstroom located on the opposite side of the mountain range, to the south. Due to the location of the site on the foothills, the site is prominent and would be seen from within a large area towards the northern low-lying lands.

Figure 7-54: View of mountainous area surrounding Wakkerstroom

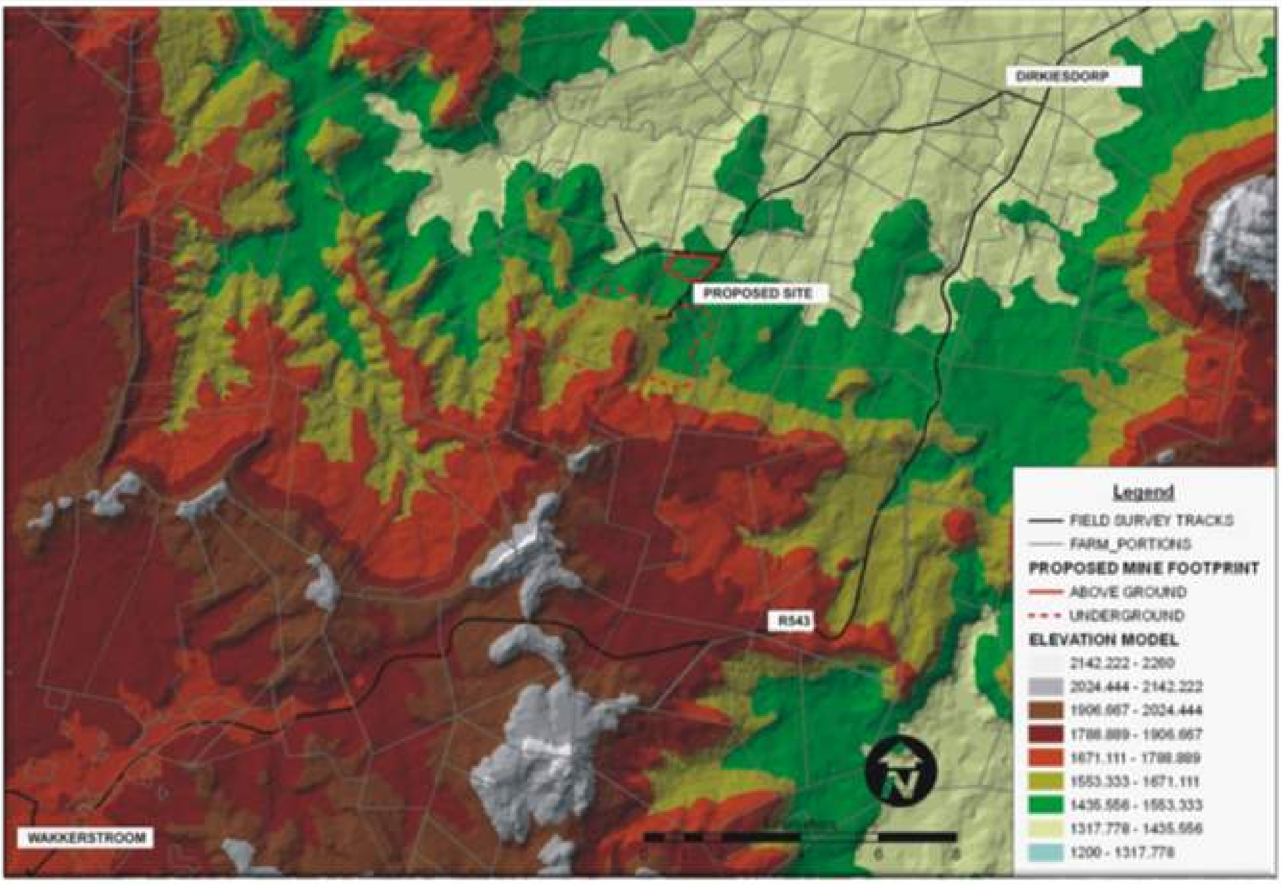

Figure 7-55: Regional terrain model

7.17.1.6 Vegetation

Within the study region, as indicated in the Yzermyn Baseline and Impact Vegetation Assessment, the vegetation is representative of the Grassland Biome and falls within the NPAs South Eastern Escarpment as well as the proposed Enkangala / Grassland Biosphere Reserve. The proposed lease and undermining area span three regional vegetation types within this biome (Section A). These vegetation types are the (i) Paulpietersburg Moist Grassland, (ii) Wakkerstroom Montane Grassland and (iii) Northern Afrotemperate Forest (Mucina & Rutherford, 2006). These vegetation types, like many other units within the Grassland Biome, are highly diverse and under threat through anthropogenic influences (**Figure 7-56**).

The wooded thicket areas within 1 km of the proposed surface infrastructure zone include natural state and restricted habitat, some alien invasives along the systems, particularly in the eastern component. Limited erosion evident, mainly at cattle crossings and it is rated as a Very High area of conservation importance. The Hydromorphic grasslands in this area are in a relatively natural state with heavy alien invasion of the eastern section with moderate diversity and has a rating of High to Very High for areas of conservation importance. The upper slopes and plateau grasslands have a medium to Medium-High conservation importance rating. (Natural Scientific Services. 2013).

Figure 7-56: Photograph of local mountain grasslands vegetation

7.17.1.7 Rivers and Vlei Areas

The extent of wetlands within the greater underground mining area, as assessed in the Yzermyn Wetland Baseline and Impact Assessment, has an overall wetland extent (underground mining area and surface infrastructure footprint) of approximately 668 ha, approximately 40% of the area. Both the Seep wetlands and the Channelled Valley Bottom wetlands score a Very High in terms of Ecological Importance and Sensitivity. This is due to the protected areas proposed and within the vicinity of the site, the current integrity of the site and the numerous species identified. Due to the pristine nature of the area and the land capability, the opportunities to provide future additional benefits is very low, however the threats to future benefits are extremely high due to the proposed mining in the area. (Natural Scientific Services. 2013) (**Figure 7-57**).

The habitat integrities for the selected sites on the Mawandlane and Mkusaze Rivers, as assessed in the Yzermyn Aquatic Baseline and Impact Assessment, showed very few existing impacts on the system instream and riparian habitats which were classified as being largely natural to natural, with some more impacted riparian habitats which were classified as moderately modified during low flow due to significant erosion, decrease in indigenous vegetation and an increase in alien vegetation. (Natural Scientific Services. 2013)

WWF and Nedbank's Green Trust has been a driving force behind the protection of this region and in recognising the critical water production role of the high-altitude grasslands between KwaZulu Natal, Mpumalanga and the Free State (which provide water to the whole of Gauteng, as well as to several of South

Africa's major power stations). The Wakkerstroom river biodiversity area is significant due to the importance of the area as an avitourism destination and IBA.

Figure 7-57: Mountains forming backdrop to the Wakkerstroom vlei areas, approximately 21 km from the minng site

7.17.1.8 Existing Infrastructure

The N2 highway is sign cant for the proposed sidings and road users using the N2 national highway are mainly commercial and trucking, with some tourism. The R543 road would be used by coal trucks to transport coal to the sidings (**Figure 7-58**). The local district road would be used for access to the proposed mine (**Figure 7-59**).

Figure 7-58: Photograph of R543 landscape character

Figure 7-59: Photograph of local district road

7.17.1.9 Landscape Value

The proposed mine site falls within Southern Mpumalanga which is a site of rich floral and faunal endemism, an IBA and the source of major river systems, namely the Usutu and Pongola Rivers (www.wwf.org.za). The site is situated between Wakkerstroom and Piet Retief and approximately 15 km from the small rural town of Dirkiesdorp, which has a population of approximately 350 people.

Adjacent land users are agricultural. Their sensitivity to the proposed landscape modifications would mostly be low as they would benefit from the increased access and improved road. Dirkiesdorp is a small rural village on the R543 which has a fairly dispersed settlement pattern. Scenic value of the town is moderate. Road users using the N2 national highway are mainly commercial and trucking, with some tourism.

The mountain areas are an important scenic resource and tourism in the area is closely linked to the natural landscape features such as mountains, rivers and wildlife. Much of the area to the south of the site remains nature tourism based. 23 600 hectares of privately-owned farmland extending from Wakkerstroom to Luneburg in the high altitude grasslands of southern Mpumalanga is a Protected Environment. According to the Biodiversity Assessment both types of wetlands score a Very High in terms of Ecological Importance and Sensitivity. This is due to the protected areas proposed and within the vicinity of the site, the current integrity of the site and the numerous species identified. Due to the pristine nature of the area and the land capability, the opportunities to provide future additional benefits is very low, however the threats to future benefits are extremely high due to the proposed mining in the area. (Natural Scientific Services. 2013)

Industry in Wakkerstroom is mainly based on tourism. This region also has a critical water production role due to the high-altitude grasslands.. Should the northern access route be utilised for the transportation of coal from the mine to the siding at Panbult or Piet Retief, transport trucks would come into the visual context of Wakkerstroom. Higher levels of contrast would be generated and the Class I visual resource management objectives would be exceeded.

There is an existing coal mining context surrounding the proposed siding site in Piet Retied. Scenic quality is low in both proposed Piet Retief and Panbult coal siding sites. The Piet Retief siding is located in close proximity to the town of Piet Retief, which is a timber and industrial node. Current scenic quality is lowered by the presence of the existing Jindal railway siding where coal stockpiles and trucks are located. Receptor sensitivities are low as the majority of users are industrial or agricultural. However, sensitivities of adjacent land users are rated high due to the close proximity of the site to the middle income residential area of Piet Retief.

7.17.2 Local Setting

The viewshed of the mine is extensive. However, the northern extent would be screened by the elevated topography to the south of the target area. It does include the town of Dirkiesdorp and sections of the R543, as well as the northern extents of the Gazetted conservation areas. This area is restricted by the northern ridgeline which offers topographic screening to the rest of the conservation areas located to the east of the site.

Receptors are defined by the Bureau of Land Management as the people located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed.

The potential receptor locations are identified by the viewshed assessment in relation to the proposed landscape modifications as seen in the viewshed map. Receptors are then screened to determine if they are Key Observation Points (KOPs). These KOP locations are used to assess the suitability of the proposed landscape modifications by means of assessing the degree of contrast of the proposed landscape modifications to the existing landscape, taking into consideration the visual management objectives defined for the area. The following areas and receptors were identified and will be assessed in detail during the scoping phase of the project:

- R1 – R543;
- R2 – R543;
- R3 – Dirkiesdorp residential area;
- R4 – Sinethemba Agricultural High School;
- R5 – District road;
- R6 – District road;
- R7 – District road;
- R8 – Dirkiesdorp residential area;
- R9 – Piet Retief residential, in proximity to the Piet Retief Siding; and
- R10 – N2 Highway, in the proximity of the Panbult Siding.

Table 7-19 below outlines the activity that may cause an impact on the surrounding visual aspect associated with the project, as well as the proposed exposure to the biophysical and socio-economic environment.

The surrounding landscape has high potential scenic value and may have moderate to high sensitivity due to the close proximity of the site to the gazetted conservation areas. The current land use is mainly livestock farming and settlements are rural in nature with minimal man made modifications. There is currently no precedent for mining in the area and should the mine take place, it must be recognised that there may be the potential for landscape degradation from cumulative visual impacts associated with coal mining related landscapes. The proposed mine site is located on the foothills of large hill and is in a prominent location with a large viewshed to the north. The tourist town of Wakkerstroom is outside of the viewshed to the south of the proposed mine site.

The area available for the mining structures and regent dumps is constrained by the topography and wetland/ river systems to the south. There is also a strong ridgeline which runs through the site which if developed on, would increase the visual intrusion potential of the project. The mine is an underground activity which may reduce the extent of the surface disturbing activities. The location of discard dumps may be clearly visible due to the colour contrast and would need to be located in the lower lying areas.

The Wakkerstroom and surrounding conservation areas are significant townscapes with a strong future natural based tourist industry. It is recommended that the areas visible from the town and conservation areas are classified as Class I (no-go areas) where the existing landscape context should not be altered. This is to ensure that from a regional perspective, the landscape character remains nature tourism based. The potential visual impacts associated with the expansion of the mine to into the remainder area of the prospecting right will be assessed during the ESIA phase.

Table 7-19: Summary Baseline Table of Receptors

Category	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
Name	R543	R543	Dirkiesdorp	Sinethemba Agricultural High School	District road	District road	District road	Dirkiesdorp	Piet Retief Siding	Panbult Siding
Type	Scenic route	Scenic route	Town	Mission	Road	Road	Road	Town	Road	Road
Land use	Agricultural	Agricultural	Residential	Institutional	Agricultural	Agricultural	Agricultural	Residential	Industrial	Industrial
Activity 1	Mine structures	Mine structures	Mine structures	Road upgrade	Mine site	Mine site	Mine site	Transport trucks	Piet Retief siding	Piet Retief siding
Activity 2	Lights at night	Lights at night	Lights at night	Trucks	Upgrade of road/trucks	N/A	N/A	Dust	N/A	N/A
Exposure	Low	Low	Low	High	Medium	High	Medium	High	High	High

7.18 Traffic

7.18.1 Regional Setting

There are three main provincial roads within the Pixley ka Sema Municipality, namely the R543, R35 and R23. Most of the roads are in a bad state due to high volumes of coal trucks that transport coal to surrounding power stations. The main roads are tarred but most of the local roads are still gravel. Existing railway transport exists that has a direct link to the Richards Bay Coal Terminal, which is utilised exclusively for freight transportation.

7.18.2 Local Setting

Traffic in the surrounding area is dominated by farm vehicles (tractors), light commercial vehicles (two and four-seater commercial car), light delivery vehicles (4x4 commercial vehicles), heavy delivery vehicles and coal trucks. The target area is boarded by an unpaved duel carriageway road to the north of the site, which continues for approximately 10 km east to the town of Dirkiesdorp. The road is used by local farmers and surrounding communities and does not see a large volume of vehicles (farm vehicles, light delivery vehicles and light commercial vehicles).

The R543 duel carriageway paved road runs from Wakkerstroom to the west of the area past Dirkiesdorp to Piet Retief. This road sees a considerably higher volume of vehicles. Vehicles include light commercial and delivery vehicles, heavy delivery vehicles and coal trucks transporting coal from the nearby mines (Jindal Coal, Kangra Coal and Savmore Mine).

The land surrounding the proposed target area is mainly open uncultivated land but there are some small townships and agriculture areas as well. There are two schools along the route to the mine area which cause public safety issues.

The proposed mine is to be situated on the western side of the R543 between Wakkerstroom and Dirkiesdorp, to the south-west of Piet Retief which is at the intersection of the R543 and the N2. It has been noted that the preferred access to the mine may be via the existing intersection with R543 and Vaalbank Road in Dirikiesdorp The R543 in the vicinity of Intersection 1 is a tarred, single carriageway road. The speed limit along the R543 in the vicinity is 60 km/h. Vaalbank Road is a single carriageway road which becomes an unpaved road a few meters from the intersection. This unpaved road provides access to the proposed mine area.

Another intersection exists along the R543 where heavy vehicles are deployed (R543 and Uitgevallen Road Intersection). This intersection is approximately 20km northeast of Intersection 1 (R543 and Vaalbank Road). The R543 in the vicinity of Intersection 2 is a tarred, single carriageway road with localised widening at the intersection. The speed limit along the R543 in the vicinity is 80 km/h.

Further north along the R543, approximately 25 km form Intersection 2, is the intersection of the R543 and the Road to the Railway Siding in Piet Retief. This intersection is identified as Intersection 3. The speed limit along the R543 in the vicinity is 60 km/h. All intersections operate at more than acceptable levels of service and very low volume capacity ratios.

7.19 Socio-economic

7.19.1 Regional Setting

7.19.1.1 Provincial Overview

The Mpumalanga Province is geographically split into the Highveld and the Lowveld by the northern reaches of the Drakensberg Mountain range. Agriculture is one of the largest economic sectors in Mpumalanga, covering 68% of the land use in the province, and producing a variety of products, including sugar cane, sunflower seed, sorghum, vegetables, cotton and maize. The Highveld produces mainly legumes and summer cereals, while the Lowveld provides subtropical and citrus fruit and sugar (State of the Environment Report (SoER), 2005).

Manufacturing is the largest economic sector in Mpumalanga, contributing almost 25% of the Gross Geographic Product (GGP). This sector comprises predominantly of Sasol's coal refining activities and chemical operations in the southern Highveld, however, chrome alloy and steel manufacturing also occurs in this area. The Lowveld is dominated by agricultural product manufacturing, including food and related industries, sugar mills, paper and pulp and other forestry related activities (SoER, 2005).

The mining sector is another important primary sector activity, providing over 20% of the GGP and 6% of the employment in the province. The main mining sector is coal, with large resources situated in the western and south-western regions, while gold, iron ore, chrome, alusite, magnitie and vanadium contribute significantly towards the mining sector (Stats SA, 2007).

The province is one of South Africa's major commercial forestry areas, producing 4.7% of the provincial GGP. The SoER (2005) indicates that forestry employs approximately 4% (36 000 people) of the economically active population of the province, and 200 000 people are indirectly reliant on the industry. Mpumalanga is also a significant contributor toward the production of electricity, due to its large coal deposits and subsequent location of coal-fired power stations in the province.

Tourism in Mpumalanga is a key economic activity for the province and South Africa, as Mpumalanga is an established tourism area due to the existence of tourism facilities, such as Kruger National Park, the Blyde River Canyon, Pilgrim's Rest and private game reserves, and is growing as an eco-tourism destination (Gert Sibande Integrated Development Plan (IDP), 2012).

7.19.1.2 District Overview

The Gert Sibande District Municipality is located in the southern part of the Mpumalanga Province. It is comprised of seven local municipalities: Albert Luthuli MP301; Msukaligwa MP302; Mkhondo MP303; Pixley Ka Seme MP304; Lekwa MP305; Dipaleseng MP306; Govan Mbeki MP307.

The population is 1,043,194, comprised of 88.6% Black African, 9% White, and 1% each Indian/Asian and Coloured (Stats SA, 2011). The proximity of the district to KwaZulu-Natal (KZN) and Swaziland, means that 60% of the population speak isiZulu, and 12.9% speak Swazi, respectively, as their home languages.

The district is comprised mainly of Highveld grasslands, and drops into the Lowveld regions towards the south and east. The area has a strong mineral potential, as well as tourism and biodiversity attributes. The municipality plays host to a number of large economic activities, including mining, agriculture and tourism. The key economic sectors of the district are: Manufacturing (SASOL); Mining (coal, gold, quarry); Energy Generation and Supply; Agriculture (crops and livestock); and Services (**Table 7-20**).

Table 7-20: Sectoral Contribution of the Gert Sibande District Municipality of Regional Economy (IDP, 2011)

Sectoral Contribution to the Regional Economy	2006	2007	2008	2009
Agriculture	3.9%	4.6%	3.6%	3.5%
Mining	22.7%	23.5%	30.0%	28.8%
Manufacturing	18.4%	17.7%	15.8%	14.6%
Electricity	5.0%	4.9%	4.4%	4.8%
Construction	2.2%	2.5%	2.6%	2.9%
Trade	10.9%	10.5%	10.4%	10.7%
Transport	8.6%	8.0%	7.2%	7.6%
Finance	12.8%	13.2%	12.0%	12.0%
Community services	15.4%	15.1%	14.0%	15.1%

7.19.2 Local Setting

The proposed Yzermyn site is falls within both the Mkhondo and the Pixley Ka Seme local municipalities, approximately halfway between the towns of Wakkerstroom and Piet Retief in the Province of Mpumalanga. The site is located on a privately owned farm lands, within an extensive agricultural (grazing) area. There are a number of small homesteads located on the farms surrounding the target area. These are predominantly inhabited by farm-workers and their families, and are established on the land as tenants. The closest formal settlements to the site are the towns of Dirkiesdorp and Wakkerstroom. The number of people settled within the target area is less than 50 persons.

7.19.2.1 Population

The proposed target area falls within the Pixley Ka Seme and Mkhondo Local Municipalities. According to Statistics South Africa (Stats SA) Census 2011, the municipalities have 255,217 people living in an area of 4 868 km^2. This density is relatively low, and is likely to be the result of large areas of extensive farming activities in the area. The population structure is bottom heavy – with the 75% of the population being under 35 years old (**Figure 7-60**). The gender profile of the local municipality indicates that there are a higher number of females than males - 52.3% and 47.7% respectively (Stats SA, 2011). This is likely to indicate an out-migration of males to major economic centres for employment, specifically Gauteng.

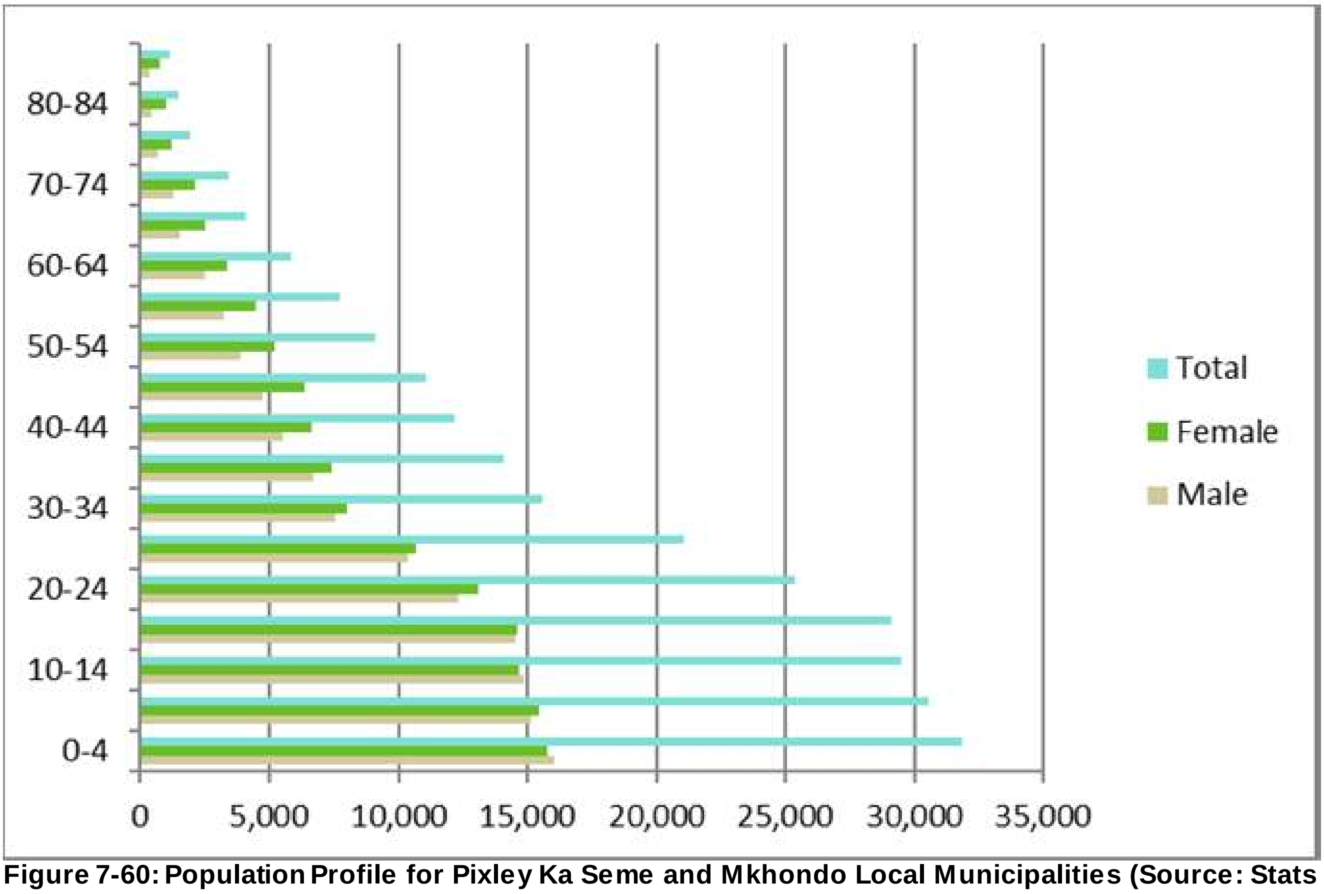

Figure 7-60: Population Profile for Pixley Ka Seme and Mkhondo Local Municipalities (Source: Stats SA, 2011)

7.19.2.2 Education

The education levels within the area is relatively low, with only 27% having some form of secondary education, 11% having completed grade 12 (or equivalent), and only 1% having tertiary education. Once again, this is indicative of the predominantly rural nature of the community within the study area.

7.19.2.3 Income and Employment

As with education levels, income levels are low, with 45% of the population having no income (including non-economically active), and 42% earning less than R1,600 per month. The employment levels are high, with 43% of the potential labour force being unemployed. As a result, 35% of the population relies on social grants for household income (**Figure 7-61**).

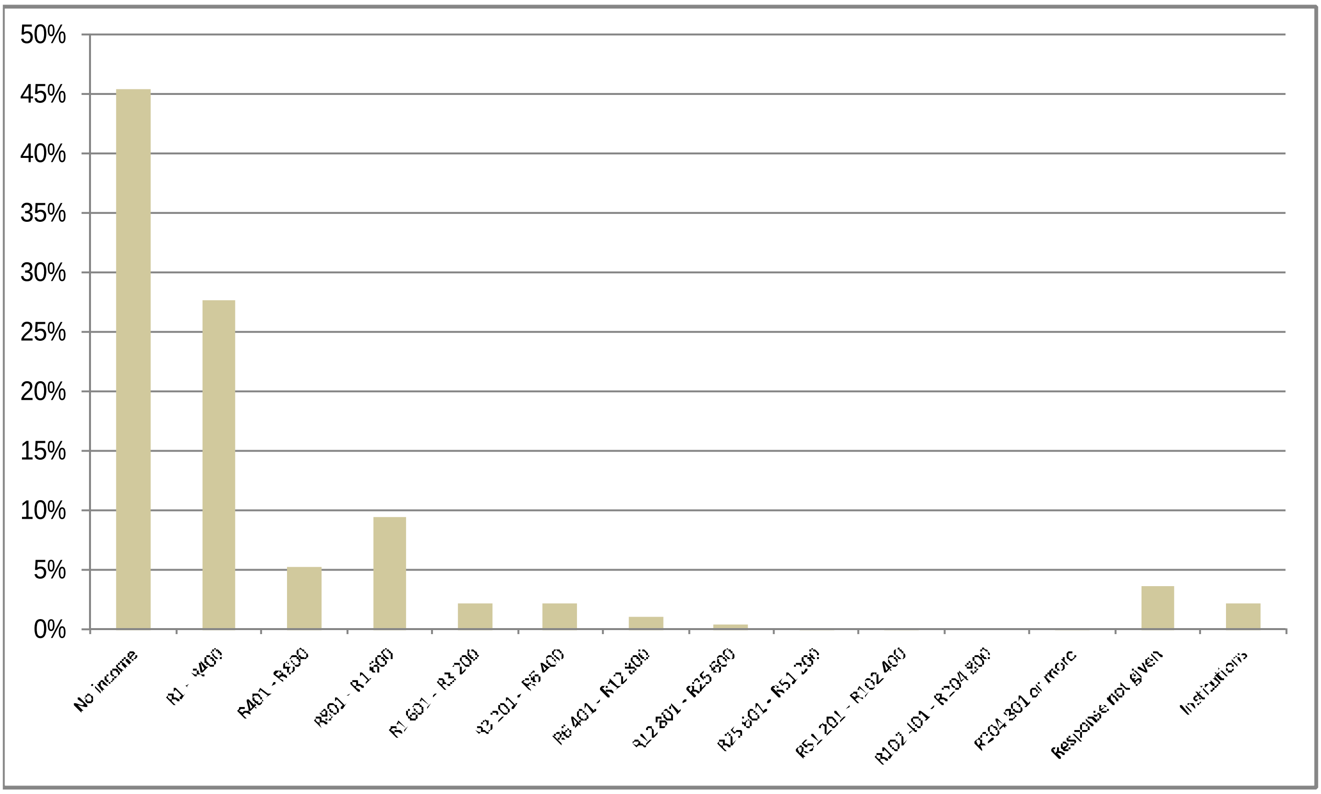

Figure 7-61: Income Levels for the Municipalities within the Project Area (Source: Stats SA, 2007)

7.19.2.4 Occupation and Key Economic Activities

Occupation profiles within the area are mostly undefined, with 29% not being classified under the Census listings (Stats SA, 2007). This is likely due to the ad hoc nature of many of people's employment. The remainder of employment sectors are as provided in **Table 7-21.** (Note: 2007 Stats SA Community Survey data was used, as 2011 data was not available, as this was not included in the 2011 census).

Table 7-21: Occupation Sectors within the Local Municipalities (Stats SA, 2007)

Occupation	Number	% of Population
Legislators; senior officials and managers	497	1%
Professionals	42	0%
Technicians and associate professionals	60	0%
Clerks	222	0%
Service workers; shop and market sales workers	354	1%
Skilled agricultural and fishery workers	148	0%
Craft and related trades workers	359	1%
Plant and machine operators and assemblers	151	0%
Elementary occupations	496	1%
Occupations unspecified and not elsewhere classified	17724	29%
Not applicable	39587	65%

Occupation	Number	% of Population
Institutions	1668	3%

7.19.2.5 Housing and Services

The type of housing in the area is split, with one third being traditional dwellings (structures made of natural/ traditional materials), and 64.7 % being brick structures on separate stands (Stats SA, 2011). The service levels within the municipalities are relatively high, with 76.6% having access to piped water, either in their dwelling or near to their property (Stats SA, 2011).

According to Stats SA (2011), 73.2% of the households have access to electricity (for lighting, 45.1% for cooking and 35.4% for heating). Other sources of fuel include wood with approximately 50% of households using wood for cooking and heating) and coal (Stats SA, 2011). Refuse removal services are generally poor, as only 43.6% of households have their refuse removed by the local municipality, and 37% have their own refuse dump for disposal (Stats SA, 2011). Sanitation services are varied, as only 47.4% have access to flushing toilets, 34% have access to pit toilets, and 16% have no access to toilet facilities (Stats SA, 2011).

7.19.2.6 Health and HIV/ AIDS

The number of healthcare facilities within both the Pixley Ka Seme and Mkhondo local municipalities is low. The IDP's of both municipalities indicate low access to facilities, and a need to provide better facilities to their populations. **Table 7-22** indicates the type and number of health facilities available within the both local municipalities.

Table 7-22: Healthcare Facilities available within the Local Municipalities (Gert Sibanda IDP, 2012)

Health Facilities	Pixley Ka Seme	Mkhondo
Private Hospital	None	None
Private Doctors	10	12
Primary Health Clinic	7	5
Mobile Clinics	2	1
Government Hospital	2	1
Dentist	2	3

Issues such as HIV/AIDs aggravate and are aggravated by poor living conditions. The Mkhondo Local Municipality (Mkhondo IDP, 2011) provides the following reasons for the high rate of HIV/ AIDs infection rates in the region:

- Cultural structure: the area is highly influenced by cultures where it is still common to find women being disempowered, making them unable to exercise their right to consent to sexual activity. Polygamy and superstitious beliefs are also common factors that contribute, albeit to a lesser extent, to the spread of HIV/ AIDS.
- Religious situation: although the majority of churches, which has a vast influence in the community, discourage pre-marital sex, it is a subject that is not general discussed.
- Social security: child support grants are often seen as a means to an income, which leads to unprotected sexual activity with the intention of becoming pregnant. Similarly, for an individual to qualify for a Reconstruction and Development Programme (RDP) (or low-cost) house, that individual has to have dependents, leading again to unprotected sexual activity with the intention of becoming pregnant. Furthermore, some women and even children may become inclined to become sex-workers in order to secure some form of income.

Communicable Diseases - The potential influx of labour and job seekers into the area of direct influence (ADI) could result in health concerns around communicable diseases, such as HIV/ AIDS and Tuberculosis (TB). There are currently high rates of HIV/ AIDs and related diseases within the ADI, which could further increase with the presence of additional people to the area.

Interventions are required at the ‘development interface’ – the place where development actually affects the receiving environment, i.e. at the place where HIV transmission occurs, refer to Figure 7-62**.**

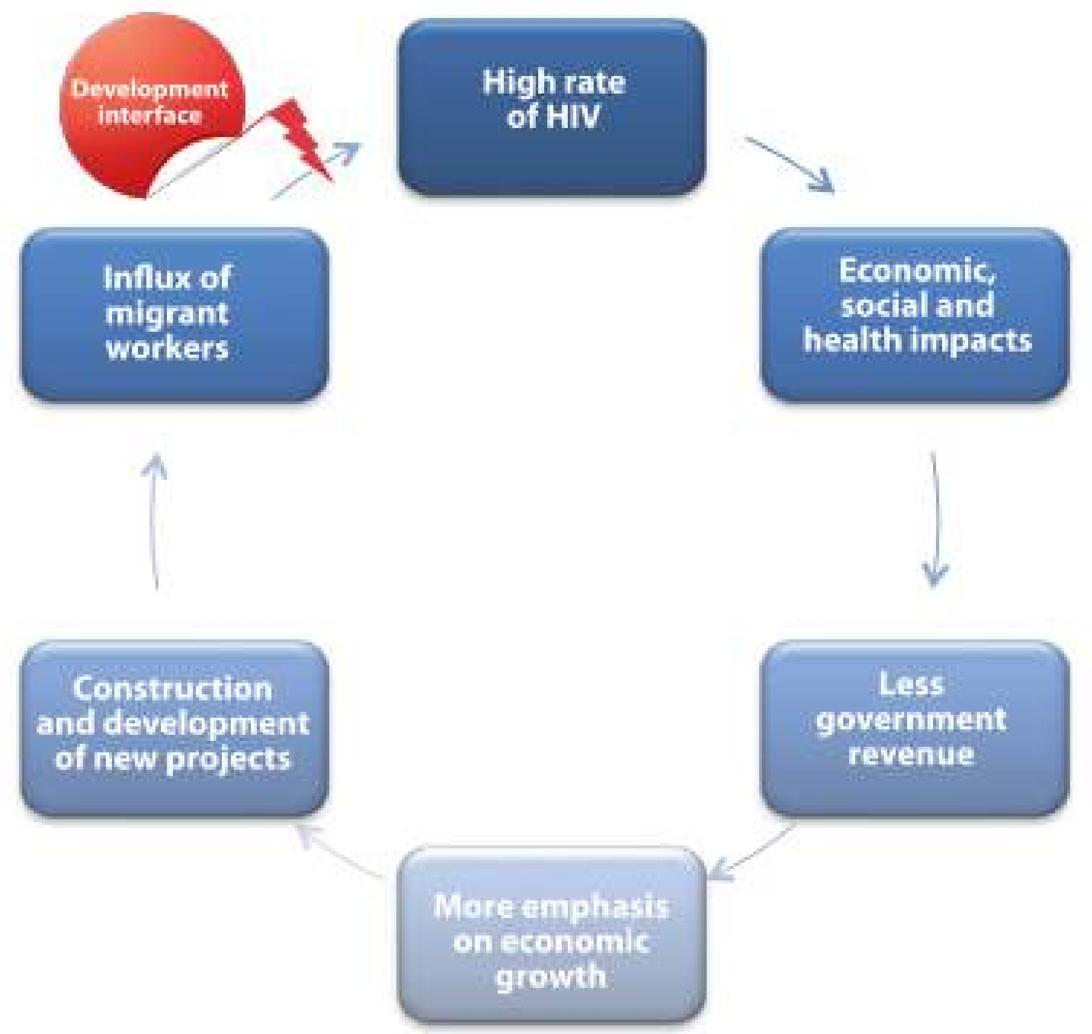

Figure 7-62: Circle of Development and the Spread of HIV (Source: UNDP, 2013)

7.19.2.7 Sphere of Influence

The proposed Yzermyn Underground Coal Mine will have an influence at two levels from a socio-economic perspective. The first level has a narrow focus and can be referred to as the Area of Direct Influence (ADI). This is related directly to the project site and the socio-economic context and issues related to this. The second level refers to the broader Area of Indirect Influence (AII), which can be up to a regional or national level. The areas of influence (both direct and indirect) are identified in accordance with the geographic and social environment in which the project is proposed to be undertaken, and on which it will potentially impact.

- **Area of Direct Influence** – the ADI has been defined as the area extending to a distance of approximately 10km from the boundary of the Yzermyn site. This ADI has been selected as it encompasses the likely directly affected communities associated with the project and its location. This is based on the understanding of the local social networks and dynamics, and reflects the communities and receptors which will be directly potentially affected by the project.

- **Area of Indirect Influence** – the proposed mining project is likely to have a socio-economic impact beyond the ADI. Indirect socio-economic impacts have the potential to extend up to 60km from the site, to the areas of Piet Retief and Volksrust. There are a number of settlements within a 60 km radius of the site (**Figure 7-63**), which may be influenced by the proposed project. The settlements of Amersfoort and Driefontein fall within the 60km radius, however it is unlikely that these communities will be affected by the mining activities. This is because they are geographical removed from the site (i.e. not connected by road, as are the other settlements), and so are therefore excluded from the study area. Potential impacts on these communities have therefore not been assessed as part of this study.

In addition to the AII, there is the potential for further indirect socio-economic effects of the proposed project to impact on a regional (Mpumalanga) and national scale. These have not been detailed within this study; however these have been taken into consideration on a broad level.

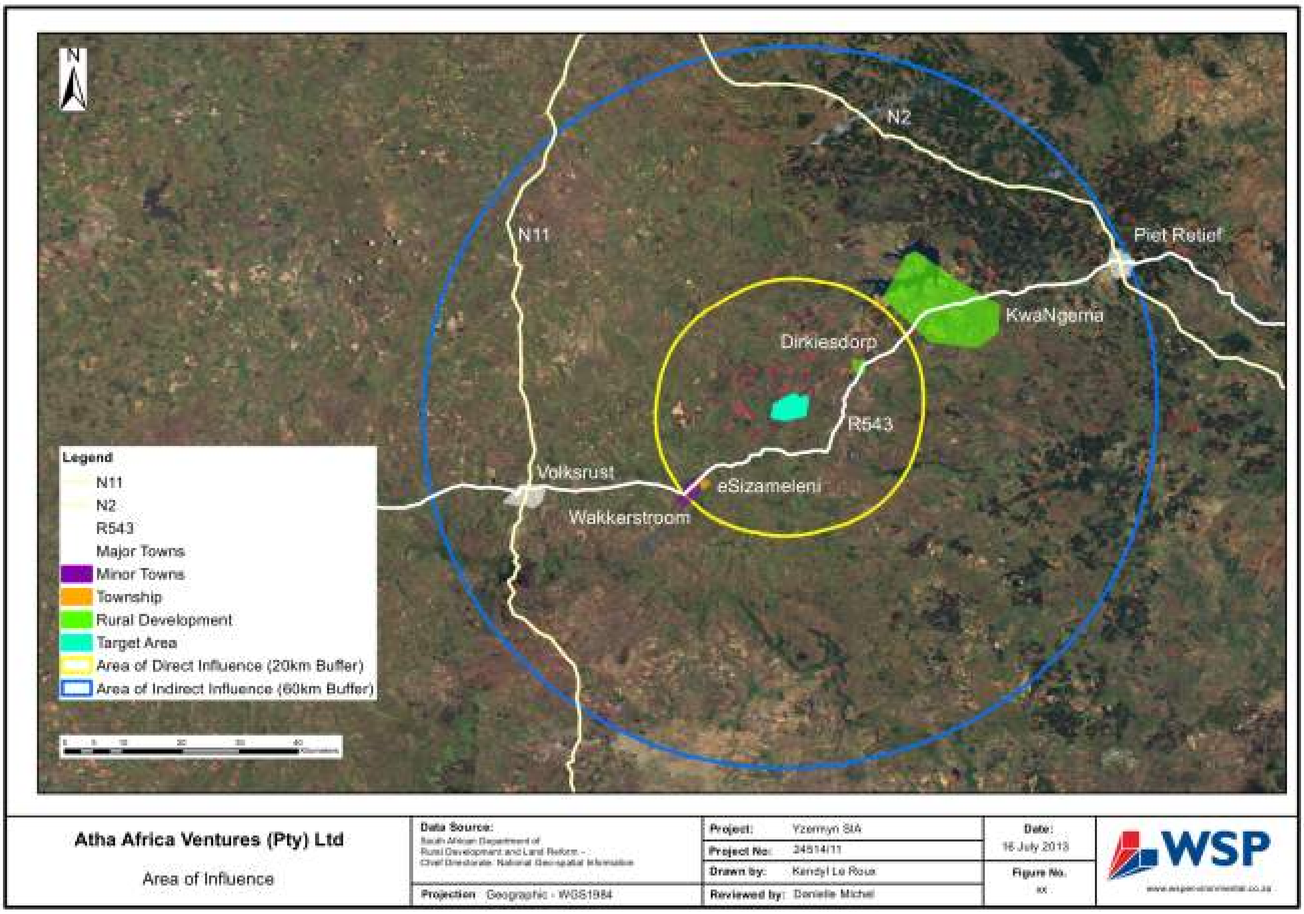

Figure 7-63: Settlements surrounding the Yzermyn Underground Coal Mine Target Area considered as ADI and AII

Table 7-23 provides an overview of the key communities (and associated proximities) related to the proposed project within the ADI and the AII.

Table 7-23: Overview of Settlements related to the proposed Yzermyn Underground Coal Mine

Town	Distance from site	Description	Population Description
Yzermyn Farm Community	0 - 2 km	Black African low-income scattered traditional homestead settlements.	160[1]
Dirkiesdorp	15 km north-east	Small rural town comprised of Black African, low-income population.	11865[2]
KwaNgema	25 km north-east	Large scattered rural settlement, with Black African traditional population.	

Town	Distance from site	Description	Population Description
Wakkerstroom	17 km south-west	Rural service centre town. Historically White rural town.	6852[3]
		Esizameleni - Township associated with Wakkerstroom, populated by Black African, low-income groups.	
Piet Retief	50 km north-east	First order major urban centre. Regionally, economically and logistically significant.	9166[2]
		eThandakukhanya - Medium sized township associated with Piet Retief, with a Black African Population.	6957[2]
Volksrust	40 km south-west	Second order town. Regionally and logistically significant.	7867[3]
		Vukuzakhe - Township associated with Volksrust. Black African population.	7554[3]

Source: [1] According to information gathered through surveys [2] Mkhondo IDP 2012/13; [3] Stat SA 2011 Census

The nine communities that have been determined to fall within the study area for the socio-economic assessment are described in detail below. Information has been sourced form site visits, surveys, interviews, observations and secondary sources (e.g. IDPs, SDFs and maps).

- **Farm Tenants**

  The proposed mining site contains approximately eight scattered homesteads, occupied by Black low-income families. These settlements are structured around the traditional Zulu homestead, with a male headed household, one main structure, and several smaller rondavels or structures for other family members. Between eight and 30 people live within (or are supported by) a single homestead.

  The structures are made in a “wattle and daub” manner, from wooden poles and clay sourced locally, and built by members of the homestead. There are no municipal services to these remote locations, and all households rely on wood for cooking and heating, river or springs for water, and have dug their own pit latrines for sanitation. They rely on local transport (taxis or hired vans) for transport to Dirkiesdorp or Wakkerstroom in order to buy supplies and to access healthcare facilities.

  These households rely on limited income from a member of the family working on the farm (herdsmen or tractor drivers), as well as social grants (child and/or pension), and with some households receiving some income from members who work in cities (e.g. Piet Retief or Johannesburg). The average total income per household (based on the limited questionnaire) is R2 200 per month, ranging from R800 for 15 person household to R3 500 for a 30 person household. Each household is allowed up to 15 head of cattle by the farmers (land owners), which are kept on the homestead in a kraal and use the surrounding grazing land.

  This community is vulnerable from a livelihood perspective, as they do not have access to finances or other resources should their current income come to an end (i.e. farm work) or access to natural resources, such as water and grazing land, be prevented. There is a low level of education, with only some of the children (aged around 7 to 16 years) currently traveling to Dirkiesdorp for schooling. It appears that few of the adults in this community have had formal education beyond primary schooling. There is a need for a primary school closer to the homesteads, and better access to healthcare and basic services.

  In addition to these eight homesteads, there are several other homesteads scattered on the farms outside of the target area, along access roads. These homesteads were not surveyed; however most appeared to be similar to the above description.

Figure 7-64: Farm Tenants

- **Dirkiesdorp Community**

Dirkiesdorp is defined as a rural node by the Mkhondo Municipality IDP (2011). It is a sprawling formal rural centre, which converges along the R543, half way between the towns of Wakkerstroom and Piet Retief (**Figure 7-65**). WSP was informed that the town of Dirkiesdorp was established in the 1980s, when a local farmer opened a drug and alcohol abuse rehabilitation centre for Black African people living in the vicinity of his farm.

In 1985, the Themba Trust (a non-profit organisation opened in 1983 by a Lutheran missionary) opened an agricultural high school for boys, and in 1996 bought a piece of land down the road to start a separate boarding school for girls (*pers. comm.* Themba Trust, 2012). The schools have subsequently consolidated to form a mixed school, which is rented by, and teachers are paid for by, the Department of Education. The Trust has also set up a number of other social and educational facilities within Dirkiesdorp, including a crèche, and training and skills development centres. The Trust also owns a number of plots of land and buildings in the town, which are rented out to local entrepreneurs for a tuck shop, bakery, second hand shop, computer classes and e clinic.

The residents near the centre of Dirkiesdorp have access to basic municipal and community services including water points within some houses or within properties, pre-paid electricity, and some water-borne sewerage. Social facilities include a police station, clinic, social centre for the elderly, and a secondary and high school. Further out form the centre of the town, houses have access to boreholes and rivers for water, make use of pit latrines, and make use of wood for heating and cooking. The town is considered safe by local residents (pers. comm. Local resident, March 2012), with relatively little crime compared to more urban areas.

The extended Dirkiesdorp area is comprised predominantly of large family (traditional Zulu) homesteads, with some individual houses. The dwellings are constructed from a variety of materials, predominantly permanent brick structures and “wattle and daub” traditional mud structures.

The employment levels are very low in Dirkiesdorp (*pers. comm*. Themba Trust, 2012). HIV/ Aids is a key health concern in the community. According to the Themba Trust, the HIV infection rates are high. This is likely to be due to the low levels of education and employment in the community. Another social issue is alcoholism, which was stated as a concern by one of the community members interviewed. Once again, the low level of employment could be a direct cause of this issue. Income is likely to come from working on nearby farms and towns, but mainly through social grants and a limited percentage through entrepreneurial enterprises, such as a road-side tuck shop, hair salon, and taverns (pers. comm., Dirkiesdorp resident, March 2012).

Figure 7-65: Dirkiesdorp

- **KwaNgema Community**

  The KwaNgema settlement is located midway between Piet Retief and Dirkiesdorp (**Figure 7-66**). This is a large, sprawling community, without a key central point. It is comprised predominantly of scattered traditional homesteads. KwaNgema, however, appears to be more established, with larger, cohesive homesteads, which include visible small-holdings for subsistence crop farming. This community appears to have a stronger focus on agriculture activities, specifically crop and cattle rearing.

  Little evidence of social services or municipal services was observed within the settlement. There is limited electricity and water supply services (Mkhondo IDP, 2012). According to the Mkhondo Local Municipality IDP (2011), there are severe service backlogs in this area (especially with regards to the provision of electricity). Comments within the IDP by communities indicate that housing is insufficient, with a number of people living in shacks and mud huts. Water is trucked in by the municipality, however is limited and does not reach all areas of the settlement. The roads in this area are also poor, being comprised of gravel, which is not graded regularly, resulting in them often being impassable. The IDP (2011) also highlights the need for crèches, schools, community halls, healthcare, houses and many other social and basic services to be provided to the KwaNgema area.

Figure 7-66: KwaNgema

- **Wakkerstroom/ Esizameleni Community**

  Wakkerstroom is classed as a third order service centre, or minor node, within the local municipality (Pixley Ka Seme IDP, 2011) (**Figure 7-67**). The town is a small rural centre, located on the R543 (28km from Volksrust, on the road between Volksrust and Piet Retief). Wakkerstroom performs a service function to the agricultural and tourism sectors in the immediate area. The town comprises approximately 344 households, with sufficient potable water supply, sanitation, electricity (prepaid or full connection), and refuse removal

(Pixley Ka Seme IDP, 2011). The town has not been fully developed, with a large number of vacant residential stands within its boundaries.

The tourism sector forms a significant role within the local economy of Wakkerstroom, due to the historical, archaeological, scenic and ecological features in the area. The area between Wakkerstroom and the farm, on which the site is proposed, is an internationally recognised birding site with four endemic species, as well as an ecological corridor (Pixley Ka Seme IDP, 2011). Historically, Wakkerstroom was a British fortification during the Anglo-Boer War, and a base for the British to transit into the former Transvaal, and a number of other historical features, such as bushman paintings are located in this area (*pers. comm.* Mr Smit).

Business within the town is limited to a few independent restaurants and retail outlets in the centre of the town, and a number of governmental buildings. In terms of social services, Wakkerstroom has a police station, magistrate court, library, old age home, cemetery, a primary and secondary school, guest houses, and religious centres (churches).

Adjacent to town of Wakkerstroom is the eSizameleni Township, which is comprised of approximately 1642 households (Pixley Ka Seme IDP, 2011). This settlement is characterised by high-density, low to middle income housing (predominantly RDP housing), limited formal and informal businesses (retail), and limited social services. This township has access to water, sanitation, electricity and refuse removal, as well as a cemetery, secondary school, primary school, crèche and churches (Pixley Ka Seme IDP, 2011).

Figure 7-67: Wakkerstroom

- **Volksrust/ Vukuzakhe Community**

  Volksrust and the associated township, Vukuzakhe, form the largest urbanised area within the Pixley Ka Seme Local Municipality. Volksrust is a medium-sized town, with 2819 households, and 3709 households in Vukuzakhe (Pixley Ka Seme IDP, 2011).

  The Pixley Ka Seme IDP (2011) classifies Volksrust as a second order service centre settlement. It has relatively good access to basic services, with potable water (including local water treatment), water-borne sanitation (local waste water treatment), electricity, and refuse removal to most households (Pixley Ka Seme IDP, 2011).

  The strategic location of the town on the N11 (between Ladysmith and Limpopo) has resulted in the town that services not only the agriculture and rural settlements in the area, but major transport and logistics routes, as well as tourists passing through the area. The town is also the head office of the Pixley Ka Seme Local Municipality, and the largest retail centre after Newcastle (50km away).

- **Piet Retief/ eThandakhanya Community**

  The large town of Piet Retief is a first order urban node, located on the N2 in the centre of the Mkhondo Local Municipality, and is the seat of the local municipality (Mkhondo IDP, 2011). The greater Piet Retief area (Wards 7, 10 and 14) has a population of 22,229 (Stats SA, 2011). The town is well serviced, with all households receiving basic services (electricity, water, sanitation, and refuse removal).

Piet Retief plays a significant role in the local and regional context in terms of service provision, including a logistics and transport hub (road and rail), and the seat of local branches of national businesses (specifically forestry and agriculture related). The town also plays a role in terms of tourism and other service (tertiary) sector industries (e.g. real estate, legal, etc.) as it provides support to businesses in the area.

eThandakukhanya, the township associated with Piet Retief, is located on the outskirts of the town, on south western side. This is largely a dormitory town, but with access to municipal services (water, electricity, refuse removal) and social services (healthcare, policing) (Mkhondo IDP, 2011). This settlement relies heavily on Piet Retief, as well as forestry, mining and agricultural activities in the area for income.

7.19.2.8 Community Organisation of Key Communities

The site and the study area fall within the Gert Sibande District Municipality, over the Mkhondo and Pixley Ka Seme Local Municipalities. Outside of towns and urban areas, the extensive rural landscape is managed through these municipalities; however traditional leadership plays a role.

There is a local headman or “chief” (based near Dirkiesdorp), however there does not appear to be substantial traditional community or following. The community appears divided, as although they are predominantly Zulu-speaking (due to the town’s proximity to the KZN border), there are a number of Swazi and other families and individuals who live within these settlements. The following two towns are detailed in terms of their local leaderships structures, as these are the primary ADI settlements. The settlements within the AII are managed by the local municipalities, and therefore have not been detailed.

- **Dirkiesdorp** - The Dirkiesdorp community falls under the Mkhondo Local Municipality, and the local ward councillor is responsible for the implementation of services and communication between the community and the municipality. The strongest leadership/ town management in Dirkiesdorp, however, appears to have emerged from the Themba Trust, as they provide facilities and guidance for schools and entrepreneurs in the local area. This is, however, a non-governmental organisation (NGO), and therefore cannot be engaged directly (pers. comm. Mkhondo Local municipality, December 2012). Due to its peripheral location, the Mkhondo Local Municipality indicated that the Gert Sibande District Municipality has been responsible for this area, including provision of municipal services.
- **Wakkerstroom** does not have specific community leadership, however the population of the town appears to have been historically well organised and independent, and therefore there are strong community representatives, as well as support from environmental NGOs. Wakkerstroom falls within the Pixley Ka Seme Local Municipality to the west of the Mkhondo Local Municipality. The local ward councillor and committee are therefore responsible for implementation of service delivery and communication with the local municipality.

8 Summary of Specialist Studies

8.1 Geology

No specialist study was required, however, a description of the potential impacts associated with geology haven been discussed below and rated in the environmental and social impacts rating table in **Section 10**.

8.1.1 Impacts Identified with Geology

8.1.1.1 Construction Phase

The development of the adit (boxcut and high-wall) will necessitate the removal of the underlying geology (site specific). Blasting will also be required in order to establish the adit. Ground vibration yielded from this blasting is expected to be nominal during the construction phase. Raise-boring of the ventilation shaft will also involve the removal of overburden layers. The permanent removal of geology to lay foundations and initiate shaft sinking activities will result in the permanent loss of a natural resource.

8.1.1.2 Operational Phase

The underground mining operations will necessitate the removal of coal and, to a lesser degree, dolerite rock, which will result in the permanent loss in a natural, non-renewable resource and associated geology.

8.1.1.3 Closure Phase

Not applicable. As the coal would have already been mined from the underground workings, the geology of the area would have been permanently altered.

8.2 Topography

No specialist study required, however, a description of the potential impacts associated with topography haven been discussed below and rated in the environmental and social impacts rating table in **Section 10**.

8.2.1 Impacts Identified with Topography

8.2.1.1 Construction Phase

The development of the adit and construction of infrastructure (building structures, access roads, fencing, etc.) will create a visible, artificial landscape for the LOM. The construction of the co-disposal discard facility will result in a permanent wide visual envelope and a permanent change in topography. The surface infrastructure is likely to disturb the natural and/ or existing flow of the topography and free drainage of the area. No subsistence is expected from the construction and operation phases.

8.2.1.2 Operational Phase

The establishment of the surface infrastructure will lead to a wide visual envelope on receptors and a change in the natural topography of the area for the LOM. The co-disposal discard dump facility can create long-term topographic impacts if not reprocessed. The surface infrastructure may also include the disturbance to the natural and/ or existing flow of the topography and free drainage of the area.

8.2.1.3 Closure Phase

The demolition of the surface infrastructure that will be utilised as part of the project, will return the topography to its pre-mine state (dependent on the mine's closure and rehabilitation objectives). Co-disposal discard dump facility could create long-term topographic impacts if not reprocessed or adequately rehabilitated.

8.3 Air Quality

The air quality impact assessment was undertaken independently by WSP: Air Quality. The summary of the reports is included below and the detailed assessment report in included in **Appendix C: Air Quality Assessment.**

8.3.1 Methodology

The assessment comprised onsite ambient air quality monitoring in order to assess the existing air quality in the region as well as dispersion modelling to determine the predicted impacts that the proposed mine will have on the existing air quality. A comprehensive emissions inventory was developed to account for all emission sources at the proposed Yzermyn Underground Coal Mine during both the construction and operational phases. Calculated emission rates were then used as input into ADMS (v5) dispersion modelling software. Included into the model was Unified Model (UM) meteorological data generated for the site co-ordinates; background pollutant concentration (monitored) data; and a complex terrain file to account for the influence of the undulating regional topography on the dispersion of pollutants.

Predicted particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and volatile organic compound (VOC) concentrations were assessed against the NEMAQA ambient air quality standards to assess compliance, whilst dust fallout was assessed against the SANS 1929:2005 guidelines.

8.3.2 Assumptions and Limitations

Various assumptions were made and limitations experienced in this assessment that may impact on the outcome of the results obtained in this report.

These assumptions include:

- The proposed site layout as provided by Mindset is assumed to be representative of reality;
- All areas utilised in the emissions inventory calculations were calculated using ArcGIS 10, based on the site layout provided by Mindset;
- It was assumed that the operational statistics provided by Atha and Mindset is representative of reality;
- Topsoil density was assumed to be 1,806.4 kg/m^3 based on experience from previous work undertaken in the area;
- The topsoil depth of 0.7 m obtained from the soil specialist was assumed to be representative of reality;
- The removed topsoil will be stockpiled in a berm to the south of the mine;
- The location of the topsoil stockpile/ berm was assumed to be located towards the south of the mine;
- A height of 2 m for the topsoil stockpile/ berm was assumed;
- Graders will operate twice a month on roads;
- The number of holes drilled was based on a 3 m spacing over the area of the boxcut/ high-wall;
- It was assumed that the overburden moisture content of 6.7% and silt content of 14% from a previous mining study performed in the Mpumalanga province is representative for this study;
- 20 vehicles will frequent the site on a daily basis during the construction phase;
- The construction vehicles will only enter and exit the site once;

- Activities will operate for 20 hours a day during construction phase;
- Activities will operate for 24 hours a day during operational phase;
- Height of tips above stockpiles is 1 m;
- Emissions at stockpiles were applied to the entire surface area of the stockpile;
- It was assumed that trucks will transport discard from the discard bin to the discard dump;
- Fuel consumption of trucks was based on a generic Volvo diesel truck;
- The number of vehicles operating on the mine access road during the operational phase, calculated from the personnel numbers depicted in the Mine Works Programme, are assumed to be representative of reality;
- A height of 3.5 m for the Coal Handling and Preparation Plant was utilised in the model; and
- It was assumed that the topsoil stockpile will be grassed and will not impact on emissions in the operational phase (after three years) scenario.

The limitations include:

- The lack of site specific metrological data, where only UM model data was obtainable and subsequently utilised in the dispersion model.

8.3.3 Findings of the Study

From the onsite monitoring, it was identified that dust fallout rates and particulate emissions in the region are low, particularly in the wet summer season. The region is characterised by a background PM_{10} concentration of 8.97 µg/m^3 and a $PM_{2.5}$ concentration of 2.75 µg/m^3, which were subsequently utilised as background in the dispersion model. NO_2 and SO_2 concentrations were significantly low, with monitored summer and winter concentrations indicating compliance with the NEMAQA standards.

8.3.4 Impacts Identified during the Study

8.3.4.1 Construction Phase

From the dispersion modelling and the meteorological input data, emissions from the proposed Yzermyn Underground Coal Mine will disperse towards the east and the west, with local plume dispersion being dictated by the topography. Main sources of particulate emissions during the construction phase are illustrated in **Figure 8-1** and include

- Topsoil unloading;
- Grading;
- General construction (land clearing, ground excavation, blasting, earth moving etc.);
- Drilling;
- Blasting;
- Bulldozing;
- Unloading materials from vehicles;
- Unpaved roads; and
- Wind erosion.

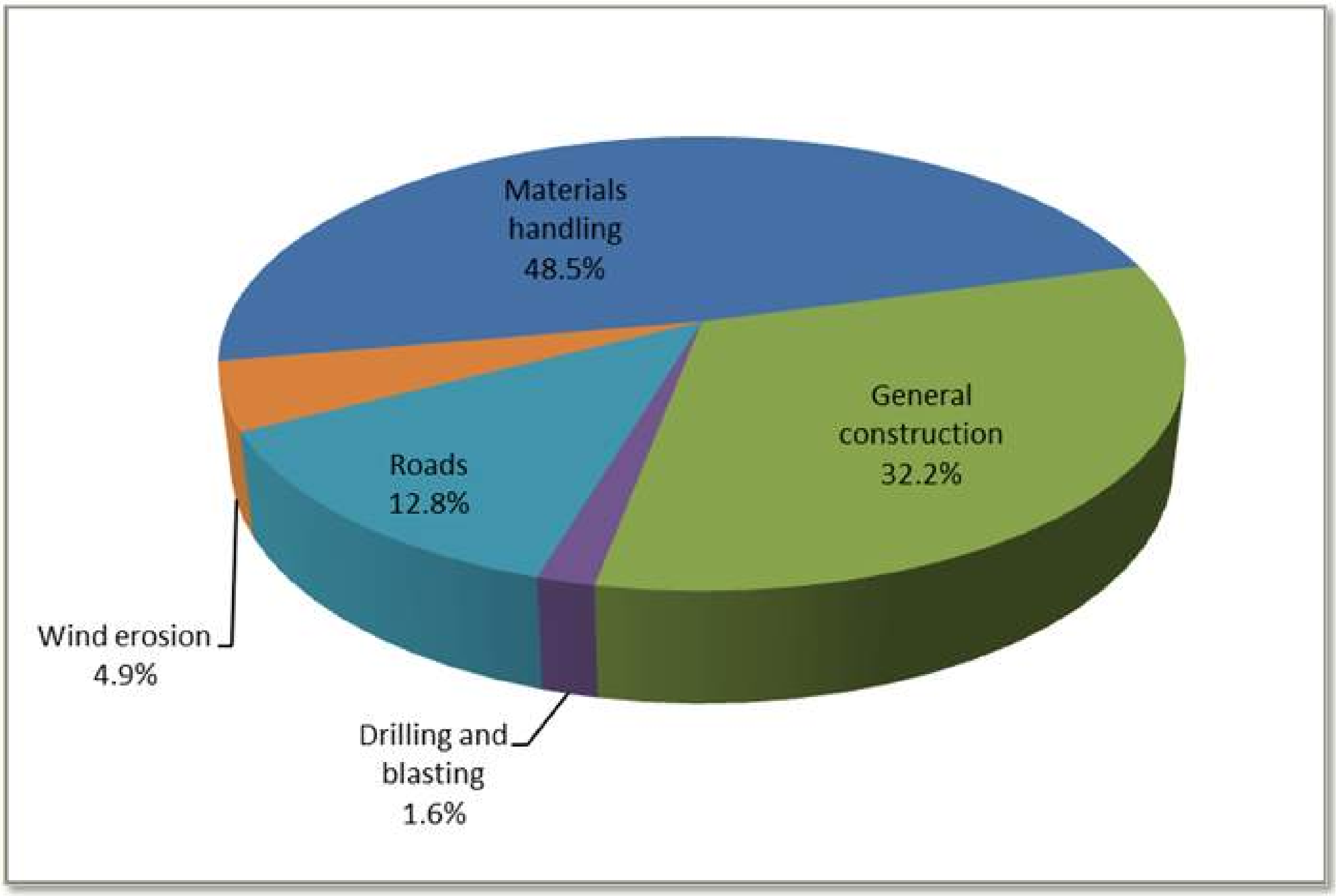

Figure 8-1: Source Pollutants during the Construction Phase

PM_{10} Concentrations

Long term PM_{10} concentrations during the construction phase are predicted to be generally low, with concentrations only exceeding the annual standard (50 µg/m^3) at receptors in close proximity to the construction activities and at receptors in closest proximity to the mine access road. Numerous exceedences of the 24 hour average standard are also predicted at these receptors. The highest number of daily PM_{10} exceedences is predicted within the mine boundary; however, a number of exceedences are predicted along the mine access road, with the maximum permitted frequency being exceeded up to 600 m from the road. This is illustrated in **Figure 8-2** and **Figure 8-3**.

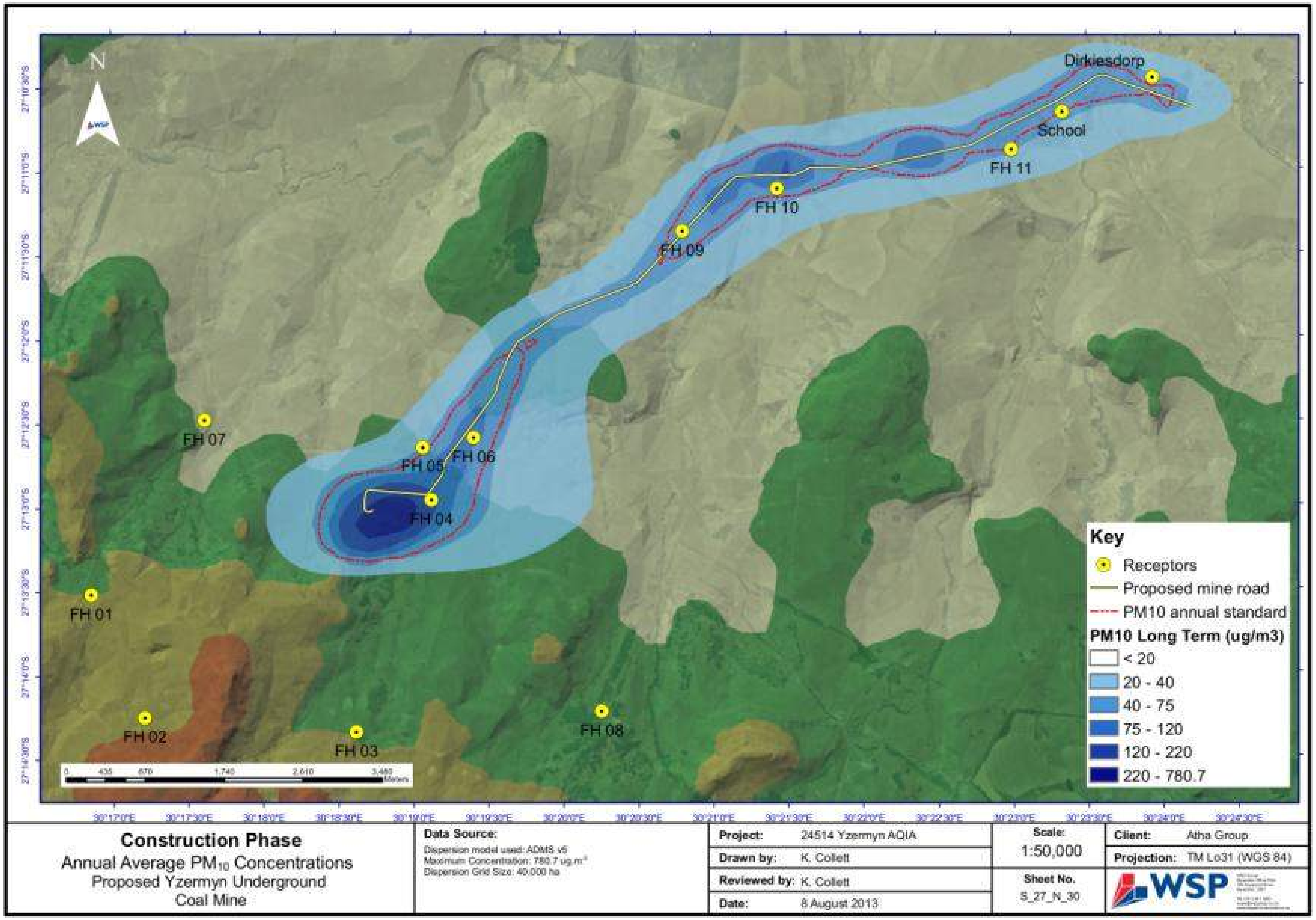

Figure 8-2: Predicted Annual Average PM10 Concentrations for the Construction Phase

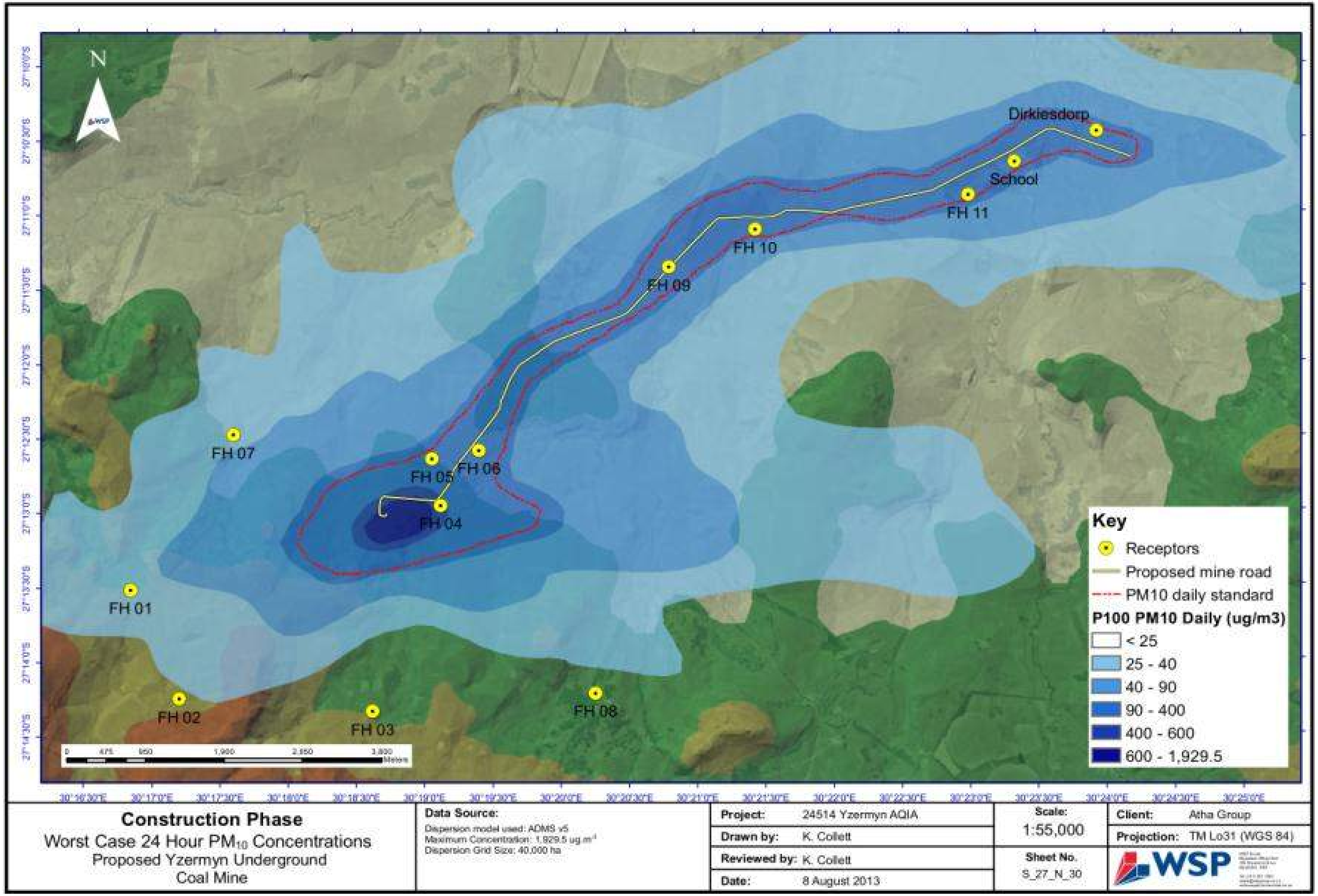

Figure 8-3: Predicted Worst Case PM10 Concentrations during the Construction Phase

$PM_{2.5}$ Concentrations

Predicted long term $PM_{2.5}$ concentrations during the construction phase are low and no exceedences of the annual $PM_{2.5}$ standard are predicted at any of the sensitive receptors. Worst case daily concentrations are also low, with the farm house receptor (location FH 04) being the only receptor to exceed the daily standard, due to its close proximity to the construction activities. From this it is evident that dust in the form of $PM_{2.5}$ is not a key emission from the construction phase of the proposed Yzermyn Underground Coal Mine and will not negatively impact on surrounding receptors. This is depicted in Figure 4 and 5.

Annual average dust fallout rates during the construction phase are low and are compliant with the SANS Residential Guideline at all receptors. It must be noted, that although low rates are predicted offsite, onsite fallout rates in the direct vicinity of the construction activities are predicted to be significantly elevated as would be expected.

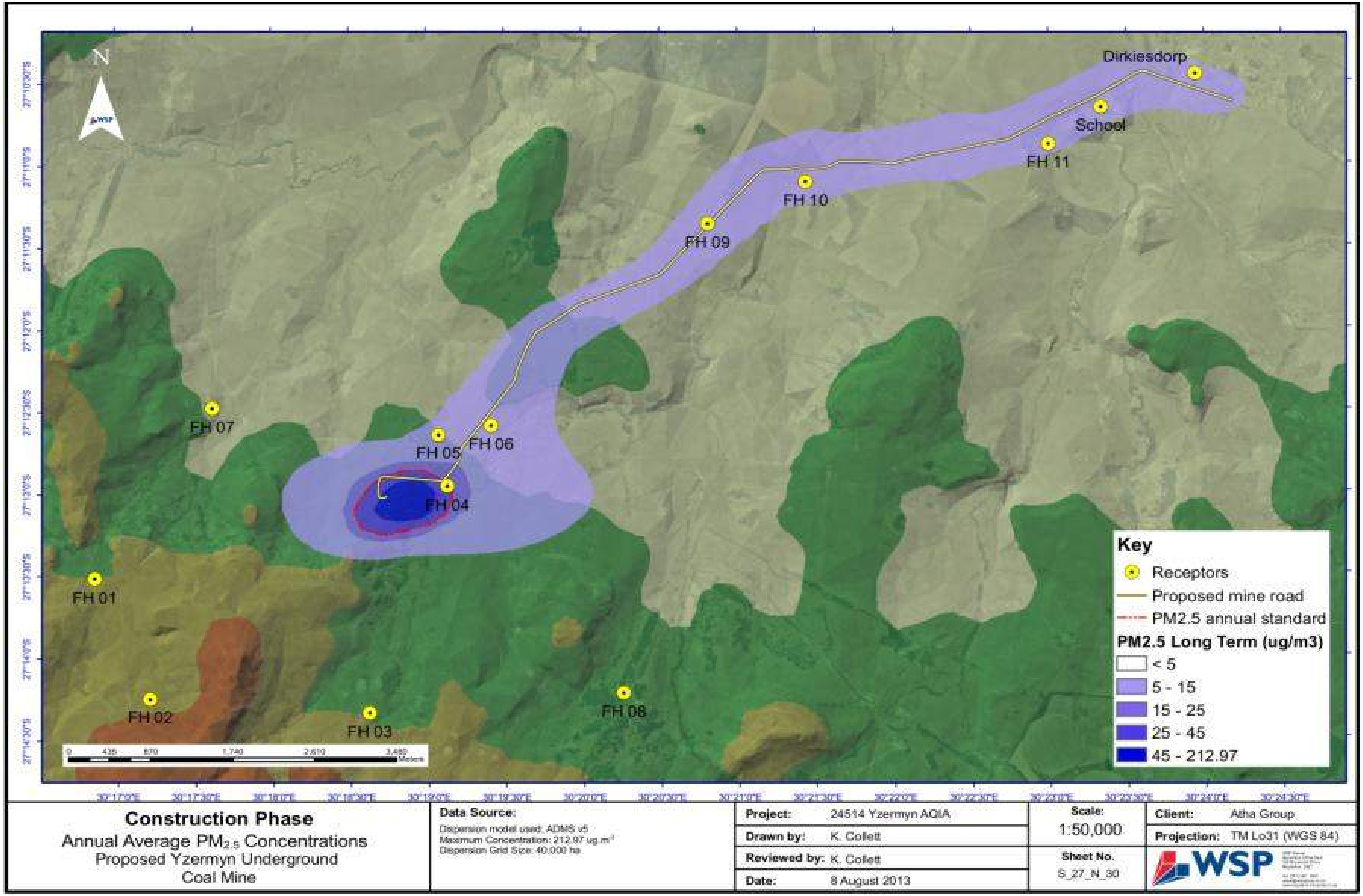

Figure 8-4: Predicted Annual Average $PM_{2.5}$ concentrations associated with the Construction Phase

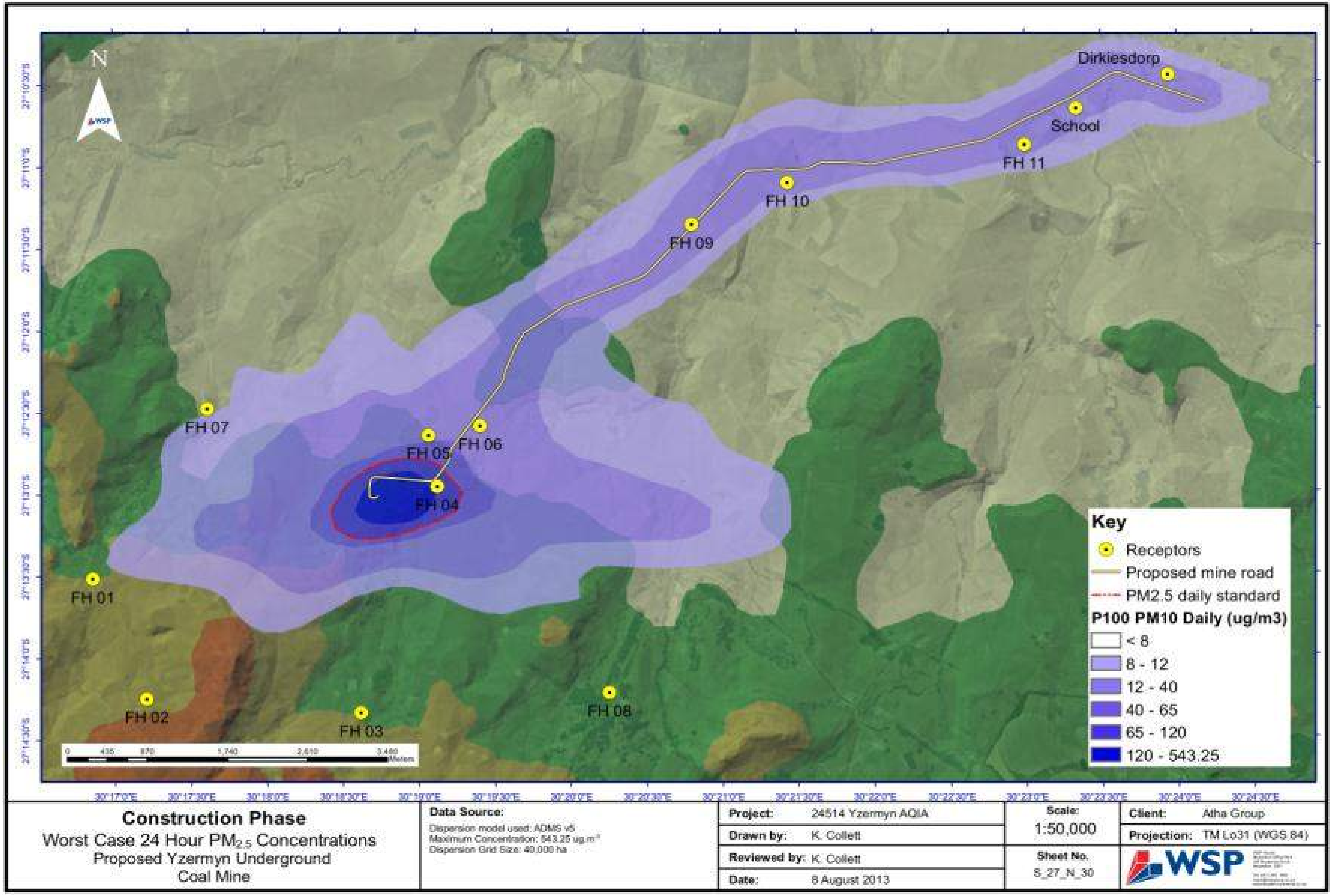

Figure 8-5: Predicted Worst Case 24 hour $PM_{2.5}$ concentrations associated with the Construction Phase

8.3.4.2 Operational Phase

During the first three years of operation the main source of particulates is from vehicular activity on the unpaved mine access road, whilst after three years (when the road is paved) the main sources include:

- Conveyor drop operations;
- Crushing and screening;
- Front end loader;
- Bulldozing;
- Coal loading;
- Truck unloading;
- Grading;
- Wind erosion;
- Unpaved roads;
- Vehicle emissions;
- Underground ventilation system; and
- Diesel storage tanks.

These are included in the chart below (**Figure 8-6**).

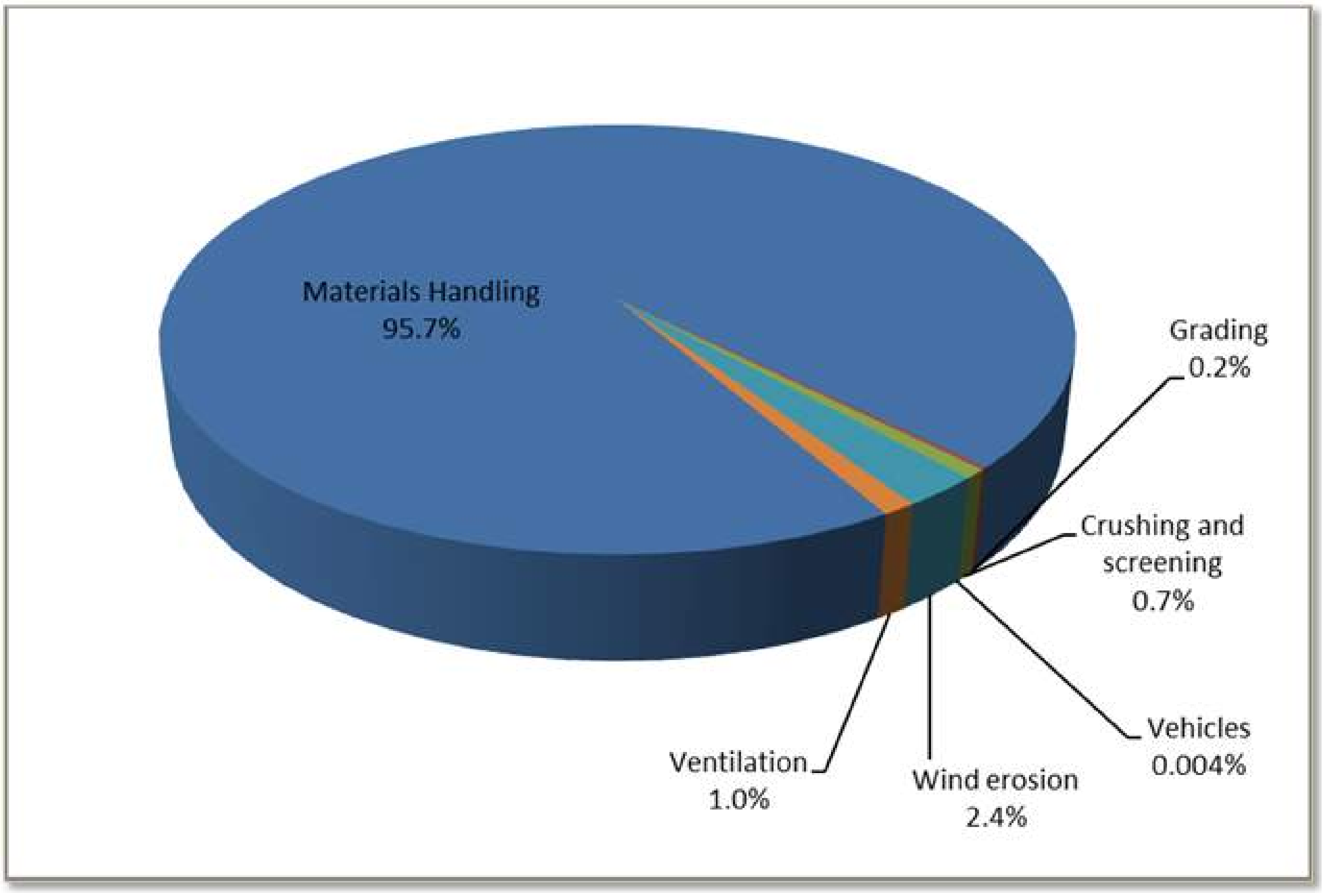

Figure 8-6: Source Pollutants during the Operational Phase

PM_{10} Concentrations

Predicted long term PM_{10} concentrations during the first three years of operation are significantly elevated if no mitigation is applied, with concentrations exceeding the annual standard at nine of the 13 receptor points. All of these receptors are in close proximity to the unpaved mine access road, that generates high dust levels as a result of the high vehicle numbers travelling on the road on a daily basis. Exceedences of the 24 hour standard are predicted at all receptors, except FH 02, with the highest number of exceedences predicted at receptors in close proximity to the mine access road. Similarly, predicted long term $PM_{2.5}$ concentrations during the first three years of operation are high with exceedences of the annual standard (25 µg/m³) being predicted at five of the 13 receptors. Worst case daily concentrations at these receptors also indicate non-compliance with the 24 hour standard. Highest concentrations are evident in the direct vicinity of the mine access road, with exceedences of the annual average standard predicted up to 400 m from the road and exceedences of the daily standard up to 600 m from the road. Refer to **Figure 8-7** and **Figure 8-8**.

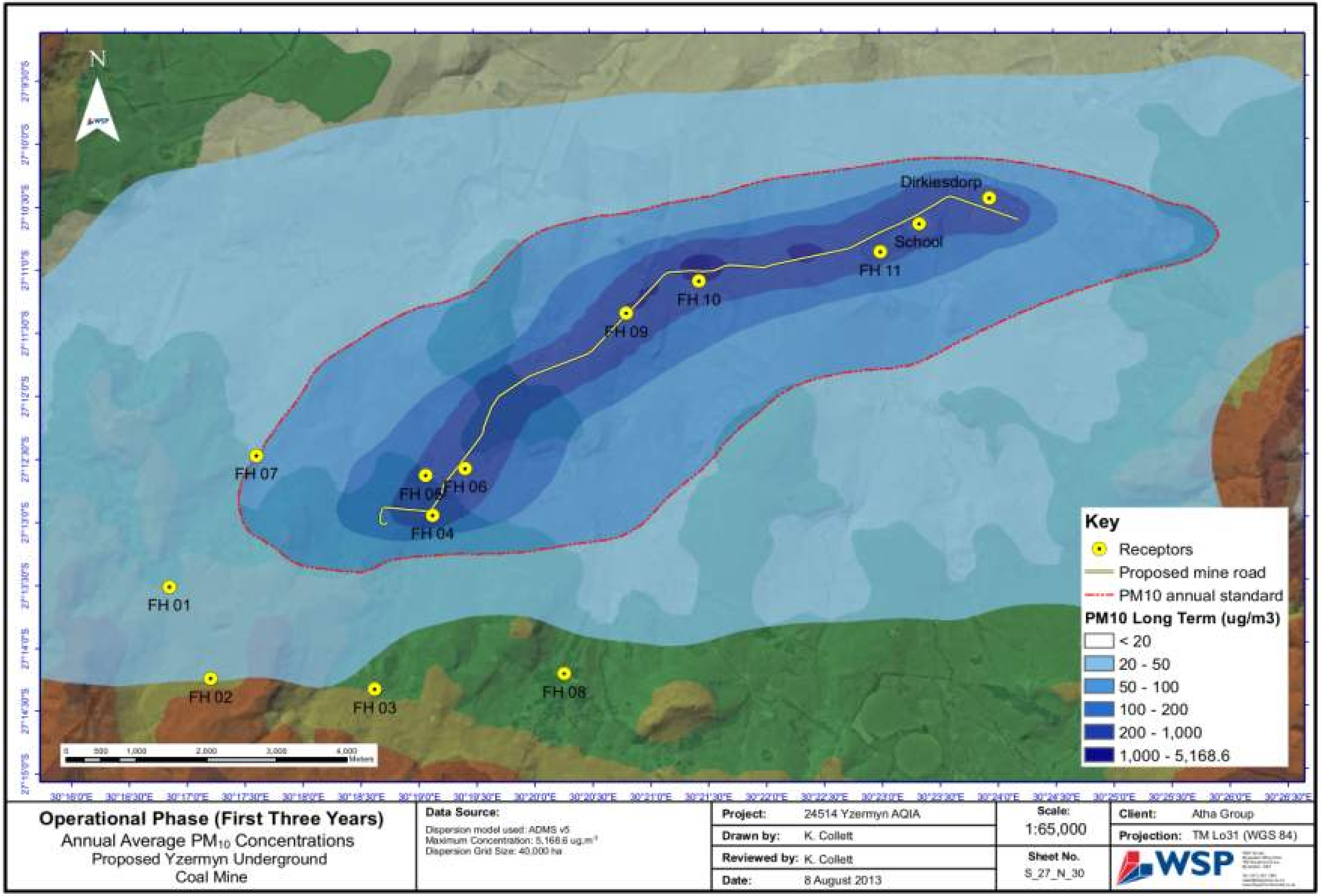

Figure 8-7: Predicted Annual Average PM_{10} Concentrations associated with the First Three Years of Operation

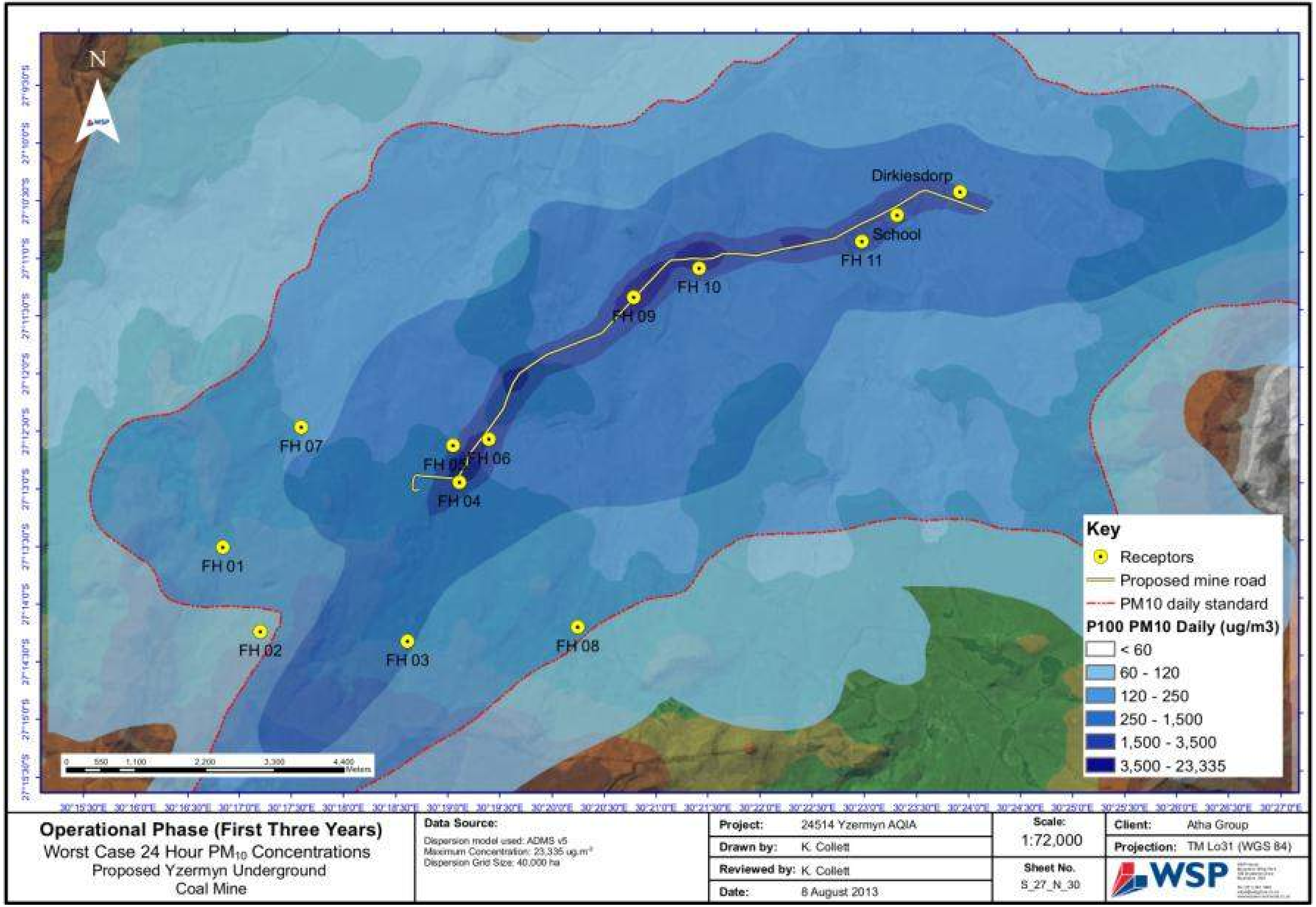

Figure 8-8: Predicted Worst Case 24 hour PM_{10} Concentrations associated with the First Three Years of Operation

After three years of operation, the mine access road will be paved and an increase in vehicle numbers is envisaged. Predicted long term PM_{10} concentrations at this time are low and are compliant with the annual standard at all receptors except at the farm house receptor, FH 04. This receptor is in closest proximity to the mine and is impacted by emissions from the handling of materials in the form of bulldozers, conveyors and tips. Exceedences of the daily PM_{10} standard are predicted in the direct vicinity of the mining operations, impacting on three receptors that are in closest proximity to the mine. Refer to **Figure 8-9** and **Figure 8-10** for the predicted model following the first three years of operation when the road has been paved.

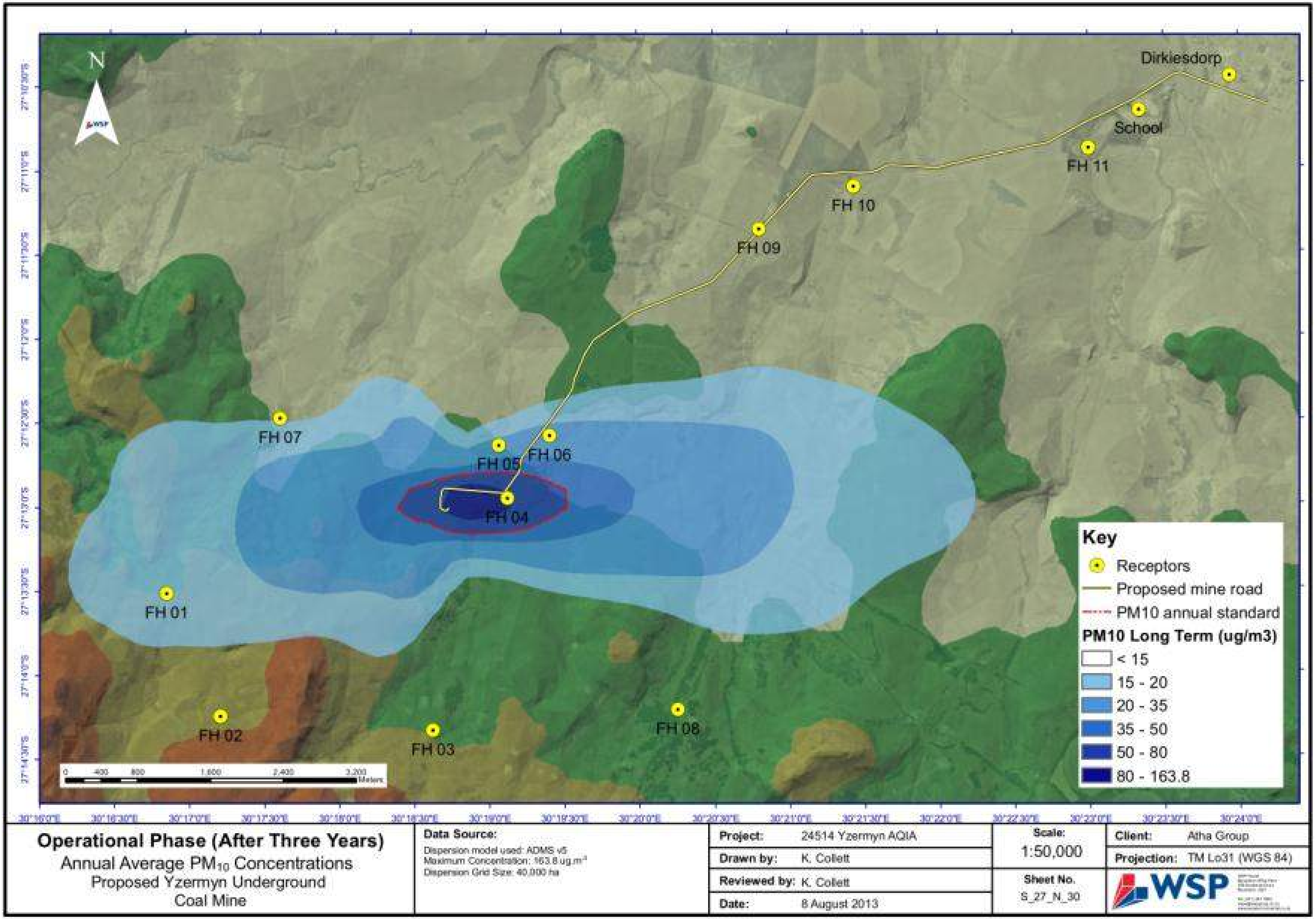

Figure 8-9: Predicted Annual Average PM_{10} Concentrations associated after Three Years of Operation

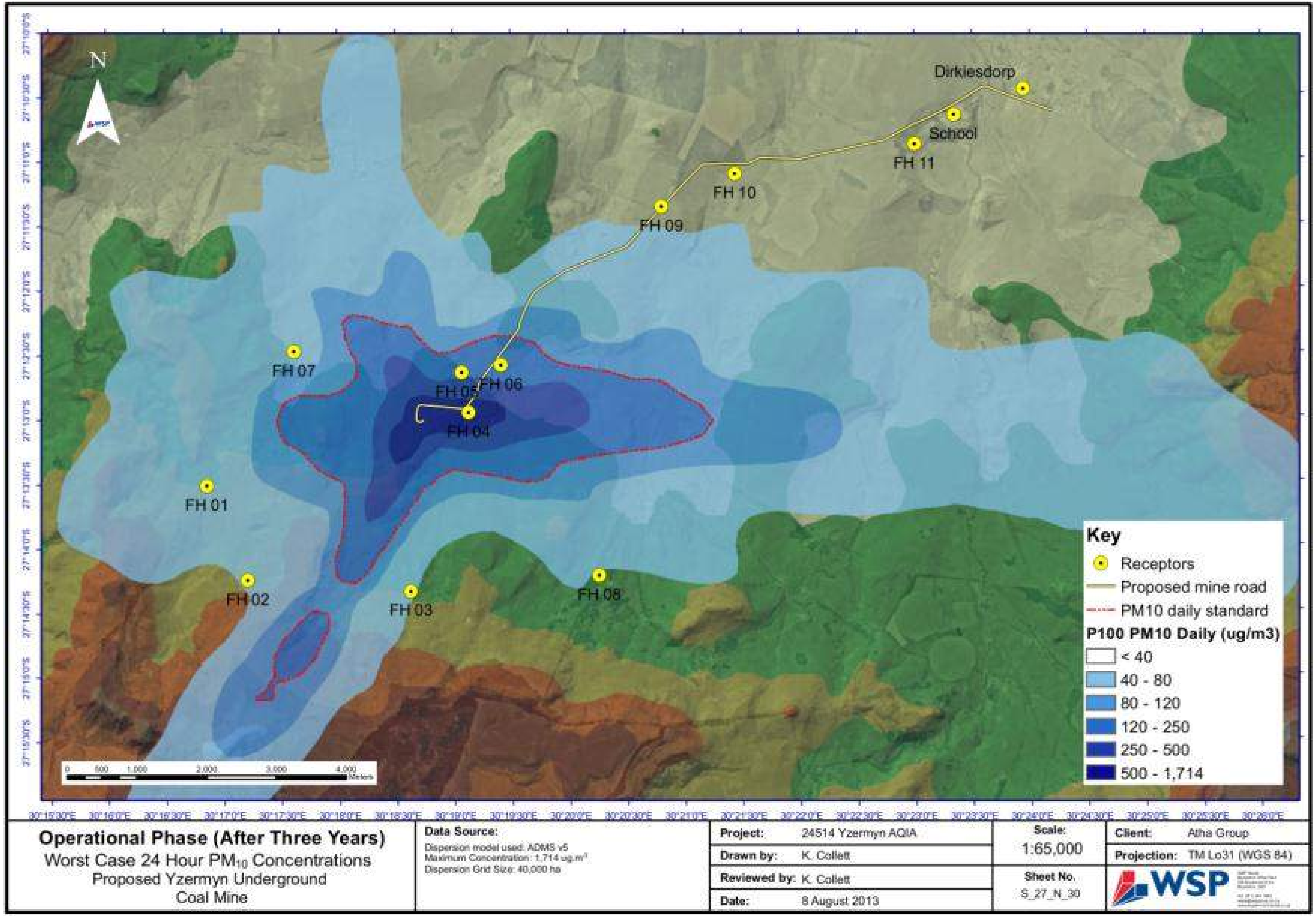

Figure 8-10: Predicted Worst Case 24 hour PM_{10} Concentrations after Three Years of Operation

$PM_{2.5}$ Concentrations

Predicted long term $PM_{2.5}$ concentrations are low, with no exceedences of the annual standard at any of the receptor points. Only one exceedence of the daily standard is predicted at receptor FH 04. Daily $PM_{2.5}$ exceedences are predicted around the direct vicinity of the mine where the loading of material from the export and middlings stockpiles occur. No offsite exceedences are predicted. **Figure 8-11** illustrates the worst case scenario pertaining to $PM_{2.5}$ exceedences after three years of operation.

Predicted annual average dust fallout rates after three years of operation are compliant with the SANS Residential Guideline at all receptors. Although compliance at receptors is noted, dust fallout rates within the mine boundary itself will be significantly elevated and mitigation measures are recommended.

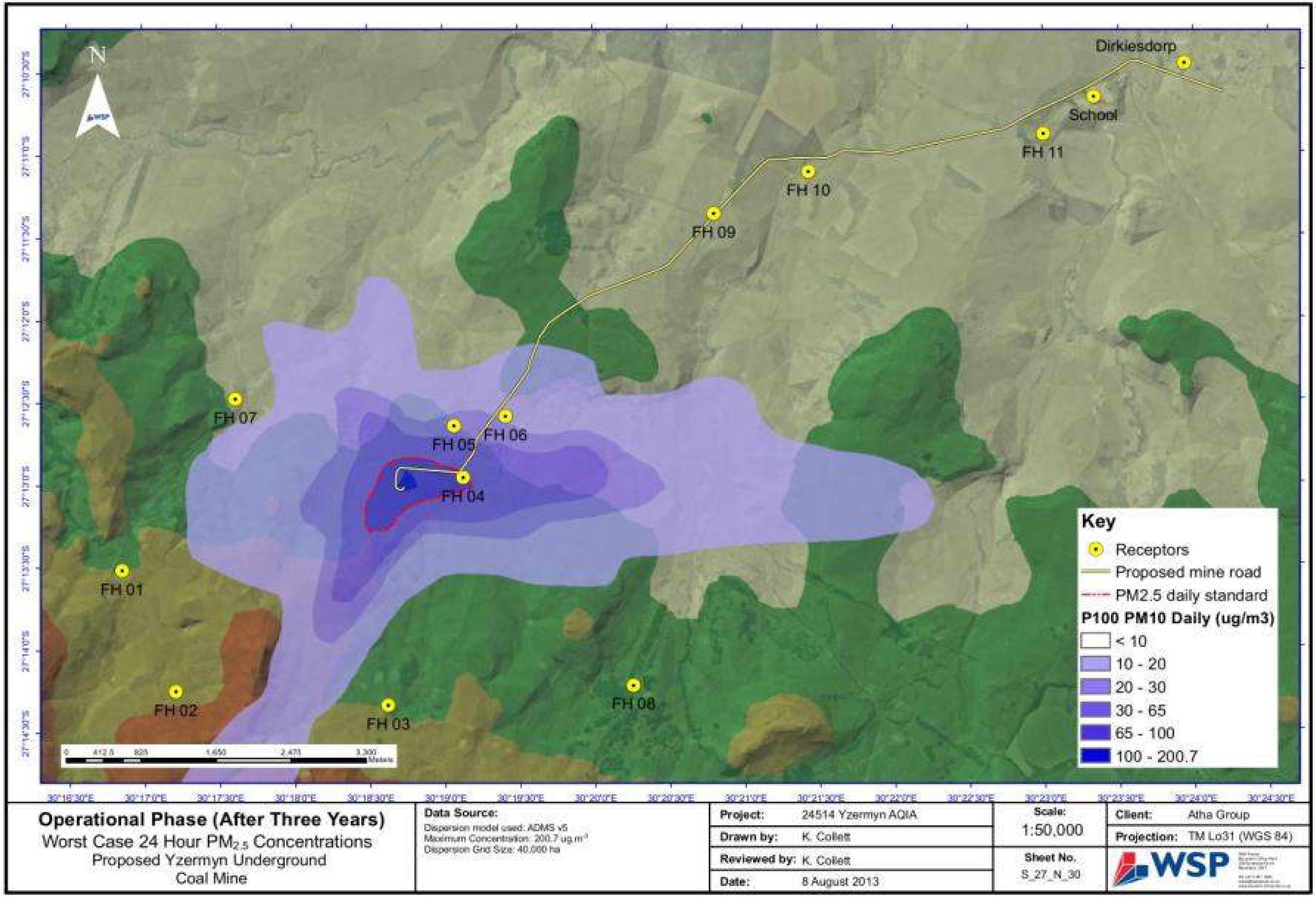

Figure 8-11: Predicted Worst Case 24 hour $PM_{2.5}$ Concentrations after Three Years of Operation

SO_2, NO_2, CO and VOC Concentrations

SO_2, NO_2, CO and VOC emissions from vehicles travelling on the mine access road during both the first three years of operation and after three years of operation are low, indicating compliance with the NEMAQA annual standards at all receptors. The contribution from activities during the first three years and after three years is minimal, contributing between 0.01 to 1.33 µg/m³ and 0.01 to 2.66 µg/m³ to NO_x emissions at receptors respectively. SO_2 emissions from activities at the mine are not predicted to result in any detectable increase at receptor locations. From this it is evident that emissions of CO, NO_x, SO_2 and VOCs from vehicles travelling on the mine access road during the operational phase will not negatively impact on the surrounding environment.

8.4 Noise

The noise impact assessment was undertaken independently by WSP: Air Quality. The summary of the reports is included below and the detailed assessment report in included in **Appendix C: Noise Impact Assessment.**

8.4.1 Methodology

The assessment comprised onsite environmental noise monitoring in order to obtain a baseline / existing noise climate for the region as well as acoustic modelling to determine the predicted impacts that the proposed mine will have on the existing noise climate. An inventory of all noise sources during the construction and operational phases was compiled with associated sound power levels for each source. These sources were then input into the Computer Aided Noise Abatement (CadnaA) acoustic model. Results were compared with the monitored (existing) noise levels as well as the SANS day and night-time guidelines to assess compliance.

8.4.2 Assumptions and Limitations

In this environmental noise impact assessment, various assumptions were made that may impact on the results obtained. These assumptions include:

- The proposed noise source locations as identified in the site layout prepared by Mindset are assumed to be representative of reality;
- The location of the generators, pollution control dam water pumps and dewatering pump were assumed based on best guess estimates from the mine plan;
- All proposed noise sources for the proposed Yzermyn Underground Coal Mine have been included in this assessment;
- Activities will operate 20 hours a day during construction phase;
- Construction will last for six months;
- Roads will be graded twice a month during construction phase;
- Activities will operate 24 hours a day during operational phase;
- Trucks will transport the discard from the discard bin to the discard dump;
- During the first three years of operation, roads will be graded twice a month;
- No underground noise sources were included as this is an environmental noise assessment and not an occupational noise assessment. In addition, with the 107 m depth of the proposed mine together with the logarithmic nature of noise, additional noise from underground sources is assumed to be minimal;
- The number of vehicles operating on the mine access road during the construction phase was assumed;
- The number of vehicles operating on the mine access road during the operational phase, calculated from the personnel numbers depicted in the MWP, are assumed to be representative of reality;
- A generic height of 3 m was used for general buildings in the model; and
- A height of 3.5 m for the CHPP was utilised in the model.

A limitation in the study was the lack of site specific metrological data, where only UM model data was obtainable and subsequently utilised in the acoustic model.

8.4.3 Findings of the Study

From the onsite monitoring, it was identified that the region has a characteristic daytime noise level of 26.9 dBA and a night-time noise level of 25.7 dBA, which are both compliant with the SANS rural guidelines. The region is characterised as rural, with the dominant land use being natural bush and grazing land. Existing noise sources at the proposed site include insects, livestock, wind and the odd passing vehicle.

From the acoustic modelling, predicted daytime and night-time noise levels during the construction phase are elevated at receivers in close proximity to the construction activities, whilst receivers that are further away experience much lower noise levels. The highest noise levels are predicted at FH 04, a homestead that is in closest proximity to the mine. When the predicted noise levels are added (logarithmically) to the existing baseline daytime or night-time noise levels, cumulative noise levels at all receivers (except FH 04, FH 05 and FH 06) are compliant with the SANS day and night-time guidelines. Owing to the close proximity of these homesteads (FH 04, FH 05 and FH 06) to the main construction activities, such elevated noise levels would be expected. At night, noise levels at receivers in close proximity to construction activities decrease by an average of 3 dBA, whilst those receivers further away decrease by an average of 7.5 dBA. These decreases are a result of fewer construction hours at night; absence of grading and blasting activities at night and fewer vehicles frequenting the site at night.

8.4.4 Impacts Identified during the Study

8.4.4.1 Construction Phase

During the construction phase the highest noise levels are associated with general construction activities, which include land clearing, earthworks, grading, bulldozing and unloading of material. Since blasting events at the boxcut/ high-wall are not continuous and will only occur once per day, impacts from this source are low. Noise levels emanating from the mine access road that runs from Dirkiesdorp to the mine are minimal as all construction vehicles will only use the access road twice during the construction phase (once on entry to the site and once on exit) and grader activity on the road will only occur twice a month. Noise from general traffic on the mine access road will slightly increase the noise levels experienced at FH 09 and the town of Dirkiesdorp, although these levels are still in compliance with the SANS guidelines. This is illustrated in **Figure 8-12** and **Figure 8-13**.

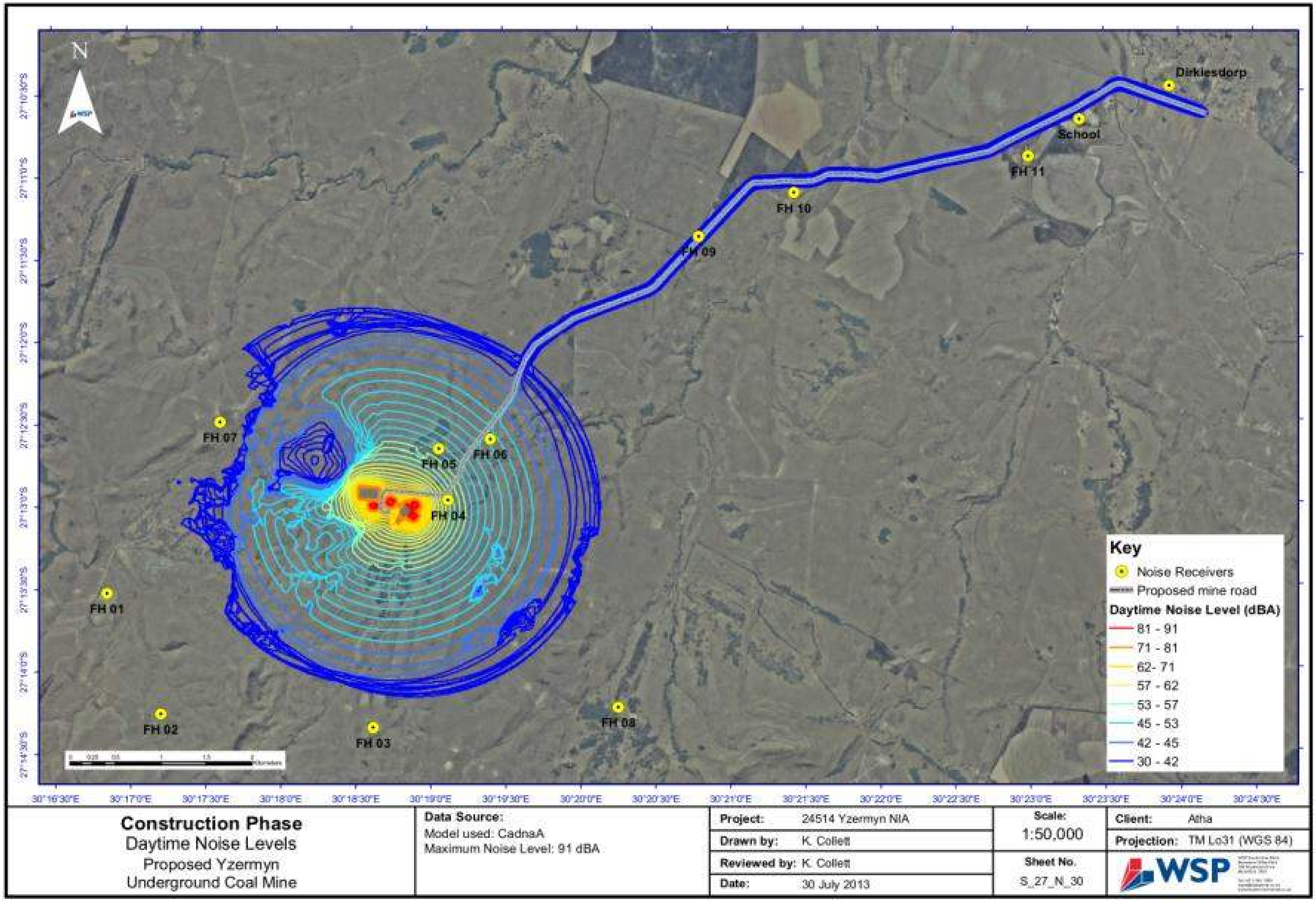

Figure 8-12: Predicted daytime noise levels during Construction Phase

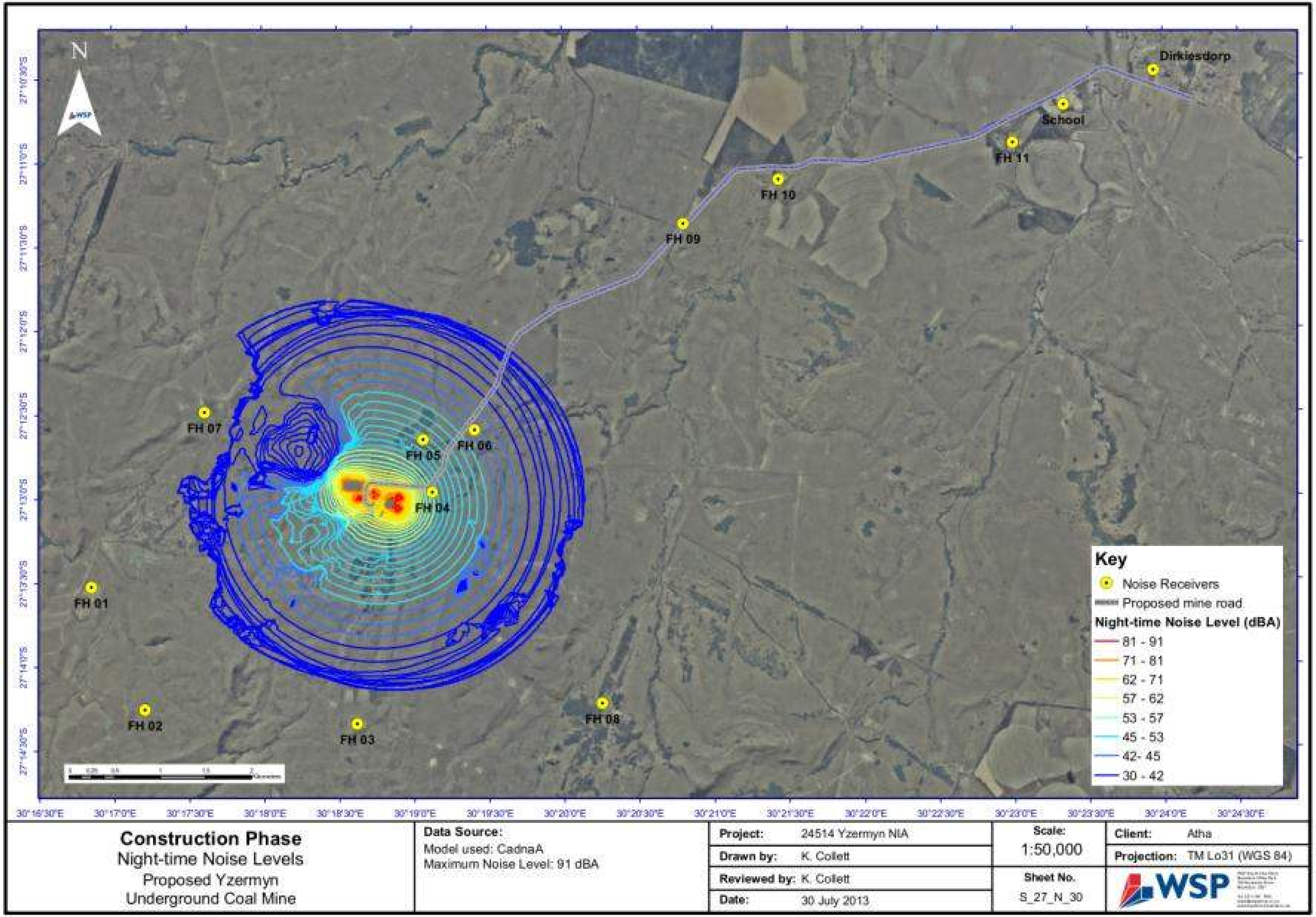

Figure 8-13: Predicted night-time noise levels during Construction Phase

8.4.4.2 Operational Phase

During both operational phases dominant noise sources include conveyor belts; loading activities at the export and middlings stockpiles; the pollution control dam water pumps; and the dewatering pump located outside the adit. Noise associated with the mine access road from Dirkiesdorp impacts far more greatly on the adjacent receivers (FH 09, FH 10, FH 11, School and Dirkiesdorp) than noise during the construction phase. This is a result of increased traffic flow on the roads. Such noise levels increase substantially after the first three years of operation as a result of increased traffic flow.

Predicted noise levels at most receivers during the first three years of operation are higher than those noise levels predicted during the construction phase. The highest noise levels are predicted at FH 04. Cumulative noise levels at receivers are compliant with the respective SANS daytime guidelines except at FH 04, FH 05, FH06 and FH09. Night-time noise levels are identical to daytime levels as a result of 24 hour operations at the mine. Due to the stricter SANS night-time guideline, cumulative night-time noise levels exceed the guidelines at seven of the ten receivers. These non-compliant receivers are located in close proximity to the mine itself or along the access road from the town of Dirkiesdorp. Refer to **Figure 8-14**.

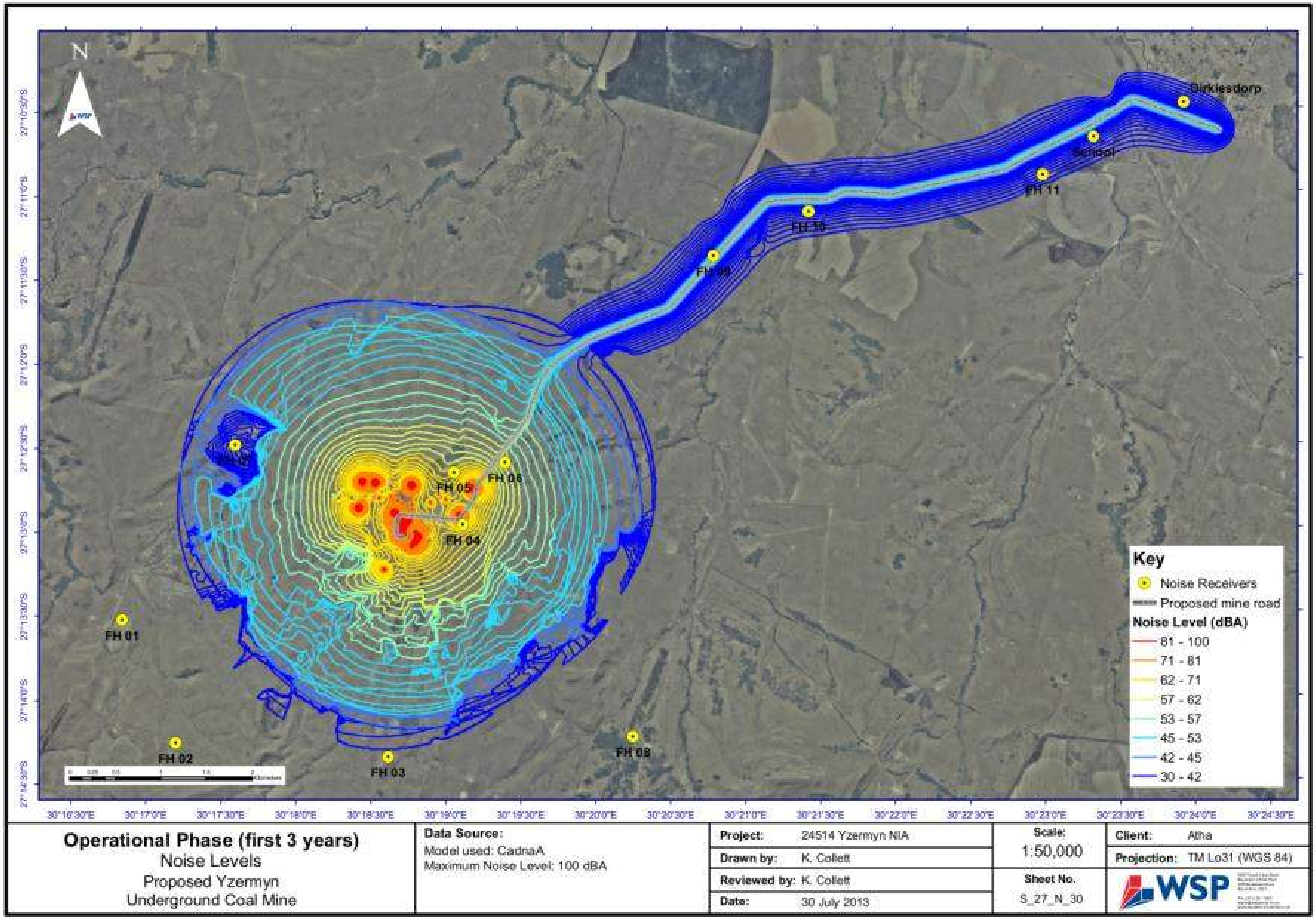

Figure 8-14: Predicted noise levels during the First Three Years of Operation

Predicted noise levels after the first three years of operation remain similar in the direct vicinity of the mine as no processes will have changed. With an increase in vehicular activity along the mine access road after three years, noise levels at the receivers adjacent to the road are predicted to increase substantially with noise levels exceeding the SANS daytime guideline at FH 09 and the SANS night-time guideline at FH 09, FH 10, FH 11, School and Dirkiesdorp. This is illustrated in **Figure 8-15**.

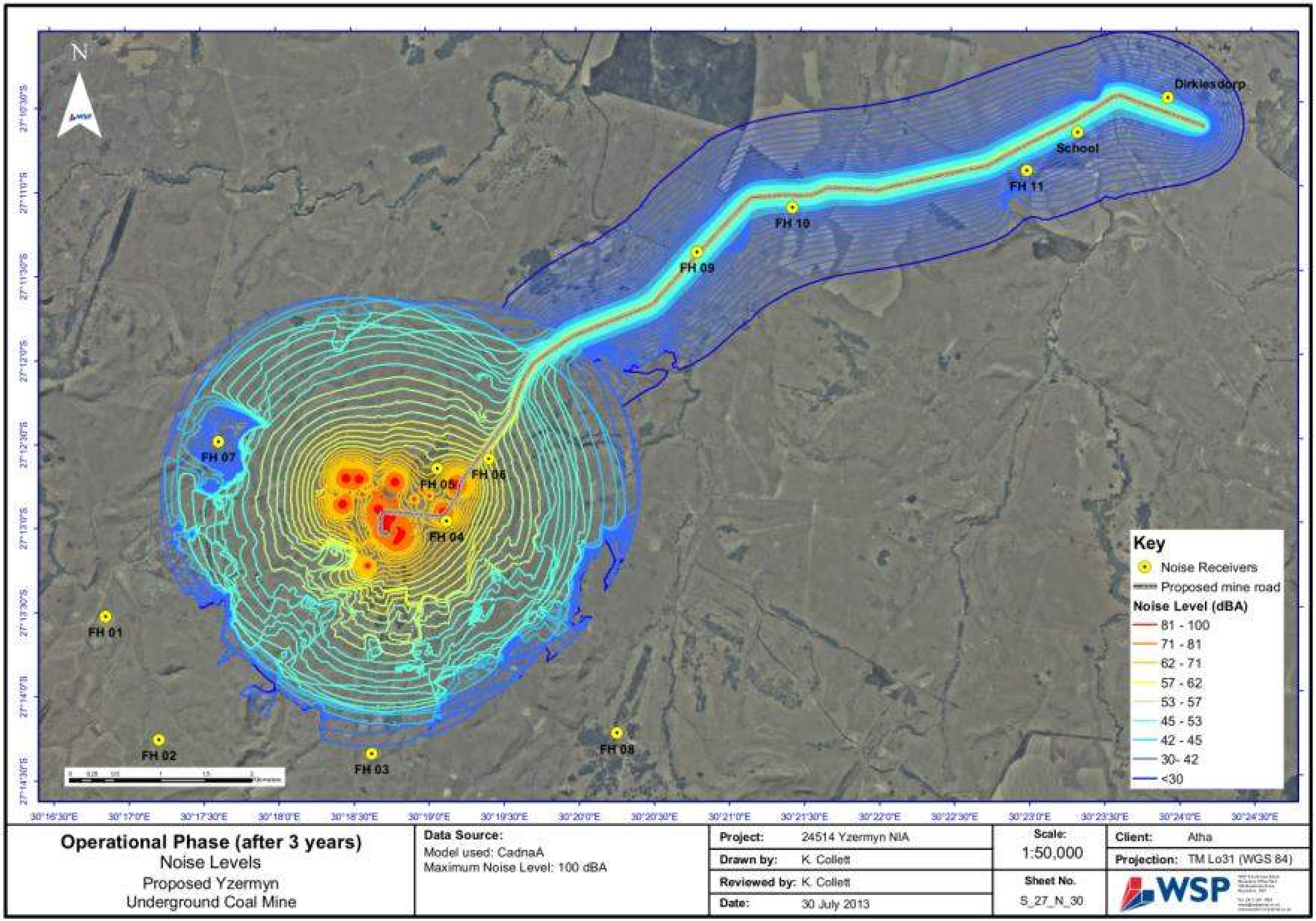

Figure 8-15: Predicted noise levels after the First Three Years of Operation

8.5 Soils, Land Use and Land Capability

The soils, land use and land capability assessment was undertaken independently by WSP: Land Restoration and Ground Engineering. The summary of the reports is included below and the detailed assessment report in included in **Appendix C: Soils, Land Use and Land Capability Assessment.**

8.5.1 Methodology

The following was undertaken as part of the soils, land use and land capability assessment:

- Desktop review
- Site assessment, focusing on the following:
  - Topography;
  - Vegetation type and health;
  - Soil properties (investigation through soil samples to the depth of 1 m);
  - Soil classification;
  - Land capability factors (including vegetation type, topography, topsoil texture, depth, permeability class); and
  - Land use.
- Impact assessment.

8.5.2 Assumptions and Limitations

The desktop study is reliant on various published data sources (aerial imagery, mapping and previous reporting) which have been assumed to be accurate. The groundtruthed information is valid only for the mine area specified in the development plan, and cannot be considered applicable to the wider prospecting area.

8.5.3 Findings of the Study

8.5.3.1 Land Use

The site walkover identified the current land use within the proposed surface infrastructure area as being grassland used for cattle grazing. Isolated thicket comprising predominantly black wattle is located to the north-east of the footprint. Formalised fencing is in place to demarcate the grazing areas. An informal unpaved farm road passes through the eastern extremity of the site, with an unnamed unpaved district road making up the north boundary of the surface infrastructure area. A rural homestead is located at the eastern boundary, comprising ten structures, with limited subsistence cropping. Rock outcrops are located on the western and southern boundaries of the proposed mine area.

8.5.3.2 Soil

Due to the uniformity in topographical units, vegetation type and slope the soils within the proposed surface infrastructure area, the impact area are not expected to vary significantly. As a result, only five sampling locations were explored. Soils logs and the location of the soil sampling locations are included in **Appendix C: Soils, Land Use and Land Capability**. The soil properties within the surface infrastructure area can be broadly be described as follows:

- The topsoil extends to a depth of between 0.2 m to 0.3 m below ground level (bgl) and is characterised by light brown, loose, fine to medium grained sands. Grass roots were predominantly within this portion of the profile;
- The subsoil is characterised by yellow-brown, loose fine to medium grained sands, extending to a depth of 0.5 m to 1.0 m; and
- Practical refusal was encountered on light grey to pink and orange, medium to coarse grained sandstone (Vryheid Formation) at depths ranging from 0.5 m to 1.0 m.

Based on the South African Soil Taxonomic System, the soils are classified as the Clovelly Soil Form. The soils are expected to be of the Twyfelaar Soil Family, given the high rainfall (MAP greater than 850 mm) and sandy nature of the soils, expected to lead to non-luvic and dystrophic soil properties (i.e. leached soils which are low in clays). The observed soils differ from the land-type mapping, which indicated that sandy clays and clays are expected. This may be due to localised variability in the soil properties that is not included in the more generalised land-type maps.

It is notable that at the north-western and south-easterly extremities of the proposed surface infrastructure area, saturated soil conditions were noted in the upper profile, evident of hillseep wetland conditions.

8.5.3.3 Land Capability

Based on the methodology for Soil Potential and Land Capability determination outlined by Manson *et al.* (1995), with information obtained from both the desktop study and site walkover, the various inputs to the Land Capability determination can be summarised as follows:

- Vegetation Type: Wakkerstroom Montane Grassveld;
- Topography: An average of approximately 9.6% based on 1:50 000 topographical mapping;
- Topsoil Texture: 0% to15% clay, based on in-field estimation methods;
- Depth: Between 0.5 and 1.0 m total thickness; and,
- Permeability Class: The permeability is rapid (i.e. between 1 and 3 seconds), hence Class 6 permeability.

Based on these characteristics, the Land Class of the majority of the site is defined as Class IV. This represents a lower land capability as measured during the desktop study (Class III). Land with this classification is expected to have severe permanent limitations or hazards and is suitable for occasional row-cropping in long ley rotations (i.e. once every 4 – 6 years), with complex and intensive protection measures and practices required during cultivation (Manson *et al*; 1995). The following notable exceptions to this Land Class were encountered:

- Due to the wetland conditions noted within the north-western and south-easterly extremities of the site, the land class is downgraded to Class Vb in these specific areas. Areas with this land class are best left under permanent vegetation, according to Manson *et al*; (1995).
- A rocky outcrop present at the head to the wetland located to the northwest of the site, was noted, hence the land class is downgraded to Class VI in this specific area. Areas with this land class do not promote cultivation.

Given these limitations, the agricultural land use is best suited to grazing. Based on the desktop study, the grazing capacity of the area associated with the surface infrastructure is considered ‘to be of good quality’ on a regional scale.

8.5.4 Impacts Identified during the Study

8.5.4.1 Summary

Through the development of the proposed Yzermyn Underground Coal Mine, there are expected to be impacts to the land capability (including the use for grazing) limited to surface infrastructure development. In addition, there are expected to be a reduction in the soil, surface water quality due to contamination.

During the construction phase, the reduction in land capability is expected to have a medium to high environmental significance, both with and without the mitigation measures recommended being implemented. The reduction in surface water quality is expected to have a medium environmental significance; however, should mitigation measures be implemented, the environmental significance is expected to be reduced to low to medium.

During the operational phase, the reduction in land capability is expected to have a medium environmental significance; however, is expected have a low environmental significance should the mitigation measures outlined be adopted. Due to contamination arising from the site operations, there is the potential for soil, groundwater and surface water quality surface water quality, with a medium to high environmental significance expected; however, should mitigation measures be implemented, the environmental significance is expected to be reduced to low.

There is no further reduction in land capability during the decommissioning and rehabilitation phases. These impacts are expected to be low. The reduction in surface water quality during decommissioning and rehabilitation phases is expected to have a medium environmental significance; reduced to a low to medium environmental significance should mitigation measures be implemented.

8.5.4.2 Construction Phase

During the construction of the mine and associated infrastructure, there is expected to be the reworking of the soils (i.e. cut and fill, blasting, land levelling and foundation excavations) and associated vegetation removal. This is expected to occur over the extent of the proposed development area, including the mine adit, administration area and parking, plant area and stockpile area, pollution control dams, stormwater infrastructure and the co-disposal facility. The approximate extent of this impact is 0.6 km^2. This has the potential to lead to the following impacts:

- Damage or removal of vegetation cover through construction activities and vehicle and foot traffic;
- Erosion of unvegetated soils during rainfall events due to the sandy soil properties and the moderate to steep topography encountered at the site;
- Compaction of soils due to foot and vehicle traffic, leading to increased runoff;
- Loss of fertile topsoil due to poor stockpiling practices;
- Spills of hydrocarbons from heavy machinery; and,
- Additions of carbonaceous material (as well as explosive residues) to the soil, derived from fly rock during the blasting of the mine adit.

The loss of soils (including the fertile topsoil) and any contamination arising from the construction activities has the potential to reduce the land capability related to grazing. This will be further exacerbated by the promotion of weed and invader species encroachment due to soil disturbance. There is also expected to be water quality impacts to the adjacent watercourses due to contributions of runoff arising from the construction site, including an increase in turbidity due to erosion from the construction site, as well as contributions of hydrocarbons from any onsite spills.

8.5.4.3 Operational Phase

During the operation of the mine, there is expected to be the potential for the following impacts to the soils and associated land capability:

- Increased runoff from impervious areas (i.e. compacted soils, roads, hardstanding) leading to erosion of the adjacent land;
- Disturbances to the soil, leading to invader and alien species growth; and,
- Pollution of soils through spills from machinery and any stored chemicals. Impacts of stored coal and Co-Disposal Facility and associated pollution control dams in polluting the soils through acid mine drainage. This has the potential to lead to groundwater and surface water impacts.

8.5.4.4 Closure, Decommissioning and Rehabilitation

During the closure and rehabilitation of the mine and associated infrastructure, there is expected to be excavations, leading to the reworking of soils. This is expected to lead to similar impacts as during the construction phase, including a reduction in land capability and water quality of the receiving watercourses due to erosion and contamination arising from the decommissioning activities, and the promotion of weeds and invader plants due to soils and vegetation impacts. As with the construction phase, the approximate extent of this impact is 0.6 km^2.

8.6 Surface Water Assessment

The surface water assessment was undertaken independently by WSP: Land Restoration and Ground Engineering. The summary of the reports is included below and the detailed assessment report in included in **Appendix C: Surface Water Assessment.**

8.6.1 Methodology

The following was undertaken as part of the soils, land use and land capability assessment:

- Desktop Review (included in baseline environmental description);
- Baseflow measurements;
- Water balance;
- Water quantity assessment;
- Water quality sampling; and
- Impact assessment.

8.6.2 Assumptions and Limitations

The surface water assessment took cognisance of the following assumptions and limitations:

8.6.2.1 Water balance:

- Water requirements expected over a 22 day working month;
- Seepage volume into the underground workings is anticipated to be between 330 and 1,280 m^3 per day. This water will be used for mining activities (wash plant, vehicle wash bay and potable water);
- Excess water abstracted will be treated and released to the environment;
- The model is based on the assumption that seepage is related to the full extent of the mine workings (i.e. model only calculates seepage at year 15 of the mining operations). Therefore, less groundwater extraction is expected during the initial stages of the mine;
- Due to the depth of mining, the deep aquifer is not expected to contribute significant volumes to surface flows in the form of baseflow contribution;
- Rainfall data is based on the MAP for Dirkiesdorp;
- Since the evaporation rate from open water, wet coal and slimes material and moist coal and slimes material differs from the A-Pan evaporation, correction factors were utilised. It was assumed that the coal stockpiles contain moist material. Since the proportion of the co-disposal dump containing open water, wet slimes and dry slimes is unknown at this stage, typical values were assumed;
- The co-disposal discard dump is expected to act like a dam and it has been assumed that the side walls will be constructed to contain the 50-year storm event runoff;
- Co-disposal discard dump will be located on a liner to limit seepage to groundwater (small portion may still occur, equating to 575 m^3 per season). Toe seepage was calculated based on 10% seasonal rainfall within the area;
- Runoff from the surface infrastructure area was calculated based on equations detailed in **Appendix C: Surface Water Assessment**;
- Water required for the operations include:
  - 40,000 m^3 for wash plant start-up;

- 1,100 m^3 make-up water per month;
- 2,500 m^3 will be reclaimed from within the coal;
- Potable water requirement of 115 m^3 per day for all staff;
- 20 m^3 will be required for wash water at the vehicle wash bay; and
- 300 m^3 is required for dust suppression purposes.

8.6.2.2 Hydrological Quantity Assessment/ Baseline Flow

- Hydrological modelling is a representation of reality, however due to site specific environmental variations outside the control of the modelling environment; the estimation of the catchment hydrology can only be used as a conceptualisation tool.
- The modelling and impact assessment was based on the proposed development infrastructure and layout. Should this change, the modelling results and associated discussion will need to be updated.
- Due to a lack of flow gauges in the vicinity of the proposed mine development, the model was calibrated based on flow measurements made during the dry season at a single point in time. To ensure the validity of the model, additional flow measurements for calibration purposes are required, including wet season flows.
- The impacts to water quantity will be highest during the operational phase due to the proposed stormwater infrastructure and increased impervious areas; hence, the hydrological model was only run for the this phase (thereby representing a worst case scenario), with impacts for the construction and decommissioning/rehabilitation phases derived from this assessment.
- Based on the geohydrological impact assessment, it is expected that the impact associated with mine dewatering to the shallow aquifer and subsequent baseflow to water courses (i.e. impact to seep zones) will be in the immediate vicinity of the mining operations. Although impacts to the local baseflow conditions are expected to be pronounced, it has been assumed in the hydrological modelling that the impact as a result to regional baseflow conditions will be nominal. This will need to be confirmed through surface flow monitoring during the various phases of the mines operations.

8.6.2.3 Water Quality Assessment

The type and degree of water quality impacts of the proposed mine are dependent on the potential pollution sources and pollution control measures on site. Since the site is not yet operational, the contaminants of concern are based on typical contaminants expected to be generated as a result of coal mining operations.

8.6.3 Findings of the Study

8.6.3.1 Water Balance

The water balance for the wet season (October to March) and dry season (April to September), including the expected minimum and maximum mine dewatering volumes, is represented in **Figure 8-16; Figure 8-17; Figure 8-18,** and **Figure 8-19**. Based on these water balances, the following can be noted:

- It has been assumed that water for dust suppression is to be obtained from any of the three PCDs, which will be dependent on a suitable water quality. In the dry season there is expected to be insufficient water held within the PCDs; hence the additional water for dust suppression (16,938 m^3/season) will need to be obtained from the mine dewatering activities;
- Due to the dewatering volumes, there is an excess of water expected under all climatic conditions and seepage estimates. It has been assumed that this is treated at the Water Treatment Plant and released to the environment. Taking into account the dry season dust suppression requirements (i.e. 16,938 m^3/season), the excess abstracted groundwater can be summarised as follows:

- 209,314 m^3/season during the wet season and 192,375 m^3/season during the dry season under the high seepage estimate; and,
- 35,820 m^3/season during the wet season and 18,881 m^3/season during the dry season under the low seepage estimate.

- It must be noted that the mine dewatering volumes have been determined based on the maximum mine void space. As a result, during the initial mine stages where the void space is limited, it is expected that the dewatering volumes will be insufficient to supply the required start-up volume (40,000 m^3) and dust suppression volumes (300 m^3/day). This water will need to be sourced from alternative sources (e.g. borehole and/or surface water resources) and stored within clean water reservoirs.

The water balance and associated water demand requirements will need to be re-rationalised based on the final mine plan and associated groundwater modelling.

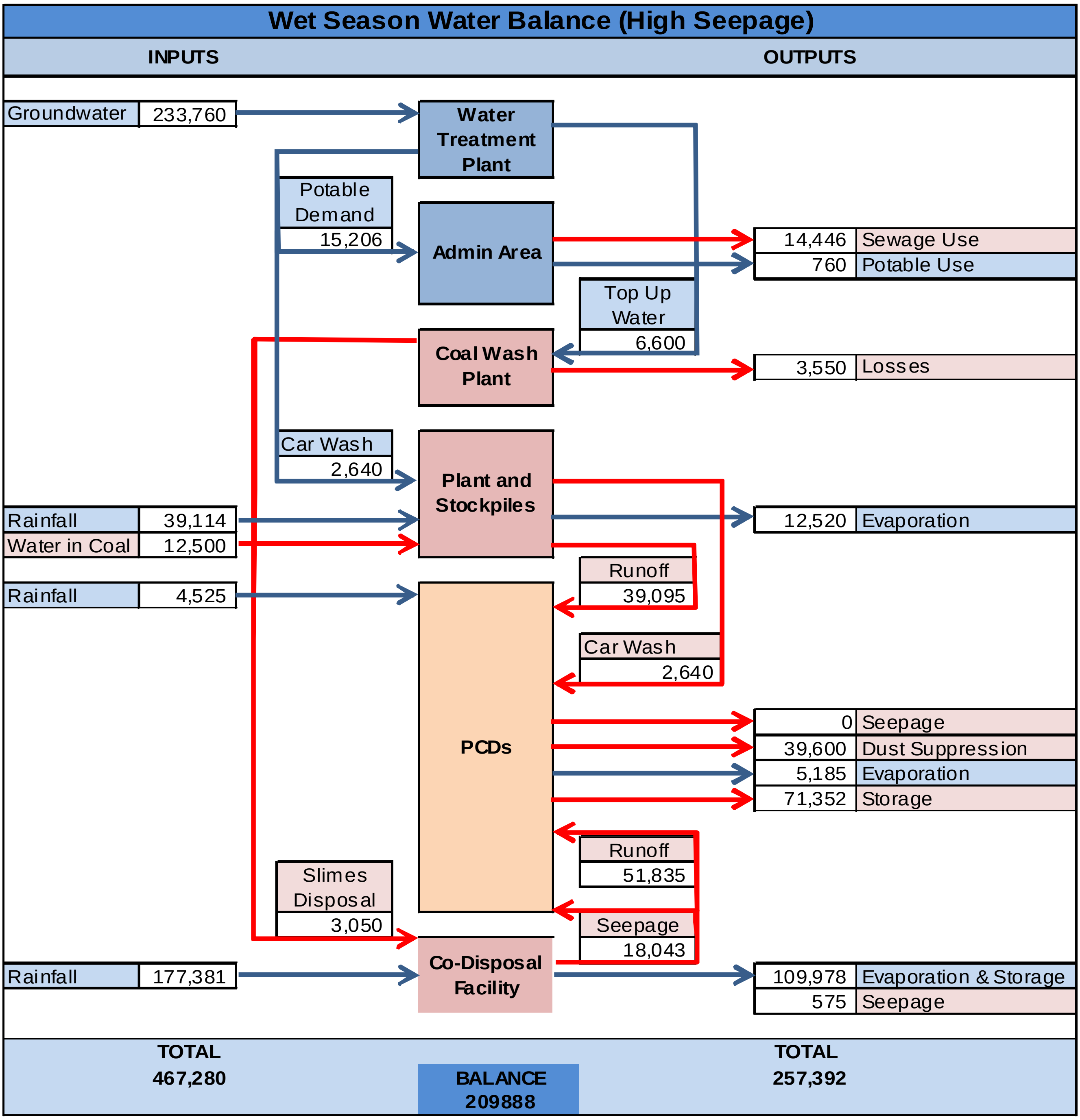

Figure 8-16: Wet Season Water Balance: High Seepage (October to March)

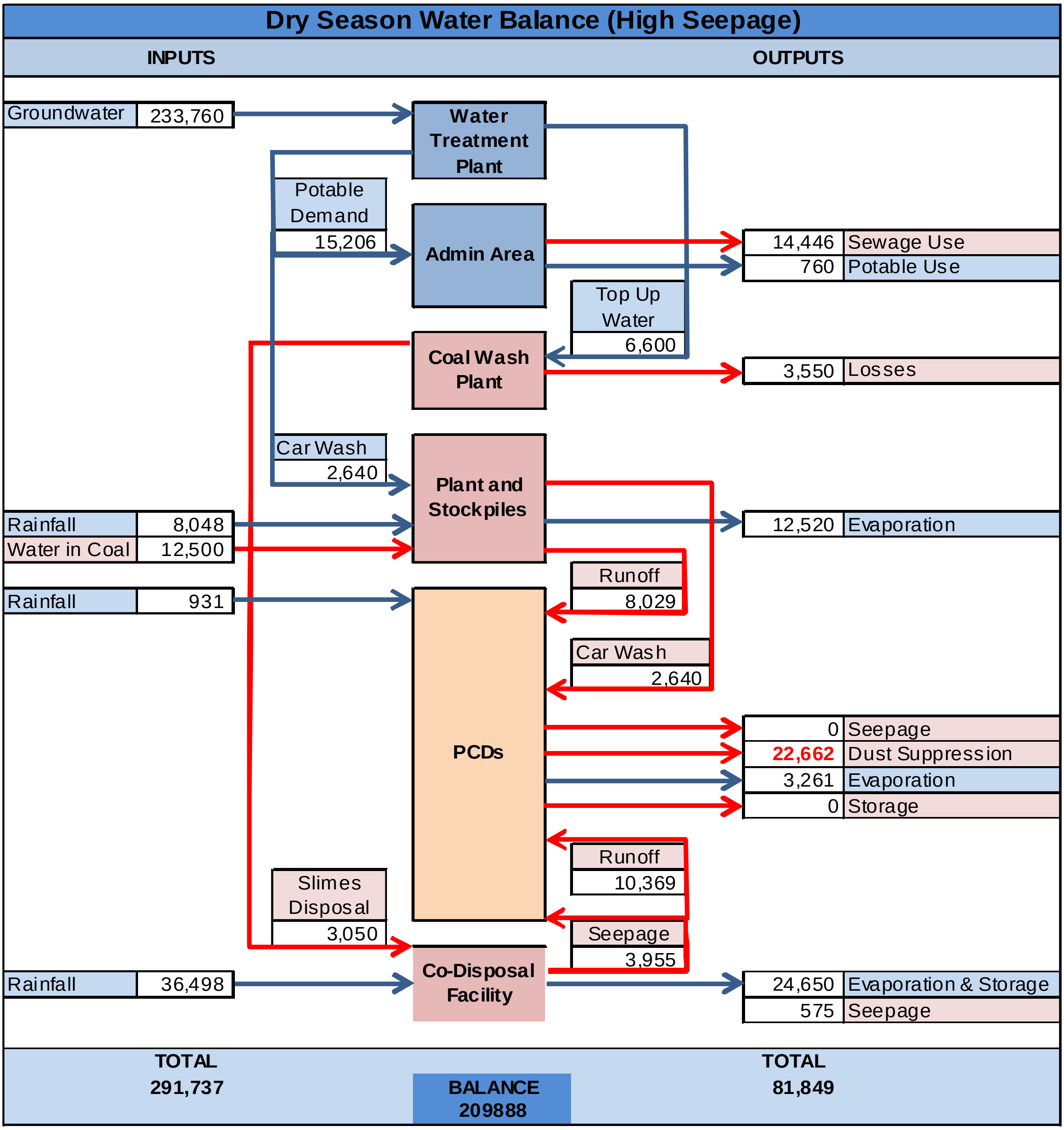

Figure 8-17: Dry Season Water Balance: High Seepage (April to September)

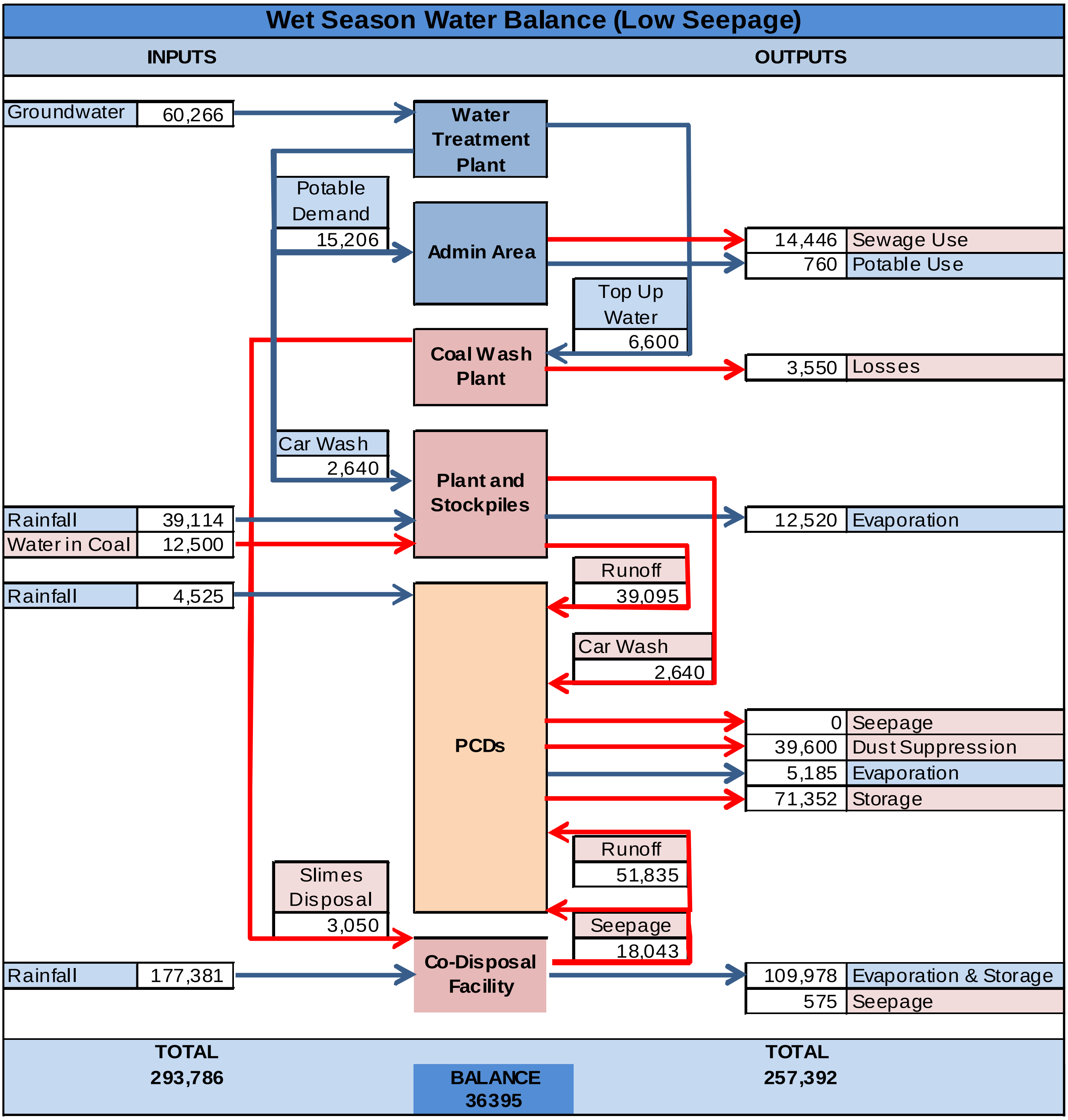

Figure 8-18: Wet Season Water Balance: Low Seepage (October to March)

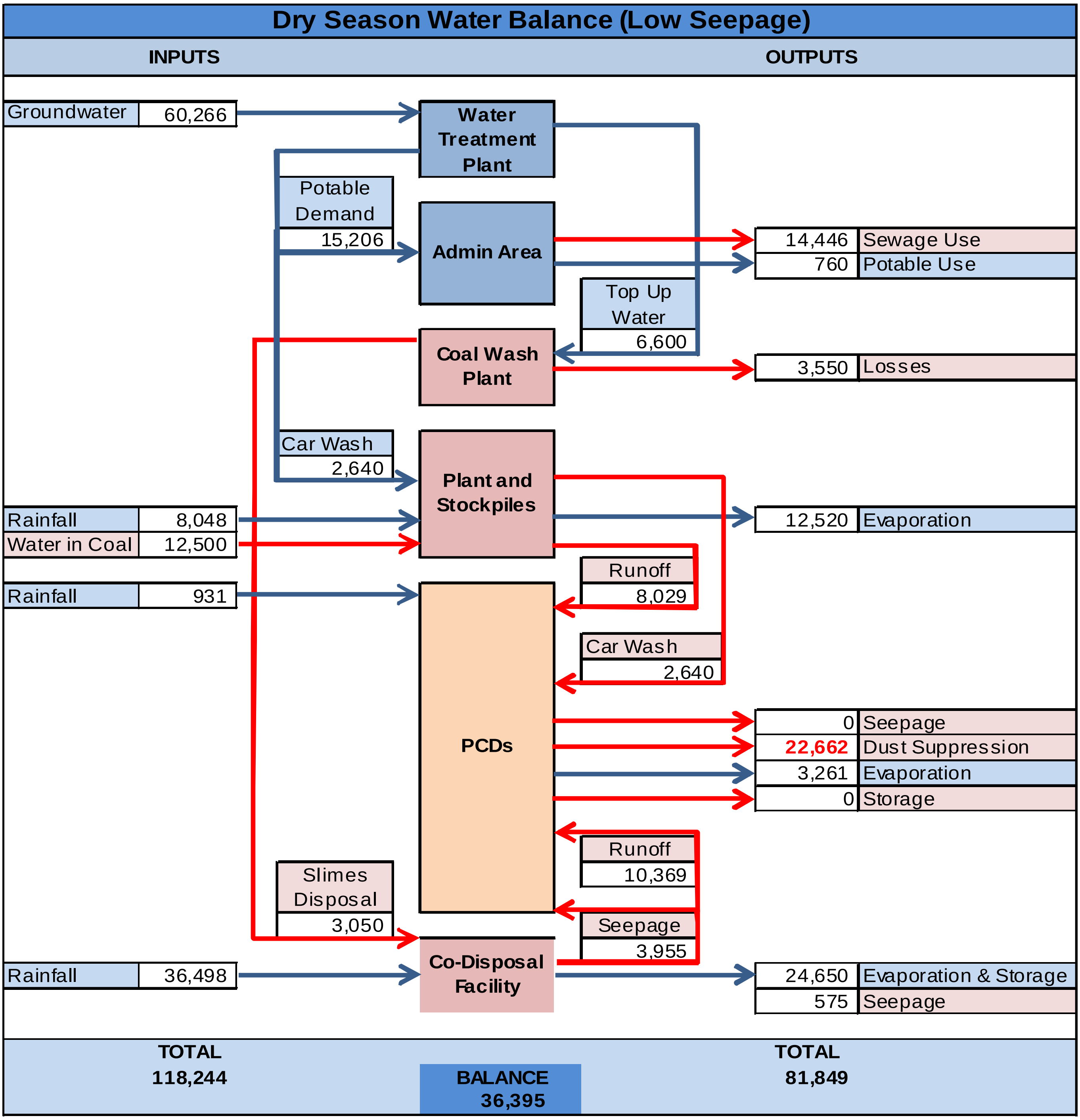

Figure 8-19: Dry Season Water Balance: Low Seepage (April to September)

8.6.3.2 Hydrological Quantity Assessment/ Baseline Flow

The hydrological modelling does do not factor in changes to baseflow contribution owing to the mine dewatering. Based on the expected zone of influence outlined in the geohydrological report, the regional impacts to flow (i.e. Assegaai River) as a result of dewatering are expected to be nominal; hence are not described further within this report.

The hydrological assessment indicated that there is expected to be impacts to both the total flows and peak flows. The total flows are generally expected to decrease (maximum decrease of 6.9% during the wet season in Catchment 19) due to the containment of dirty runoff in the PCDs. The peak flows are expected to increase during the wet season at Catchment 16 and 19, with a maximum increase of 1.6% and 0.4% respectively.

The modelling has not taken into account the contributions of the dewatering volumes outlined within the Water Balance (Section 8). There is expected to be any excess water abstracted from the mine operations that needs to be treated and discharged to watercourse. It has been assumed this water will be discharged to the closest perennial watercourse, located within Catchment 19, the following surface water impacts are therefore expected:

- Under the high seepage estimate, the contributions are expected to increase the flow at the catchment outlet in the dry, median and wet climatic conditions by a maximum of 1,779%, 99% and 34% respectively.
- Under the low seepage estimate, the contributions are expected to increase the flow at the catchment outlet in the dry, median and wet climatic conditions by a maximum of 175%, 11% and 3% respectively.

The alternative is to discharge the decant water to the Assegaai River. The impact associated with flow as a result of dewatering on the Assegaai River is expected to result in a maximum increase in flow of 5.7% during dry season flow conditions. It must be noted that this would require a pipe to convey a maximum of 13.25l/s across neighbouring properties to allow for the realisation of this option.

Due to the proximity of the development to the local watercourses, a qualitative floodline assessment was undertaken. The watercourse considered to pose the highest risk for flooding is the watercourse located 100m west (i.e. Catchment 16) of the Co-Disposal Facility. However, based on the distance to the watercourse, the associated contribution catchment area (4.25 km^2) and the vertical elevation difference between the watercourse bed and co-disposal discard dump (between 8 m and 10 m), this risk of flooding is considered to be insignificant. The increase in peak flow within this catchment due to the proposed development is 1.6%, which is expected to have an insignificant impact in increasing the flood risk. As a result, a floodline assessment is not considered necessary based on the proposed mine site layout.

With regards to the impacts of the dewatering volumes on the downstream infrastructure associated with Catchment 19, two road bridges are located across the watercourse adjacent to and at a distance of 5 km northeast of the proposed mine. In addition a farm house is located in close proximity to this watercourse 5 km northeast of the proposed mine. The increase in flow volumes as a result of dewatering to this watercourse, should this option be followed is expected to alter the flood risk to the associated infrastructure. This will need to be considered once the final discharge point has been finalised.

8.6.3.3 Water Quality

There is the potential that the co-disposal discard dump will allow seepage to the groundwater, leading to contaminated baseflow contributing to the watercourses associated with Catchment 17 and Catchment 19, both of which have a baseline sulphate concentration of <2 mg/l. Based on the groundwater report, the following is notable in relation to baseflow water quality impacts associated with the facility:

- As per the groundwater report, a volume of 27 m^3/d with a sulphate concentration of 30 mg/l is expected to report to the tributary associated with Catchment 19 at mine closure (i.e. after 15 years). After 100 years, this concentration is expected to increase to 150 mg/l. Taking into account dilution within the watercourse, the concentration within the watercourse is expected to be 9.4mg/l after 15 years increasing to 47 mg/l after 100 years;
- At Catchment 17, a volume of 17 m^3/d with a sulphate concentration of 200 mg/l is expected to discharge to the watercourse after 100 years. Taking into account dilution, the concentration within the watercourse is expected to be183.4 mg/l after 100 years. At mine closure, the concentration is expected to be insignificant; and
- Based on dilution within the Assegaai River, the maximum additional sulphate concentration within this watercourse will be 0.2 mg/l after 100 years. Given that the baseline sulphate concentration of 3.8 mg/l, this contribution is considered insignificant and the associated impact nominal.

8.6.4 Impacts Identified during the Study

8.6.4.1 Summary

The objective of the hydrological assessment was to determine the potential impacts of the proposed mine on both water quantity and quality of the receiving hydrological environment.

The following limitations to the assessment need to be noted:

- Due to a lack of flow gauges in the vicinity of the proposed mine development, the model was calibrated based on flow measurements made during the dry season at a single point in time. To ensure the validity of the model, additional flow measurements for calibration purposes are required, including wet season flows.
- Based on the geohydrological impact assessment undertaken for this project (iLEH, 2013) , it is expected that the impact associated with mine dewatering to the shallow aquifer and subsequent baseflow to water courses (i.e. impact to seep zones) will be in the immediate vicinity of the mining operations. Although impacts to the local baseflow conditions are expected to be pronounced, it has been assumed in the hydrological modelling that the impact as a result to regional baseflow conditions will be nominal. This will need to be confirmed through surface flow monitoring during the various phases of the mines operations.
- The hydrological modelling did not factor in changes to baseflow contribution owing to the mine dewatering. However, based on the expected zone of influence outlined in the geohydrological report, the regional impacts to flow (i.e. Assegaai River) as a result of dewatering on baseflow contributions to the water course are expected to be nominal; hence were not considered significant.

Based on the assessment, the following can be concluded:

- The Water Balance concluded the following:
  - Due to the dewatering volumes, there is an excess of water expected. Assuming this is treated at the Water Treatment Plant and released to the environment, the excess is expected to be 209,314 m^3/season (wet season) and 192,375 m^3/season (dry season) under the high seepage estimate. Undder the low seepage estimate, the excess is expected to be 35,820 m^3/season (wet season) and 18,881 m^3/season (dry season);
  - There is expected to be an insufficient volume of water to supply the coal wash plant start-up volume and dust suppression due to limited dewatering volumes. This water needs to be sourced from alternative sources (i.e. boreholes or surface water); and
- The proposed mine is not expected to have a significant risk of flooding. However, should the dewatering volumes be discharged to Catchment 19 as is proposed, this will increase the flood risk to downstream infrastructure.
- During the construction phase, the environmental impacts can be summarised as follows:
  - The potential impact to the watercourse ecology due to increase watercourse flow has a Low Medium environmental significance. This is reduced to Low should mitigation measures be implemented.
  - The increased potential for erosion due to the increased peak flow has a Low Medium environmental significance; reduced to Low should suitable mitigation measures be implemented.
  - There is expected to be a reduction in water quality, expected to have a Medium environmental significance, reduced to Low Medium should mitigation measures be implemented.

During the operational phase, the environmental impacts can be summarised as follows:

  - The potential impact to the watercourse ecology due to changes in flow (in particular the increase due to the discharge to Catchment 19) has a High environmental significance. This is reduced to Low Medium should mitigation measures be implemented.
  - The increased potential for erosion due to the increased peak flow has a Low Medium environmental significance; reduced to Low should suitable mitigation measures be implemented

- The operations are expected to lead to a decrease in the water quality, expected to have a High environmental significance, reduced to Medium High should suitable mitigation measures be implemented.
- During the decommissioning and closure phases, the environmental impacts can be summarised as follows:
  - The continued reduction in flows expected post-closure of the mine is expected to have a Low Medium environmental significance, both with and without mitigation measures.
  - The decrease in the water quality is expected to have a Medium environmental significance, reduced to Low Medium should mitigation measures be implemented.
- The cumulative impacts with regards to water quality and quantity are expected to be limited.

8.6.4.2 Construction Phase

During the construction of the mine and associated infrastructure, there is expected to be the reworking of the soils (i.e. cut and fill, blasting, land levelling and foundation excavations) with associated vegetation removal. This has the potential to lead to the following impacts:

- Damage or removal of vegetation cover through construction activities and vehicle and foot traffic;
- Compaction of soils due to foot and vehicle traffic, leading to increased runoff;
- Erosion of unvegetated soils and stockpiled soils during rainfall events due to the sandy soil properties and the moderate to steep topography encountered at the site;
- Spills of hydrocarbons from heavy machinery; and
- Additions of carbonaceous material (as well as explosive residues) to the soil, derived from fly rock during the blasting of the mine adit.

Water Quantity Impacts

During the construction phase there is expected to be an increase in runoff (both as peak flow and total flow) due to the loss of vegetative cover and increased impervious areas and soil compaction. The increase in total flow has the potential to influence the biota within the local watercourses. The increase in peak flow has the potential to lead to surface erosion and erosion within the receiving watercourses.

Water Quality Impacts

There is expected to be water quality impacts to the adjacent watercourses due to contributions of runoff arising from the construction site, including an increase in turbidity due to erosion from the construction site, contributions of hydrocarbons from any onsite spills, and contaminants associated with the blast rock (i.e. explosives residue and carbonaceous material).

8.6.4.3 Operational Phase

Water Quantity Impacts

It is proposed that excess seepage water removed from the mine workings will be treated at the Water Treatment Plant prior to release to Catchment 19. This is expected to increase the flow within the watercourse by as much as 1,779% (under dry climatic conditions, factoring in the high seepage rate estimate).

The hydrological assessment indicated that the total flows are generally expected to decrease by a maximum of 6.9% at Catchment 16 and 4.0% at Catchment 17 due to the containment of flows within the PCDs. The peak flows are also expected to increase during the wet season at Catchment 16 and 19 due to the influence of the storm water infrastructure (i.e. perimeter channel) proposed at the site.

The change in runoff to the Assegaai River (taking into account both the decrease of flow due to the contributions from Catchment 16 and 17, and increased contributions from Catchment 19) is expected to have a limited influence at the outlet of the W51A quaternary catchment, with a maximum increase of 3.12% under dry climatic and high seep conditions, and a maximum decrease of 0.14% under wet climatic and low seep conditions.

Based on the water quantity assessment, the following impacts are expected:

- The decrease in runoff at Catchment 16 and 17, and increase at Catchment 19 has the potential to alter the riverine ecosystems. This is considered highly likely within Catchment 19 due to the increase in flows. This is expected to be limited to the catchments adjacent to the proposed mine, with insignificant impacts to ecosystems as a result in change in flow expected on the Assegaai River.
- The increase in peak flows within the watercourses has the potential to lead to erosion impacts within the watercourses adjacent to the proposed mine. The elevated flows at Catchment 19 are expected to lead to significant geomorphological impacts within the associated watercourse. Insignificant impacts are expected on the Assegaai River.
- The increase in flow at Catchment 19 was the potential to lead to increased flood risk on infrastructure located adjacent to or traversing the water course.

Water Quality Impacts

- There is a potential for surface water impacts from the stored coal and Co-Disposal Facility and associated pollution control dams should these not be located on properly designed and monitored impermeable layers which has the potential to impact surface water through potential contaminated baseflow contribution. Based on the expected seepage from the Co-Disposal liner, this is expected to lead to water quality impacts at Catchment 17 and Catchment 19, with a concentration of 183mg/l and 47mg/l respectively;
- There is also the potential for pollution of the receiving watercourses due to spills from machinery. In addition, through the storage of mining machinery, as well as the operations of fuel store, workshops and car washes, there is the potential for an increase in petroleum hydrocarbons within the runoff; and
- Since the dirty areas are proposed to be under hardstanding, with runoff reporting to PCDs, the potential for dirty water discharge to the environment is considered low. However the watercourses have the potential to be contaminated through dust generation and settlement associated with the mine operations.

8.6.4.4 Closure, Decommissioning and Rehabilitation

During rehabilitation, it is proposed that the impervious areas are uplifted and the site is rehabilitated so that the soils and vegetation resemble baseline conditions. Due to the content of the co-disposal discard dump and PCDs, it is expected that these will be appropriately managed to limit environmental impacts; however since these measures are unknown at this stage, it has been assumed that the areas will continue to be managed as dirty areas.

Water Quantity Impacts

During the decommissioning and rehabilitation of the mine and associated infrastructure, there is expected to be a removal of impervious areas, and an increase in vegetation cover. As a result, the runoff from these areas is expected to return to the pre-mining conditions over time.

Due to the dirty nature of the co-disposal discard dump and PCDs, it has been assumed that these will continue to be managed as dirty areas, with runoff not contributing to the watercourses. This will result in a continued reduction in the contributing catchment area reporting to the local watercourses, leading to a potential impact to the local aquatic health.

Water Quality Impacts

The decommissioning phase and rehabilitation phases have the potential to lead to similar water quality impacts as during the construction phase (i.e. increased turbidity through soil exposure and spills of hydrocarbons from heavy machinery used in the decommissioning).

8.7 Geohydrological Assessment

The geohydrological impact assessment was undertaken independently by WSP: Land Restoration and Ground Engineering. The summary of the reports is included below and the detailed assessment report in included in **Appendix C: Geohydrological Assessment.**

8.7.1 Methodology

The following was undertaken in order to complete the groundwater impact assessment study for the proposed Yzermyn Underground Coal Mine.

- Desktop Geohydrological review
- Geohydrological fieldwork programme
  - Hydrocensus;
  - Borehole siting;
  - Borehole installation;
  - Pump testing;
  - Groundwater quality assessment;
  - Geohydrological modelling programme; and
  - Geohydrological impact assessment.

8.7.2 Findings of the Study

8.7.2.1 Desktop Geohydrological Review

This included a desktop assessment of the main aquifer formation in the area, including its characteristics and review of exploration drilling logs. Two aquifers are present:

- Shallow weathered aquifer 5 – 20 metres below the surface, low yielding (< 0.5 l/s), recharged by the deep aquifer and rain seepage; and
- Deep fractured rock aquifer which has variable yields (0.1 – 2 l/s) and may be a source of groundwater, where it daylights.

The flow of groundwater is to a north-easterly direction across the project area. This is expected as groundwater regionally drains towards the Assegaai, Mawandlane and Mabola Rivers.

8.7.2.2 Geohydrological Fieldwork programme

- **Hydrocensus**

Inspection of the target area and surrounding farm land to determine if there are any boreholes in the vicinity of the project area and for what purpose (i.e. domestic or agricultural). It appears that water in the project area is generally not sourced from boreholes. This was suggested by a search of the Department of Water Affairs: National Groundwater Database. No registered boreholes were found within a 30km radius of the target area. Spring/ fountain identification was also undertaken as part of this assessment. 23 fountains/ springs were identified and plotted within area in and around the target area. This is illustrated in **Figure 7-23**. The springs are used for both domestic and livestock watering purposes. Most of the springs occur high up near the sources of water courses and appear to be associated with dolerite geology.

- **Borehole Siting**

The geological model developed for the Yzermyn coal resource includes inferred faults from significant elevation differences on the coal seam. Drilling records from exploratory boreholes indicated several boreholes had encountered groundwater, generally on geological contacts. This data was used to identify five target locations for drilling of groundwater exploration/ monitoring boreholes. Shallow and deep boreholes were recommended for each borehole location to allow separate access to the shallow and deeper aquifers for the purposes of testing and sampling. Refer to **Figure 8-20** for the map illustrating the location of the boreholes.

- **Borehole Installation**

Initially, five shallow boreholes were drilled during the scoping phase of the project (60 m deep). It was noted that no groundwater was identified within any of these boreholes. Seepage of surface runoff was the only contributor of water discovered in the boreholes. In June and July 2013, 14 shallow and deep boreholes were drilled at identified locations within the target area. Shallow boreholes were drilled to a depth of ~ 60 m and deep boreholes were drilled to intersect one or both of the coal seams (~ 250 m).

Boreholes were advanced by air percussion drill with a diameter of 165 mm. Solid steel casing was installed at the top of the deeper boreholes to prevent groundwater from the shallow weathered aquifer impacting on the deeper fractured aquifer. Solid steel casing and slotted steel casing were installed in shallow boreholes to target water strikes observed in the shallow aquifer. Due to site access issues, not all of the target locations could be reached by the drill rig. Additional locations and boreholes were added to the initial programme at the request of Atha.

Table 8-1 displays a drilling summary for each borehole including final depth of borehole, depth of fractures (water strikes), estimated yields and measured groundwater level in the boreholes.

Table 8-1: Summary of Boreholes Drilled

Borehole ID	Steel Casing Solid (m)	Steel Casing Slotted (m)	Total Depth (m bgl)	Fractures (m bgl)	Water Level (m bgl)	Estimated Yield (l/s)
CBH 1	0-18	0	94	20	2.64	<0.5
CBH 2 S	0	0-24	34	24	15.16	<0.5
CBH 2 D	0-24	0	130	25, 85	15.49	3.5
CBH 3 S	0-12	12-18'	70	10, 18	1.63	2.6
CBH 3 D	0-24	0	208	10, 44, 75	44.75	<0.5
CBH 4 S	0	0-6	36	None	11.75	Seepage
CBH 4 D	0-24	0	214	29, 191	37.95	<0.5
CBH 5 S	0-24	0	49	38	12.7	<0.5
CBH 5 D	0-15	0	214	40	24.99	Seepage
CBH 6	0-18	0	82	19	30.95	<0.5
CBH 7 S	0-6	6-18'	40	10	8.97	3.8
CBH 7 D	0-18	0	202	10, 16	57.77	Seepage
CBH8 S	0-6,12-18	6-12'	49	None	14.6	<0.5
CBH8 D	0-26	0	214	None	38.75	<0.5

Based on observations made during borehole installation groundwater water occurrence appears scarce with only three of the boreholes (CBH2D, CBH3S and CBH7S) providing estimated yields above 0.5 l/s. The lack of groundwater encountered in boreholes in the project area suggests that it would be difficult to develop a sustainable groundwater supply.

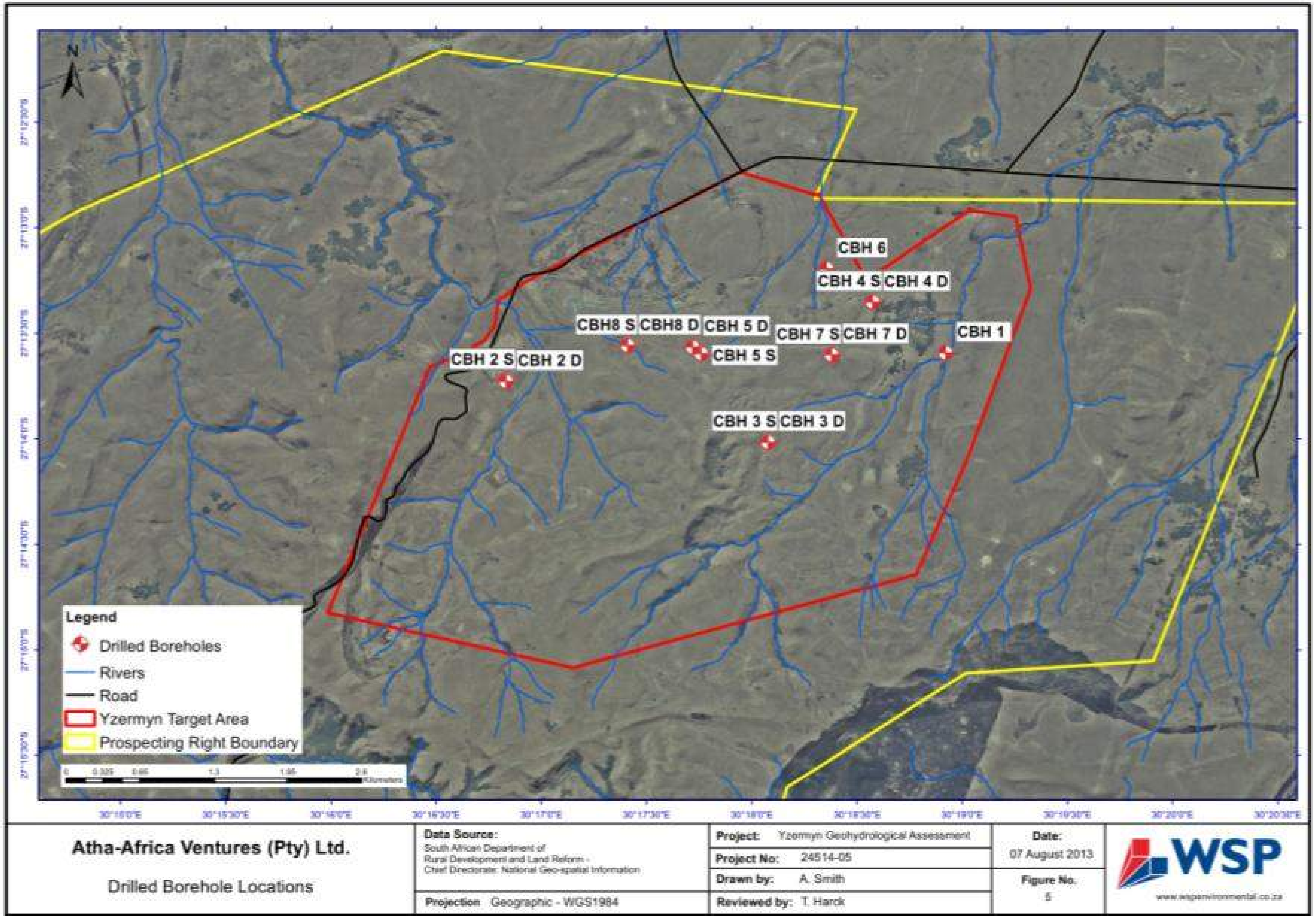

Figure 8-20: Drilled Borehole Locations

- **Pump Testing**

Aquifer testing comprised 24 hour constant discharge, recovery testing and slug testing. Aquifer characteristics were determined from pump test and slug test data. Boreholes with estimated yield greater than 0.5 l/s were tested using step drawdown and constant discharge tests from 10 to 15 June 2013. The remaining boreholes were slug tested.

Step tests were conducted on boreholes 2D, 3S and 7S. Three one-hour pumping steps were conducted at progressively increasing pumping rates with recovery measured on conclusion of pumping. This information was then used to determine a sustainable pumping rate for the constant discharge test of the borehole. Constant discharge tests were conducted over a 24 hour period with recovery recorded immediately thereafter. Aquifer transmissivity was assessed from plots of drawdown versus time.

Slug tests were undertaken on those boreholes with estimated yield less than 0.5 l/s. Slug tests involve displacing the water in the borehole using a slug of known volume and measuring the recovery of the water level. Due to low yields some boreholes contained a slurry of silt and water with insufficient depth to conduct a slug test. These boreholes were reported as “filled with silt”.

The hydraulic properties determined from all tests are tabulated in **Table 8-2**.

Table 8-2: Calculate Hydraulic Conductivity Values

Borehole ID	Test Type	Hydraulic Conductivity (m/day)
CBH 1	Slug Test	0.01*
CBH 2 S	Slug Test	1.3
CBH 2 D	Constant Discharge Test	0.02
CBH 3 S	Constant Discharge Test	0.4
CBH 3 D	Unable to test borehole filled with silt	-
CBH 4 S	Unable to test borehole filled with silt	-
CBH 4 D	Slug Test	0.5
CBH 5 S	Slug Test	1.3
CBH 5 D	Unable to test borehole filled with silt	-
CBH 6	Slug Test	0.01*
CBH 7 S	Constant Discharge Test	0.4
CBH 7 D	Slug Test	0.3
CBH8 S	Unable to test borehole filled with silt	-
CBH8 D	Unable to test borehole filled with silt	-

*Very little flow registered during slug test

Generally the hydraulic conductivity of the shallow weathered aquifer is higher than the deeper aquifer. Constant discharge testing indicates the presence of low permeability aquifer boundaries consistent with the presence of water-bearing fracture systems of limited extent. Based on the test data the geometric average hydraulic conductivity for the shallow boreholes is 0.72 m/d and for the deeper fractured rock aquifer 0.05 m/d. Estimated transmissivities vary between 1 and 5 m^2/d.

The groundwater model was used to simulate abstraction from boreholes CBH2D and CBH3S Based on aquifer test data; it is unlikely that these boreholes could be continuously pumped. It is shown that groundwater levels may be drawn down to 36 m in CBH2D and to 20 m in CBH3S (iLEH, 2013). The resultant cone of depression in both the shallow and deeper aquifers is not expected to extend more than 1 km from the boreholes. Under the assumed pumping regime, some 430 m^3/d (12 900 m^3/month) of groundwater could be abstracted.

- **Groundwater Quality Assessment**

To determine the environmental baseline groundwater quality and suitability of groundwater for use, water samples were collected and analysed. The groundwater samples were screened against the DWAF Water Quality Guidelines for Domestic Water Use. The target water quality ranges associated with domestic water use are considered applicable to the proposed Yzermyn Underground Coal Mine project water use and provide a conservative indicator of suitability for environmental uses. Sampling procedure is detailed in **Appendix C: Groundwater Impact Assessment**.

Groundwater samples were submitted for the following analytical programme:

- Indicator Parameters: pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Alkalinity.
- Inorganic Compounds: Anions F, Cl, NO_2, NO_3, and Sulphate (SO_4); and cations Na, K, Ca, Mg, including trace metal scan.

Groundwater quality in both the shallow and deep boreholes largely falls within the drinking water guideline values. The results have been used to develop a groundwater quality baseline for future reference. Water quality results obtained from the shallow boreholes are detailed in **Table 8-3** and water quality results from the deep aquifer are provided in **Table 8-4**.

Table 8-3: Water Quality Results from Shallow Boreholes Sampled

Parameter	TWQG Domestic Use	CBH2S	CBH3S	CBH4S	CBH5S	CBH7S	CBH8S	Shallow groundwater baseline quality range
Alkalinity,	--	NA	BDL	BDL	BDL	BDL	BDL	BDL
Conductivity	7000	NA	0.326	0.259	0.186	0.245	0.17	0.17 - 0.326
Total Dissolved Solids	45000	NA	257	201	132	196	140	132 - 256
Aluminium (µg/l)	300	BDL	13.4	11.2	9.98	3.21	17.1	3.21 - 17.1
Arsenic (µg/l)	10	0.279	0.355	9.08	0.132	1.2	BDL	BDL - 9.08
Chromium (µg/l)	50	1.5	1.87	1.52	1.43	2.02	2	1.43 - 2.01
Lead (µg/l)	10	BDL	0.509	0.471	0.362	0.8	0.224	BDL - 0.8
Manganese (µg/l)	500	66.4	**776**	37.9	55.6	121	259	37.9 - 776
Nickel (µg/l)	70	1.23	1.63	2.7	0.959	1.34	3.37	1.23 - 3.37
Selenium (µg/l)	10	BDL	BDL	0.522	BDL	0.467	BDL	BDL - 0.522
Vanadium (µg/l)	200	0.314	BDL	1.36	BDL	0.375	0.413	BDL - 1.36
Zinc (µg/l)	5000	0.555	6.47	13.5	2.5	5	7.36	0.555 - 13.5
Nitrite as NO_2 (mg/l)	0.9	0.05	BDL	BDL	BDL	0.119	BDL	BDL - 0.119
Chloride (mg/l)	300	BDL	4.3	6.3	2	BDL	BDL	BDL - 6.3
Phosphate as PO_4 (mg/l)	--	BDL	BDL	BDL	BDL	0.095	BDL	BDL - 0.095
Nitrate as NO_3 (mg/l)	11	NA	BDL	1	BDL	3.31	BDL	BDL - 3.31
Calcium (mg/l)	--	48.4	34.9	33.4	18.6	39.3	17.7	17.7 - 48.4
Sodium (mg/l)	200	18.9	15	19.3	14.7	7.32	6.36	6.36 - 19.3
Magnesium (mg/l)	70	14.2	20.9	8.92	11.6	10.4	12.3	8.92 - 20.9
Potassium (mg/l	50	1.61	BDL	2.68	1.05	1.13	BDL	BDL - 2.68
Iron (mg/l)	2	BDL	**11.8**	0.0362	0.0782	BDL	**11.4**	BDL - 11.8
pH	6-9	NA	**8.34**	**8.31**	7.98	7.94	7.06	7.06 - 8.34

Table 8-4: Water Quality Results from Deep Boreholes Sampled

Parameter	TWQG Domestic Use	CBH1	CBH6	CBH2D	CBH3D	CBH4D	CBH5D	CBH7D	Deep groundwater baseline quality range
Alkalinity,	--	185	NA	NA	NA	NA	BDL	BDL	NA
Conductivity	7000	2.84	NA	NA	NA	NA	0.172	0.447	NA
Total Dissolved Solids	45000	2220	NA	NA	NA	NA	133	**351**	NA
Aluminium (µg/l)	300	7.75	16.1	3.66	12.8	BDL	4.75	30.2	BDL - 30.2
Arsenic (µg/l)	10	1.8	1.73	0.149	3.56	0.939	0.401	1.84	0.149-3.56
Chromium (µg/l)	50	3.46	1.83	1.37	4.64	1.64	2.67	2.3	1.37-4.64
Lead (µg/l)	10	0.186	0.2	BDL	0.189	0.905	0.313	0.606	BDL-0.905

Parameter	TWQG Domestic Use	CBH1	CBH6	CBH2D	CBH3D	CBH4D	CBH5D	CBH7D	Deep groundwater baseline quality range
Manganese (µg/l)	500	13.6	11.9	45.6	13.3	55.1	6.18	12.7	6.18-55.1
Nickel (µg/l)	70	1.28	0.375	0.898	0.566	2.22	1.05	3.47	0.375-3.47
Selenium (µg/l)	10	3.08	BDL	BDL	1.84	BDL	BDL	BDL	BDL-3.08
Vanadium (µg/l)	200	0.625	0.386	0.265	0.887	0.361	13.1	0.342	0.265-13.1
Zinc (µg/l)	5000	2.54	BDL	0.717	BDL	8.04	12.4	12.9	BDL-12.9
Nitrite as NO_2 (mg/l)	0.9	BDL	BDL	BDL	BDL	BDL	BDL	0.356	BDL-0.356
Chloride (mg/l)	300	**367**	22.2	BDL	103	BDL	BDL	BDL	BDL-367
Phosphate PO_4 (mg/l)	--	BDL	0.131	BDL	0.096	0.128	0.109	0.05	BDL-0.131
Nitrate NO_3 (mg/l)	11	BDL	NA	NA	NA	NA	2.03	**28.1**	NA
Calcium (mg/l)	--	10.3	3.19	23.7	2.42	59.2	19	11.4	2.42-59.2
Sodium (mg/l)	200	828	118	41	477	22	7.66	105	7.66-828
Magnesium (mg/l)	70	4.37	0.721	7.3	1.09	10.4	10.2	4.12	0.721-10.2
Potassium (mg/l	50	6.73	2.24	2.14	2.96	2.19	BDL	BDL	BDL-6.73
Iron (mg/l)	2	0.028 1	0.091	BDL	BDL	BDL	BDL	0.0716	BDL-0.091
pH	6-9	**8.79**	NA	NA	NA	NA	8.06	7.9	NA

8.7.2.3 Geohydrological Modelling Programme

A site conceptual model has been developed which combines the results of the drilling (scoping phase and ESIA phase) and testing programmes. The conceptual model was used as the basis for a numerical groundwater flow and mass transport model. The numerical model was used to indicate the extent and magnitude of groundwater impacts associated with the proposed Yzermyn Underground Coal Mine.

Twenty-three (23) groundwater strikes were recorded during the Scoping Phase and the Assessment Phase fieldwork:

- Six (6) at the base of weathered zone (18m – 29m bgl);
- Six (6) perched in colluvium or weathered siltstone (10m bgl);
- Six (6) in fractured rock (16m – 40m bgl); and
- Five (5) on geological contacts (44m – 191m bgl).

This suggests that three groundwater bodies exist in the project area:

- Perched on low permeability material in the weathered zone or in colluvium;
- Perched on hard rock at the base of the weathered zone; and
- Held in fractures and geological contacts;

These groundwater occurrences are similar to those identified at other sites in the general vicinity of Yzermyn. The occurrences are presented schematically in **Figure 8-21**.

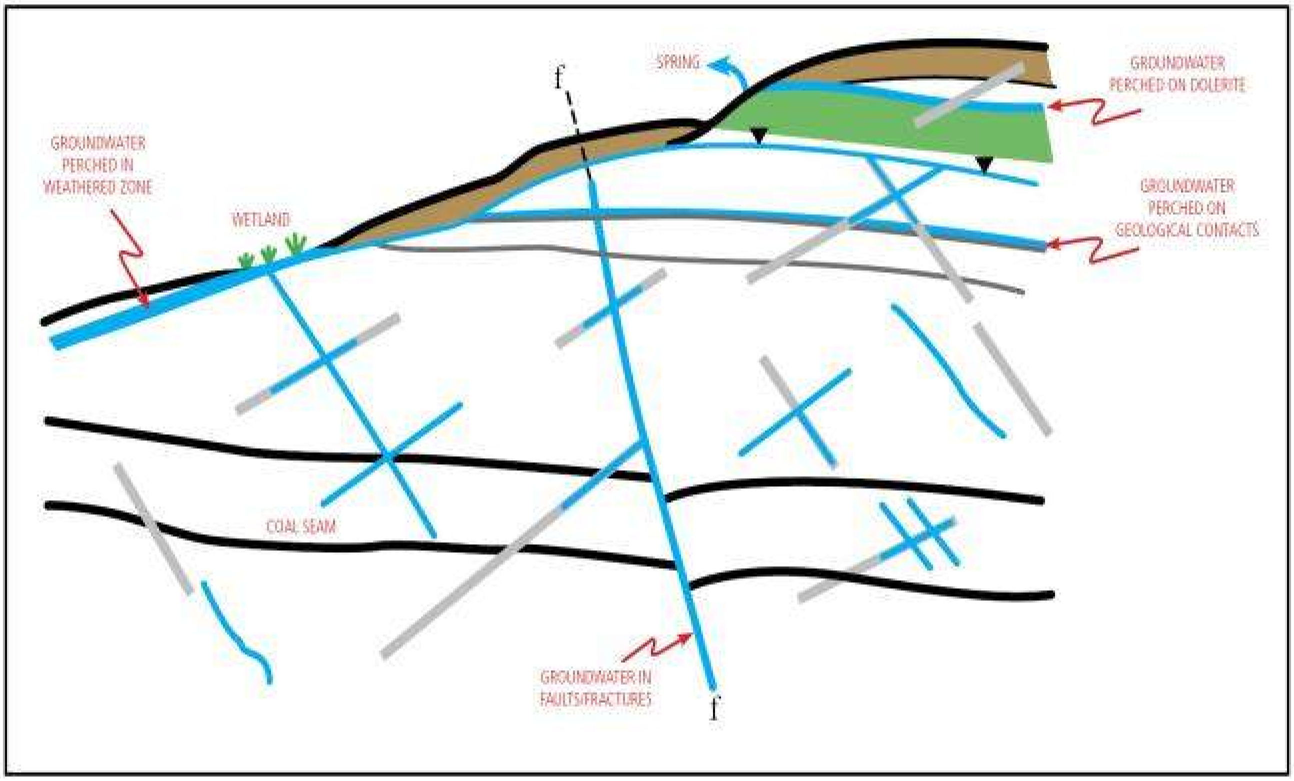

Figure 8-21: Conceptual Groundwater Model

Groundwater perched on low permeability material in the weathered zone or in colluvium may be a source of water to hillside seeps and springs. It is not clear what the source of water is for the wetlands identified at the proposed adit and plant site. The wetlands appear to be perched on low permeability material in the weathered zone and may also be fed from springs and shallow groundwater from the higher topography to the south of the adit and plant site (**Figure 8-21**). These groundwater bodies are likely to be directly recharged from rainfall.

Groundwater perched on hard unweathered rock at the base of the weathered zone may also be a source of water for wetlands. This water body would also be recharged from rainfall and the water level would be sensitive to seasonal variations in rainfall recharge.

Groundwater on horizontal and semi-horizontal contacts between different rock types may also be a source for springs. Springs appear to be associated with the dolerite sill that is present at higher altitudes in the project area. Hard rock dolerite is expected to have a significantly lower permeability compared to the Karoo-type rocks. Therefore dolerite sills may act as a barrier to vertical groundwater flow from shallow to deeper levels. The springs are considered to be fed by water bodies perched on the dolerite.

Groundwater in the deep aquifer is confined to fractures, faults and geological contacts at depth. Not all these features are expected to contain groundwater (**Figure 8-21**). Recharge of this groundwater body is expected to occur along those few fracture systems which connect the deeper aquifer to shallower groundwater bodies or directly to surface.

As a result of the limited connectivity between the deeper and shallower groundwater bodies drawdown in the deeper aquifer is expected to have a limited impact on the shallow perched aquifers. Faults and fractures may provide preferred pathways for groundwater flow and could result in locally significant inflows where intersected by underground workings. Dolerite contact zones are expected to act as preferential pathways to groundwater flow, similarly to faults and fractures.

Numerical model parameters and numerical modelling procedures and methods are detailed in **Appendix C: Geohydrological Impact Assessment**.

8.7.3 Assumptions and Limitations

The groundwater study is based on the following assumptions and statements:

- The hydrogeological conceptual model and parameters for the project are based on available information and were inferred where necessary. Should additional information become available, it is recommended that the hydrogeological parameters presented in this report be re-evaluated.
- The groundwater impact assessment is based on the information available at the time of compilation of this report. The results of this study and specifically the modelled impact assessment should be confirmed once additional information is available.
- Some aquifer parameters could not be obtained from the fieldwork programme results. Therefore, storativity for the two aquifers simulated and the characteristics of the dolerite intrusions, were inferred from experience with similar Karoo aquifers elsewhere.
- It was assumed that groundwater flow mimics the topography. Groundwater levels were statistically estimated from the DTM generated for the sub-catchment in which the project is situated.
- It was assumed that pollution control dams, wash plant and product stockpile area will be paved. The area underlying the co-disposal discard dump will be constructed on compacted soil, clay and bentonite to reduce permeability. These will limit seepage to the underlying aquifers. Therefore, the discard facility and underground workings are the only significant source of groundwater contamination considered in the numerical model.
- The contaminant source terms for the discard facility and underground workings should be revised once more specific information is available. This information may include geochemical analysis of discard samples once the wash plant is in operation, and samples of underground water during mining operations.

8.7.4 Impacts Identified during the Study

8.7.4.1 Summary

The consequence of the environmental impact is determined based on the expected severity, duration and extent. The impact likelihood is determined based on the frequency and probability of the impact. The environmental significance is then determined based on the consequence and likelihood. The environmental significance is used to guide the required management and mitigation measures to limit these impacts.

Based on the impact assessment, the groundwater impacts of medium to high significance include:

- Aquifer dewatering;
- Groundwater contamination from the discard facility;
- Groundwater inflow to the underground workings; and
- Groundwater contamination from the flooded underground workings after closure.

Mitigation measures for the above impacts and general groundwater management measures are discussed in detail in this section under the headings of groundwater management and groundwater monitoring.

8.7.4.2 Construction Phase

The construction of the adit may have an impact on the groundwater as discussed below:

Groundwater Availability

Local dewatering of the aquifer is expected to occur around the adit when the excavation depth exceeds 10 m bgl. The modelled cone of depression is expected to be steep around the adit and will not extend more than 500m away (iLEH, 2013). Water level drawdown is expected to be limited to the weathered aquifer. Shallow groundwater beneath wetlands in the vicinity of the adit may be affected if perched water bodies are dewatered into the adit excavation.

Groundwater will seep into the adit and decline shaft but this flow is likely to be sealed off during lining of the adit walls. The volume of groundwater expected to seep into the adit during the construction phase is estimated to be 35 to 80 m^3/d (iLEH, 2013). However, this may increase depending on whether significant water-bearing fractures and faults are intersected. Please note that the inflow of water to underground workings will be minimised through sealing of these areas in order to maintain safe working conditions and thereby reducing the volume of groundwater inflow into the opening.

Groundwater Quality

Adit construction is not expected to have a significant impact on groundwater quality other than the occasional hydrocarbon spill or leak from machinery used during construction. Sulphide oxidation in the exposed coal seam, interburden and overburden may occur during construction, however, will not have a significant impact on surrounding groundwater quality due to dewatering activities, thereby ensuring groundwater flows towards the adit. To keep the operations dry excess water will be removed to the surface by pumping. This will be considered dirty water and will be dealt with in the mine's water management system.

8.7.4.3 Operational Phase

List of activities that may have an impact on groundwater:

- Inflow of groundwater into the underground workings;
- Dewatering of aquifers above the underground workings;
- Abstraction of groundwater for water supply;
- Development of acid mine drainage; and
- Seepage of contaminated groundwater from the discard facility.

Groundwater Availability

- Inflow of Groundwater to Underground Workings
  - Groundwater inflow is expected to occur when mining intersects water-bearing geological features such as water bearing faults, fractures and dyke contact zones. The numerical groundwater model was used to estimate the volume of groundwater flowing into the underground workings considering the range of permeabilities assigned to the deeper aquifer.
  - Modelling results indicate that inflow may vary between 330 and 1280 m^3/d (iLEH, 2013) over the life of the operation. Measured inflow during mining may differ significantly from the model results. This is because the model is not able to account for specific water-bearing features with characteristics that vary from the average considered in the model simulations.
- Aquifer Dewatering
  - Groundwater inflow to the Yzermyn underground workings will result in reduced groundwater levels in aquifers above the workings. This creates a cone of depression above and around the mining area. The extent of the cone of depression depends on the depth of mining and the permeability of the aquifers that are dewatered.
  - Vertical hydraulic conductivity in the project area is expected to be lower than horizontal conductivity due to the horizontal layering of the sedimentary geology. Model results indicate groundwater levels in the deep aquifer may be affected up to 3.5km from the mine workings by the end of mining (iLEH, 2013). Boundary conditions along the southwest model boundary have distorted the simulated drawdown cone. However, this is not expected to significantly impact on the validity of the simulations. The simulated drawdown cone provides a first order assessment of the impact of mining on the fractured rock aquifer.
  - The conceptual geological model suggests that the position and permeability of faults intersected by the underground workings will play a role in the extent and shape of the dewatering cone. However, it is

uncertain whether the inferred faults in the geological model exist or would be water-bearing and act as preferential groundwater flow paths. Therefore two scenarios were tested in the numerical model:

  - Water-bearing faults included as discrete zones in the fractured rock aquifer with hydraulic conductivities double that of the host rock ($3m^2/d$).
  - Water-bearing faults with hydraulic conductivities equal to that of the host rock.

- Including the faults as transmissive features in the model resulted in similar simulated drawdowns to excluding the faults from the model. Highly transmissive water-bearing features may be present at Yzermyn even though there is no data to confirm this.
- The shallow and deep aquifers are hydraulically connected. According to the conceptual geohydrological model flow from the shallow aquifer is considered to recharge the deep aquifer. Therefore, drawdown in the deep aquifer will also draw down water level in the shallow aquifer. The impact on water level in the shallow aquifer will depend on the connectivity between the two aquifers. This could not be quantified from the fieldwork programme or other geohydrology studies.
- Connectivity is likely to be localised and driven by geological structures which intersect both the shallow and deep aquifers. The numerical groundwater model assumed a uniform connectivity between the shallow and deep aquifers. The connectivity was assumed to be related to the transmissivity of the aquifers as determined from the fieldwork programme..
- Drawdown in the shallow aquifer after 15 years of mining is generally limited to a zone approximately 1,500 m around the mine workings. The simulated shallow groundwater level declines up to 2 m south of the adit and plant. This area includes several wetlands delineated by Natural Scientific Services (NSS, 2013).
- Geological exploration borehole results indicate no dolerite sills in the vicinity of the adit entrance. Therefore, the identified wetlands are not perched on dolerite. Based on the conceptual geohydrological model, wetlands near the base of slopes may obtain water from one or all of the following sources: the shallow aquifer, perched water and springs at higher altitude. The numerical simulations do not apply to water bodies perched on low permeability horizons in the weathered zone or colluvium deposits which are likely to be unaffected by lower water levels in the shallow weathered aquifer. The simulation results are considered to indicate that the volume of water available to the wetlands may be reduced by the decline in water level in the shallow aquifer.
- The proposed bord and pillar mining method is not expected to result in surface subsidence. Therefore, the low vertical permeability of the dolerite sill is not expected to increase due to fracturing induced by mining. As such, no significant impact on springs perched on dolerite is expected.
- Based on the model simulation results, the boreholes and springs that may be affected by mine dewatering are listed in **Table 8-5**.

Table 8-5: Expected drawdown in boreholes (iLEH, 2013)

BH ID	Expected drawdown (m)	Comment
ATHA-BH4	0 – 5m	Scoping Phase Boreholes – not considered a significant impact. Borehole may continue to perform under pre-mining conditions.
ATHA-BH6		
ATHA-BH3	5 – 10m	Scoping Phase Boreholes – not considered a significant impact. Borehole may continue to perform under pre-mining conditions.
ATHA-BH1		
CBH4D	10 – 15m	Assessment Boreholes - may be a significant impact. Borehole may not continue to perform under pre-mining conditions.
CBH6		
BH116	15 – 20m	Assessment and Exploration Boreholes will probably be significant impacted on. Boreholes will not perform under pre-mining conditions. Reduced yields are expected to occur
CBH1		
BH056	20 – 25m	Assessment and Exploration Boreholes will probably be significantly impacted on. Boreholes will not perform under pre-mining conditions. Reduced yields/drying-up are expected to occur
CBH7D		
BH073	25 – 30m	Scoping Phase and Exploration Boreholes will probably be significantly impacted on.

BH084 BH106 ATHA-BH5		Boreholes will not perform under pre-mining conditions. Drying-up are expected to occur
CBH2D	>30m	Assessment and Exploration Boreholes will be significantly impacted on. Borehole will not perform under pre-mining conditions. Drying-up is expected to occur.

The extent to which the boreholes will be impacted will depend on whether the borehole is located in the shallow or deep aquifer. It will also depend on the specific transmissivity characteristics of the water bearing feature(s) intersected.

- Abstraction of Groundwater
  - The groundwater model was used to simulate abstraction from boreholes CBH2D and CBH3S Based on aquifer test data; it is unlikely that these boreholes could be continuously pumped. It was therefore assumed that the boreholes will be pumped for 12 hours per day.
  - It is shown that groundwater levels may be drawn down to 36 m in CBH2D and to 20 m in CBH3S (iLEH, 2013). The resultant cone of depression in both the shallow and deeper aquifers is not expected to extend more than 1 km from the boreholes.
  - Under the assumed pumping regime, some 430 m^3/d (12 900 m^3/month) of groundwater could be abstracted.
  - It is however noted that these two boreholes are between 2 and 3.5km from the plant which may limit their use as a convenient source of water supply.
  - Based on the field programme and model results the potential of the aquifer to provide bulk water supply appears to be limited. Bulk water abstraction therefore results in a significant drawdown of groundwater levels.

Groundwater Quality

A source term presents the mass released from a contaminant source over time. It is generally developed using the results of geochemical characterisation of mine materials such as discard, overburden and coal. Source terms were estimated from published sources by Solution[H^+] (2013a) and supported by limited geochemical testing results (Solution[H+] 2013b).

Sulphate, a product of acid mine drainage, was used as an indicator of impact on groundwater quality. At moderate concentrations sulphate has limited chemical interaction in the aquifer. Sulphate is relatively mobile when compared to other dissolved constituents in groundwater. Therefore, sulphate mobility is a conservative indicator of the movement of dissolved groundwater contamination.

The discard facility source term was included in the groundwater model and is summarised in **Table 8-6.**

Table 8-6: Discard source term used during numerical modelling simulations

Source identified	Comment	Avg pH	Avg SO_4 at source (mg/l)	Avg SO_4 downstream in aquifer (mg/l)	Seepage rate
Discard facility	■ Consistent with site specific geochemical data ■ Infiltration to groundwater limited by the permeability of material underlying the discard ■ Infiltration rate could be similar to background rates, if discard slopes towards drains to capture excess seepage.	6.51	7400	862 – 2329*	Uncovered discard: 15 – 40% of MAP

Two scenarios were simulated:

- **High permeability:** The discard facility footprint was conservatively assigned the same permeability as the shallow aquifer; and
- **Low permeability:** The discard facility footprint was assigned a permeability of 10^{-7} cm/s, as specified for H:H waste facilities in the DWAF Minimum Requirements guidelines (DWAF 1998).

Model results indicate that the plume from the discard facility will move to the north and northeast with a smaller component to the south and west due to dispersion and the effect of increased recharge from the discard facility.

The high permeability scenario indicates sulphate concentrations of up to 650 mg/l (iLEH, 2013) in the shallow weathered aquifer adjacent to the discard facility. The contaminated groundwater plume is expected to extend up to 500 m to the north of the facility and 500 m west to the Mawandlane River after 15 years of operation. Groundwater sulphate concentrations at the plume front are expected to be more than 60 mg/l.

Under the low permeability scenario the extent of the sulphate plume does not change significantly. However, sulphate concentrations at the plume front are significantly lower with the modelled concentration at the Mawandlane River about 10 mg/l.

8.7.4.4 Following Closure

List of post-closure impacts on groundwater:

- Possible decant of contaminated water from the underground workings;
- Development of AMD and contamination of water in the mine workings; and
- Contamination of the aquifer from surface and underground sources after mining ceases.

Decant of Water from Abandoned Groundwater Workings

This impact relates to the addition of a water source where none existed before mining. This is likely to change ecological conditions around and downstream of the water source. Numerical modelling indicates that groundwater levels will recover between 20 and 50 years after mining (iLEH, 2013). Since no ground subsidence is expected from mining recharge to the underground workings is expected to take place at natural (pre-mining) rates.

The proposed adit entrance is above the pre-mining groundwater level. Modelled post-mining groundwater levels are not significantly different to pre-mining levels. Therefore, it is considered unlikely that excess water from the underground workings will decant from the adit. Other access points to the underground workings (such as ventilation boreholes) may be a source of decant if located at a lower elevation than the adit.

If faults with high permeabilities are intersected in the workings, the hydraulic head at potential decant points may be higher than the pre-mining head. This could result in decant unless the decant points are sealed. A decant scenario was simulated in the numerical model considering a mining height of 1.2m and underground void space 60% of the total area mined.

Potential for Acid Mine Drainage

The potential for acid mine drainage from the proposed mining activities was assessed by Solution[H+] (2013b). Fifteen samples were obtained from geological exploration boreholes drilled at the proposed Yzermyn Underground Coal Mine. The samples were submitted for acid-base accounting (ABA) testing at Waterlab laboratory in Pretoria.

- All samples from the Dundas Seam roof and floor are non-potentially acid generating (non-PAG). This is due to low sulphur concentrations in the samples and significant neutralisation potential.
- All samples but one from the Alfred Seam roof and floor are potentially acid generating (PAG). This is due to higher sulphur concentrations than the Dundas samples although neutralisation potential (NP) values are similar.
- Two of five coal samples are PAG and the remainder uncertain. This arises since the coal samples generally have the highest sulphur concentrations. The coal samples also have significant NP. High paste pH values suggest that the coal seams may be associated with veins of calcite which is a source of NP.

Based on the ABA results, it appears that there may be distinct differences in drainage quality between the Dundas workings and discard, and the Alfred workings and discard.

A source term presents the mass released from a contaminant source over time. It is generally developed using the results of geochemical characterisation of mine materials such as discard, overburden and coal. Source terms were estimated from published sources by Solution[H^+] (2013a) and supported by limited geochemical characterisation.

Acid mine drainage is not an environmental impact itself. AMD gives rise to impacts on surface and groundwater quality. Therefore, the impact significance of AMD has not been assessed. However, specific impacts from AMD contaminated water have been assessed individually in this report.

Contamination of Aquifers

Water filling the workings after closure is a source of contamination. However, the hydraulic gradient and groundwater flow is generally towards the underground workings until groundwater levels recover after mine dewatering. It is expected to take 30 to 50 years before groundwater levels recover. Therefore, significant movement of contamination from the mining areas is unlikely to occur until a considerable time after closure.

The high permeability scenario indicates groundwater contamination will have extended approximately 1,600m north of the facility 100 years after closure. Modelled sulphate concentrations up to 500 mg/l may be present at the head of the plume. The plume also extends northeast along the Mawandle River.

The low permeability scenario indicates a significantly reduce plume extent and concentration. The plume is modelled to extend approximately 1,000 m north of the facility with sulphate concentrations of 10 to 20mg/l at the head of the plume. The low permeability sulphate plume also extends a shorter distance along the Mawandlane River.

Both model scenarios show potentially contaminated groundwater from the discard facility flowing into the Mawandlane River and the tributary of the Assegaai River. Normally the groundwater component of stream base flow is comparatively low. However, during the dry season, the groundwater base flow component may become more pronounced when surface runoff is reduced or absent.

Preliminary groundwater base flow calculations based on model results suggest groundwater flow of 27 m^3/d into the Mawandlane River. The associated salt load will depend on the contaminant concentrations in the inflowing groundwater. Base flow to the Assegaai River tributary is estimated to be 19 m^3/d.

Model simulations indicate that groundwater contamination will move from the mine workings in a north and northeast direction in the deeper fractured rock aquifer. The plume may extend more than 2km down gradient of the mining operations. Simulations considered the inferred faults to act as preferential paths of groundwater flow.

8.8 Biodiversity Impact Assessment

The biodiversity assessment was undertaken independently by NSS. The summary of the reports is included below and the detailed assessment report in included in **Appendix C: Biodiversity Assessment.**

Please note: The groundwater model was rerun following additional information supplied by Atha. The updated groundwater model needs to be reassessed by NSS in order to incorporate the findings into the Biodiversity Impact Assessment Report. However, due to the timeframes associated with the report submission to the DMR, the Biodiversity Impact Assessment Report has not been updated and is therefore considered a DRAFT. WSP will place the updated Biodiversity Impact Assessment Report on public review as a standalone report following finalisation and all stakeholders will be informed of such.

8.8.1 Methodology

The biodiversity assessment was completed in the context of:

- Relevant international, national and provincial legislation, policies and guidelines;
- Results from the desktop- and field-based investigations of flora, fauna, aquatic ecology and wetlands, including local observations of CI species;
- The national and provincial significance of local Biodiversity, and relevant national, provincial and local conservation initiatives; and
- The habitat sensitivity ratings, buffer zones and sensitivity maps developed for the project

The IA includes the following:

- Current impacts on biodiversity in the study area;
- Future potential impacts of the proposed project;
- Cumulative impacts; and
- Recommended measures to mitigate these impacts.

The biodiversity assessment was undertaken utilising WSP"s Impact Rating Methodology which assesses the Severity, Duration, Extent, Consequence, Frequency, Probability and Likelihood of each potential impact and used to calculate each impact's overall Significance (with and without mitigation).

8.8.2 Assumptions and Limitations

The biodiversity assessment was based on the following main assumptions and limitations:

- If approved, the proposed surface infrastructure will be located within the footprint shown in **Figure 8-22** (which was supplied to NSS after initial field work was performed);
- Potential impacts associated with access roads, conveyor routes, pipelines, electricity supply routes etc. have not been assessed as part of this assessment;
- Two groundwater aquifers exist within the study area (iLEH, 2013) including a:
  - Shallow weathered aquifer (5–20 mbs); and a
  - Deeper fractured aquifer.
- The source of water for the wetlands identified within the study area and within the greater cone of depression is unknown (WSP, 2013a). A conservative approach has therefore been taken, assuming the following:
  - The shallow and deep aquifers are hydraulically connected. Recharge of the deeper aquifers is expected to occur along the few fracture systems which connect the deeper aquifer to shallow groundwater bodies or directly to the surface.

- The wetlands may be fed by one or more of the following sources:
  - The perched aquifer, perched on low permeability material in the weathered zone or in colluviums;
  - The shallow aquifer, perched on hard rock at the base of the weathered zone; and
  - The deeper aquifer in terms of springs, groundwater on horizontal and semi-horizontal contacts between different rock types.
- Based on the above uncertainties on the source of water for the wetlands in the study area, it has been assumed that the mine dewatering will impact all wetlands in the proposed underground mining and surface infrastructure areas for both the shallow and deep aquifers. The impact will also extend into and beyond the greater mine lease area;
- Groundwater will be used to augment water supply to the washing plant. Boreholes CBH2D, CBH3S and CBH7S will be pumped 12 hours a day;
- A cut-off trench will be constructed around the surface infrastructure footprint and the clean water collected in the cut-off trench will be returned to the receiving environment;
- The discard dump will be underlain with compacted soil, clay and bentonite surface;
- The coal stockpile area will be lined;
- The PCDs will be lined;
- It is estimated that groundwater levels will recover within 20 – 50 years after mining stops;
- The plant area will be paved, which will limit seepage to the underlying aquifers;
- It is uncertain whether the drawdown cone extends into the quaternary catchments V31A and W42A (as the groundwater model did not extend into these catchments). For this assessment it has been assumed that it is unlikely. However, further investigations should be undertaken due to the sensitive nature of these catchments and associated watercourses (FEPA rivers and wetlands);
- Conventional board and pillar underground mining methods will be used. This will involve drill and blast, and continuous miner operations. The pillars will be 6m wide and to the mining height. No high extraction is planned. The dolerite sill intruded into the area is furthermore expected to increase the strength of the overburden material. The risk of subsidence is, therefore, considered to be low;
- A modular sewage treatment plant will be constructed, which is contained. It is therefore assumed that no soak-aways or french drains will be implemented. A reputable contractor will empty septic tanks. For this reason, the sewage plant is not expected to pose a threat to groundwater contamination. Chemical toilets will be used during the construction phase of the project; and
- In addition to the above, all the assumptions made in the groundwater report apply to this assessment as the results of the groundwater model are dependent on these (WSP, 2013).

In terms of offsets, no national or Mpumalanga provincial guidelines (MTPA pers. comm., 2013) currently exist for wetland offset projects. The MTPA does not readily entertain offsets as an option unless the long-term security of a site can be guaranteed. . This project will impact on wetlands, fed by the shallow aquifer, within an area of approximately 5,398 ha and wetlands, fed by springs sourced in the deeper aquifer, within an area of approximately 7,977 ha. The possibilities for offsets, of this extent within the same catchment, are unlikely. As this proposed project is at the head of catchment W51A and will impact on water resources downstream and may also impact on catchments V31A and W42A, no wetland could be offset to the same value and ecological state (Natural to Largely Natural) as those that would be lost.

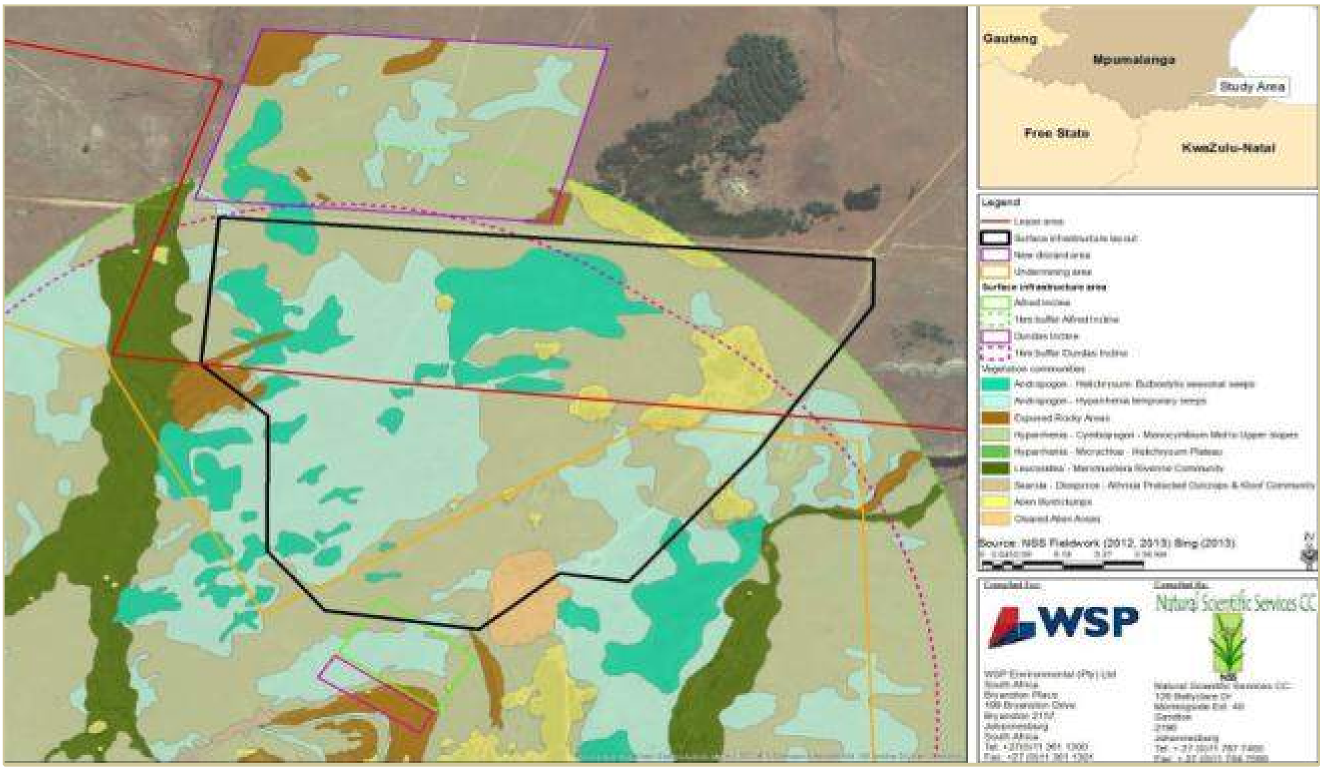

Figure 8-22: The Planned Surface Infrastructure Footprint

8.8.3 Findings of the Study

In Mpumalanga, coal-mining has had extensive negative impacts on biodiversity, and remaining grasslands and wetlands are severely threatened by the accelerating demand for low-cost energy from coal (Tweddle et al. 2009). It was within this context that NSS performed a biodiversity sensitivity assessment. The sensitivity assessment was based on findings of the floral, faunal, aquatic and wetland assessments, and takes cognisance of relevant national and provincial planning and other biodiversity conservation initiatives. Separate sensitivity maps have been compiled for the different disciplines and combined to create an overall sensitivity map for biodiversity in the study area.

8.8.3.1 Local Habitat Sensitivity

Very High Sensitive Habitat

Floral communities which are considered to have a Very High importance include the:

- *Leucosidea – Merxmuellera* Riverine Community;
- *Searsia – Diospyros – Athrixia Protected* Outcrops and Kloof Community; and
- *Andropogon – Helichrysum- Bulbostylis seasonal* seeps.

These are restricted intact habitats, diverse in floral species and contain a number of CI plant species including the Near Threatened *Merwilla plumbea*. This is a highly sought after species that has been exploited over most of its range for medicinal use. These areas provide habitat for a number of Declining TSP-listed species as well as a broad range of protected species under the provincial legislation.

All wetlands on site, including the rivers, channelled valley bottom systems and seeps, are protected under the NWA, and are regarded as having Very High sensitivity. The assessed wetlands represented Natural to Largely Natural systems, and their main ecosystem service is the maintenance of biodiversity. Wetlands on the site are largely fed by groundwater from the shallow, weathered aquifer and the deeper, fractured aquifer, and are, therefore, sensitive to changes in groundwater levels and water quality.

From a faunal perspective all wetlands and patches of Scarp Forest were assigned Very High conservation importance. Wetlands onsite support many CI faunal species such as the Vulnerable African Grass-owl, Near Threatened Half-collared Kingfisher and Serval, and the potentially occurring Critically Endangered Rough-haired Golden Mole and Vulnerable Marsh Sylph butterfly. Patches of Scarp Forest provide important habitat for foraging bats, and several CI species such as the Near Threatened Rusty Pipistrelle, and Bush Blackcap, and the potentially occurring Near Threatened Plain Stream Frog and provincially Vulnerable Natal Cascade Frog.

In addition, two large adits from previous mining in the area have Very High conservation importance. This is because these adits provide roosting habitat for at least four CI bat species including the Endangered Swinny's Horseshoe Bat (*Rhinolophus swinnyi*), and the Near Threatened Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*), Temminck's Hairy Bat (*Myotis tricolor*) and the Natal Clinging (or Long-fingered) Bat (*Miniopterus natalensis*). Moreover, the Geoffroy's Horseshoe Bat population comprised >270 individual bats.

High Sensitive Habitat

Andropogon – Hyparrhenia temporary seeps were assigned a High sensitivity. This is because this habitat remained mostly in a relatively natural state, and supported TSP- and MTPA-listed floral species and several Vulnerable and Near Threatened CI faunal species.

Smaller adits from previous mining in the area have a High conservation importance. This is because these adits provide roosting habitat for small numbers of at least three CI bat species including the Near Threatened Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*), Temminck's Hairy Bat (*Myotis tricolor*) and the Natal Clinging (or Long-fingered) Bat (*Miniopterus natalensis*).

Medium High Sensitive Habitat

The *Hyparrhenia – Cymbopogon – Monocymbium* Slope Community was regarded as having Medium-High conservation importance. This community remains in a relatively natural state and supports a number of CI floral and faunal species e.g. rocky patches within this community provided habitat for the Vulnerable White-bellied Korhaan and Near Threatened Cape Grass Lizard.

Medium Sensitive Habitat

The *Hyparrhenia – Microchloa – Helichrysum* Plateau grassland was regarded as having a Medium sensitivity, as this community was characterized by comparatively less floral and faunal diversity and fewer CI species.

Savanna patches (such as the *Acacia - Ziziphus* Savanna community) were also assigned Medium conservation importance. This was because Savanna is widespread and well-conserved relative to other biomes in South Africa, and local patches of this habitat supported intermediate levels of Biodiversity including comparatively few CI species.

Low Sensitive Habitat

Clumps of alien, invasive trees were considered to have Low sensitivity. Despite that some CI faunal species (e.g. Serval and African Crowned Eagle) may frequent alien bushclumps, these habitat patches have limited indigenous floral species in the undergrowth, and low overall faunal diversity.

8.8.3.2 Buffer Zones

A buffer is a strip of land surrounding a sensitive area in which activities are controlled or restricted to reduce the impact of adjacent land uses on the sensitive area. The following buffer zones have been applied to the sensitivity maps:

- Buffer zones for wetlands and other aquatic habitat

The wetland buffers applied are not uniform across the study area, with following buffers required:

- A 1 km buffer on all FEPA wetlands, wetland clusters and rivers. As specified by the NFEPA (Driver et al. 2011), mining in any form (including prospecting) should not be permitted in wetland FEPAs, or within 1 km of a wetland/riverine FEPA buffer (including wetland clusters).
- The River and associated Channelled Valley Bottom wetland in System 1 should be protected by a minimum 200 m buffer measured from the outer edge of the wetland temporary zone or the outer edge

of the riparian fringe. This 200 m buffer is based on the Vulnerable Grass-owl breeding and foraging habitat identified within this system.

– A minimum 100 m buffer should be retained around the River and Channelled Valley Bottom Wetland in System 2 and all Seeps identified within the study area. These systems were Natural to Largely Natural systems supporting a wide variety of CI floral and faunal species and have a Very High Ecological Importance and Sensitivity.

NOTE: The buffer zones for wetlands unfortunately only apply to the surface loss of wetland habitat. The loss of wetlands will be due to the decline in water input. A buffer cannot be placed to protect the wetland habitat from this impact as it relates to the dewatering of the perched shallow and fractured deep aquifers.

- Buffer zones for fauna
  - Mammals

    Currently, the South African Bat Assessment Advisory Panel (SABAAP) recommends a minimum 200 m buffer around all potentially important bat features including e.g., rocky ridges and outcrops, delineated watercourses, woody vegetation (aloes and trees including alien bush clumps) and built structures (e.g., mine adits, farm buildings, bridges and water towers). For confirmed or suspected (permanent or seasonal) bat roosts the following buffers apply:

    - 1 – 50 Least Concern bats – 500m
    - 50 – 500 Least Concern bats – 1km
    - >500 High Risk Least Concern bats – 2.5km
    - 1 – 50 Low Risk Conservation Important bats – 500m
    - 1 – 50 Med-High Risk Conservation Important bats – 1km
    - 50 - 500 Low Risk Conservation Important bats – 1km
    - 50 - 500 Med-High Risk Conservation Important bats – 2.5km
    - 500 - 2000 Low Risk Conservation Important bats – 2.5km
    - 500 - 2000 Med-High Risk Conservation Important bats – 10km
    - >2000 Bats of any status or risk level – 20km

    These are minimum values and they do not exempt developers from implementing additional mitigation measures outside of these buffer zones where necessary.

    For the large adits where four CI bat species were detected (including the Endangered Swinny's Horseshoe Bat, and >200 Near Threatened Geoffroy's Horseshoe Bats), a 1 km aboveground and a 500 m underground radial buffer are prescribed. For the smaller adits where much lower densities of CI bats were found, a 500 m aboveground buffer is prescribed, which corresponds with the 500 m cave buffer recommendation of GDARD (2012).

    In addition, a 50m buffer around all forest patches is prescribed to protect the Near Threatened Rusty Pipistrelle, which roosts in tree crevices, and all five recorded CI bat species, which are expected to frequent local forest patches when foraging. This 50 m buffer recommendation was based on international bat impact mitigation guidelines including the EUROBATS (http://www.eurobats.org) and Natural England (Mitchell-Jones & Carlin 2009) bat impact mitigation guidelines.

    Based on the 50 m riparian buffer recommendation of GDARD (2012), a minimum 50m buffer is recommended around all wetlands for the Data Deficient Swamp Musk Shrew and Reddish-Grey Musk Shrew. This recommendation would hopefully also protect small, potentially occurring CI wetland mammal species such as the Critically Endangered White-tailed Mouse and Near Threatened African Marsh Rat.

    For the comparatively mobile Near Threatened Serval, buffer zones do not seem appropriate and emphasis is instead placed on maintaining connectivity between wetlands and undisturbed grassland areas.

- Birds

  GDARD (2012) recommends a minimum 170 m buffer and DEC (pers. comm. 2013) recommends a minimum 200 m buffer on any linear wetland system supporting the foraging and breeding habitat of the Vulnerable African Grass-owl.

  For the Vulnerable White-bellied Korhaan, GDARD (2012) recommends the protection of contiguous habitat patches >100 ha. Three patches of habitat in the vicinity of the current proposed surface infrastructure area were accordingly delineated for the protection of this species. These patches are separated by approximately 400 m-1 km and collectively exceed 100 ha.

  Patches of Scarp Forest should be preserved for forest-specialist CI bird species such as the Bush Blackcap. For wider-ranging, grassland-dependent CI bird species such as the Near Threatened Secretarybird and Black-bellied Bustard, the maintenance of connected grassland areas is most appropriate.

- Reptiles

  Observed and potentially occurring CI reptile species are mostly grassland specialists, such as the provincially Near Threatened Cape Grass Lizard (*Chamaesaura anguina*), and during field surveys the highest diversity of reptiles was recorded in Rocky Grasslands. Therefore, it would be most appropriate to conserve grassland habitat in the absence of information on specific buffer zones for these species.

- Frogs

  Protection of wetland, grassland and forest habitat would, respectively, benefit the potentially occurring Vulnerable Spotted Shovel-nosed Frog, provincially Vulnerable Karoo Toad and Giant Bullfrog, and the provincially Vulnerable Natal Cascade Frog.

8.8.3.3 Sensitivity Maps

Based on the afore-mentioned habitat sensitivity ratings and buffer zones, separate sensitivity maps were compiled for flora, fauna, wetland and other aquatic habitat, which are respectively shown in **Figure 8-23, Figure 8-24** and **Figure 8-25**. These were subsequently combined (overlaid) to create an overall sensitivity map for biodiversity in the study area, shown in Figure 8-26. **Table 8-7** indicates the areas included per sensitivity rating.

Table 8-7: An Outline of the Areas Included Per Sensitivity Rating

Sensitivity Rating	Areas Included
Very High	■ The *Leucosidea – Merxmuellera* Riverine floral community. ■ The *Searsia – Diospyros – Athrixia* Protected Outcrops & Kloof communities. ■ The *Andropogon – Helichrysum- Bulbostylis* seasonal seeps. ■ All wetlands (Rivers, Channelled Valley Bottom systems and Seeps) and the buffers around these. ■ The two large, abandoned adits and the buffers around these
High	■ The *Andropogon – Hyparrhenia* temporary seeps. ■ Smaller, abandoned adits and the buffers around these
Medium-High	■ The *Hyparrhenia – Cymbopogon – Monocymbium* Slope community
Medium	■ The *Hyparrhenia – Microchloa – Helichrysum* Plateau community. ■ The *Acacia - Ziziphus* floral community and other savanna patches
Low	■ Alien bushclumps

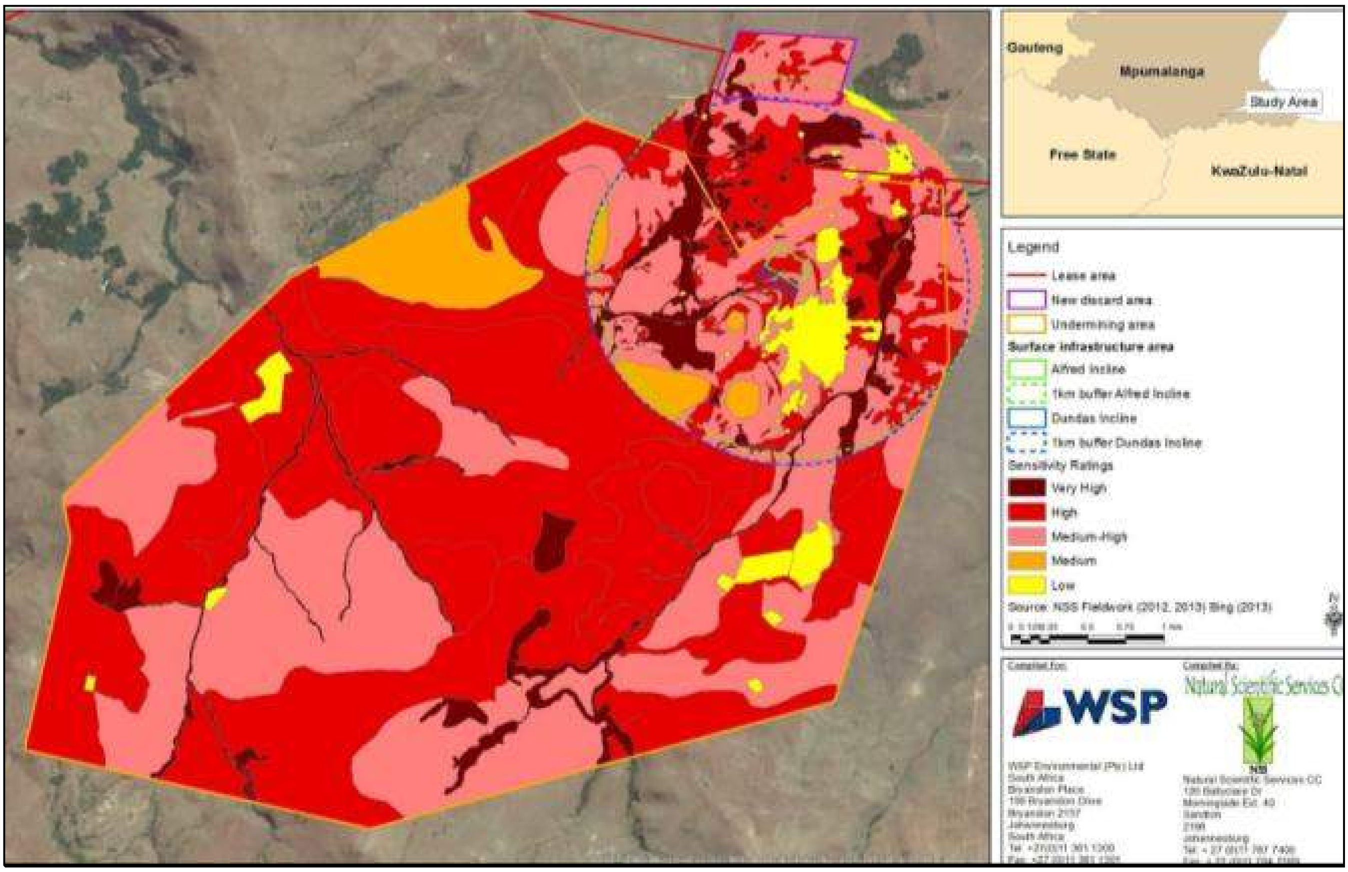

Figure 8-23: Flora Sensitivity Map

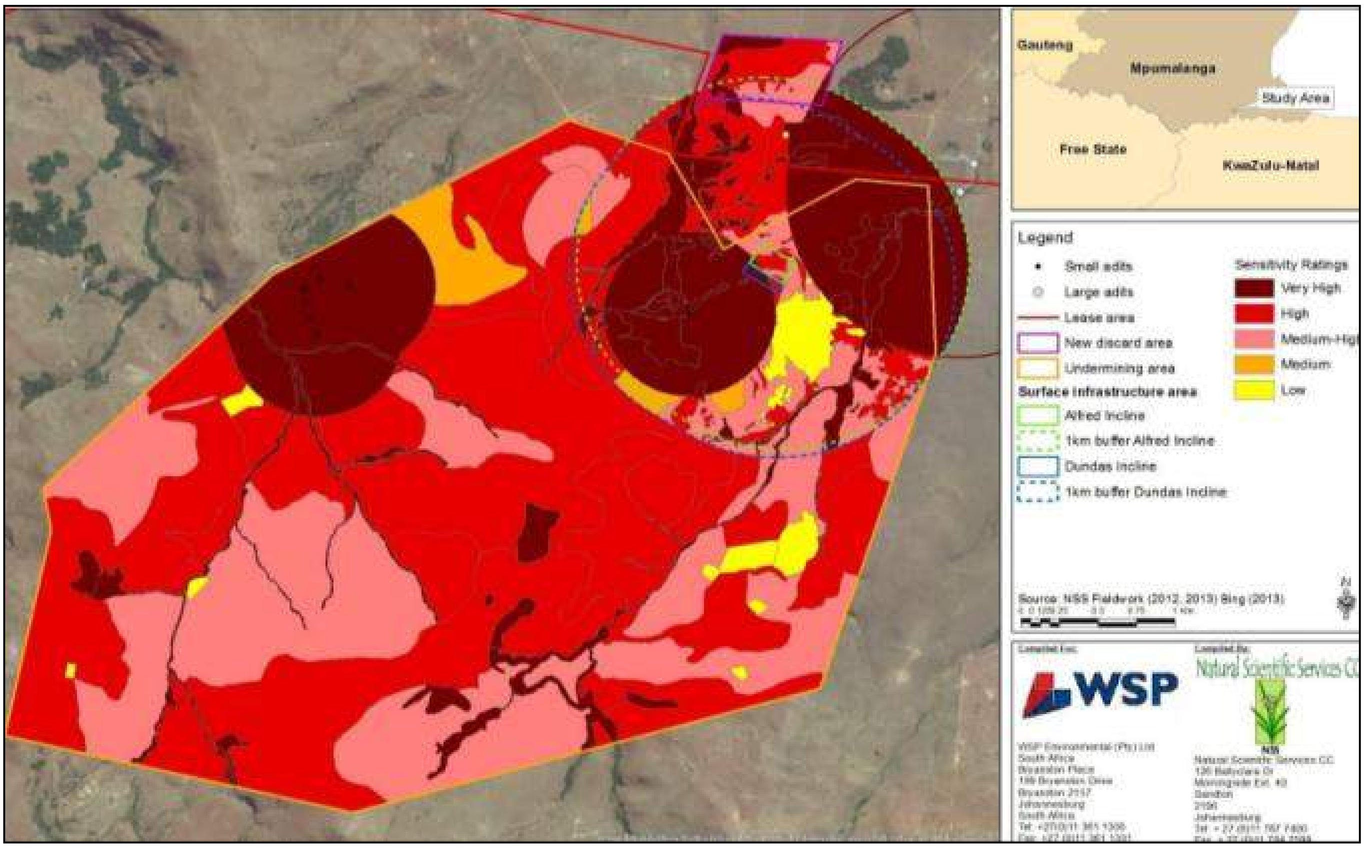

Figure 8-24: Fauna Sensitivity Map

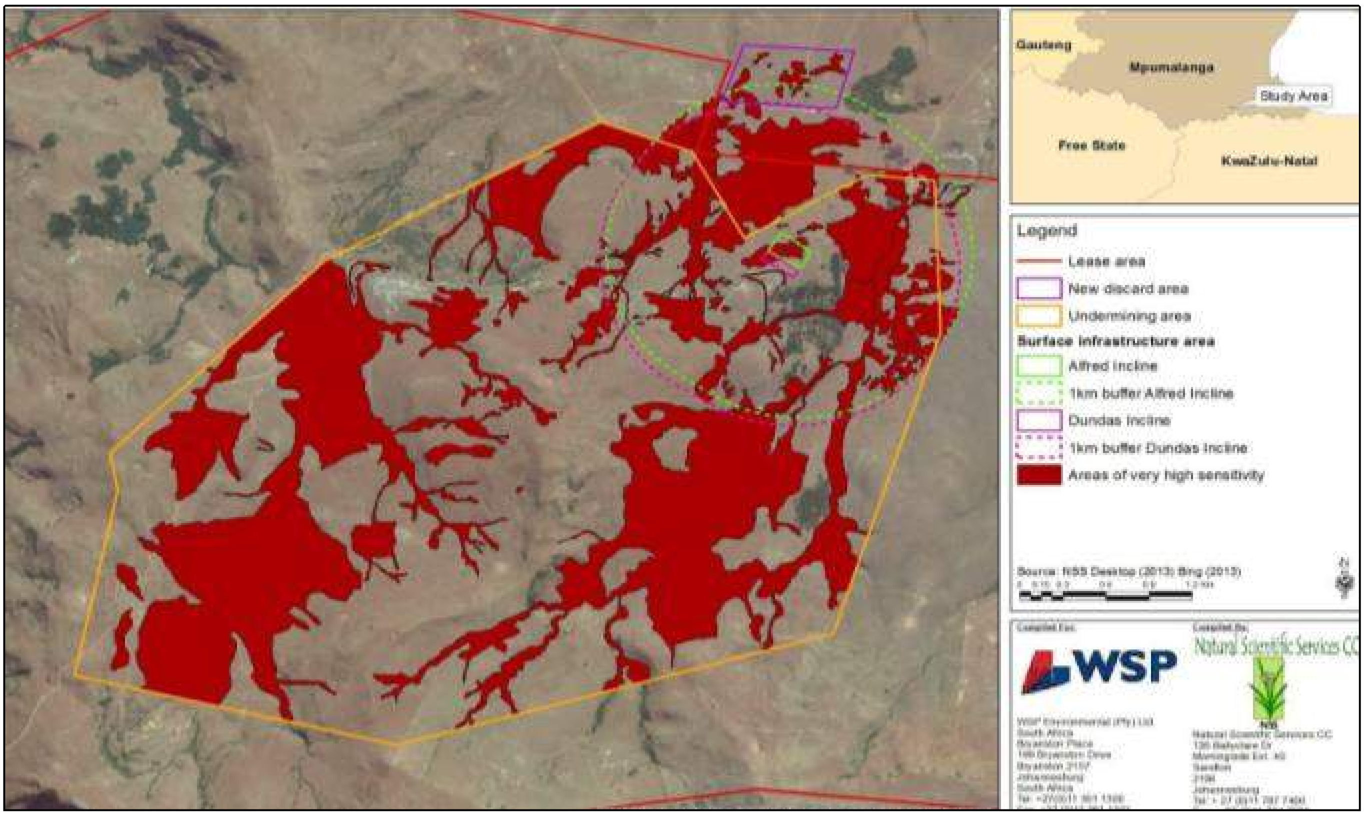

Figure 8-25: Wetland and other Aquatic Habitat Sensitivity Map

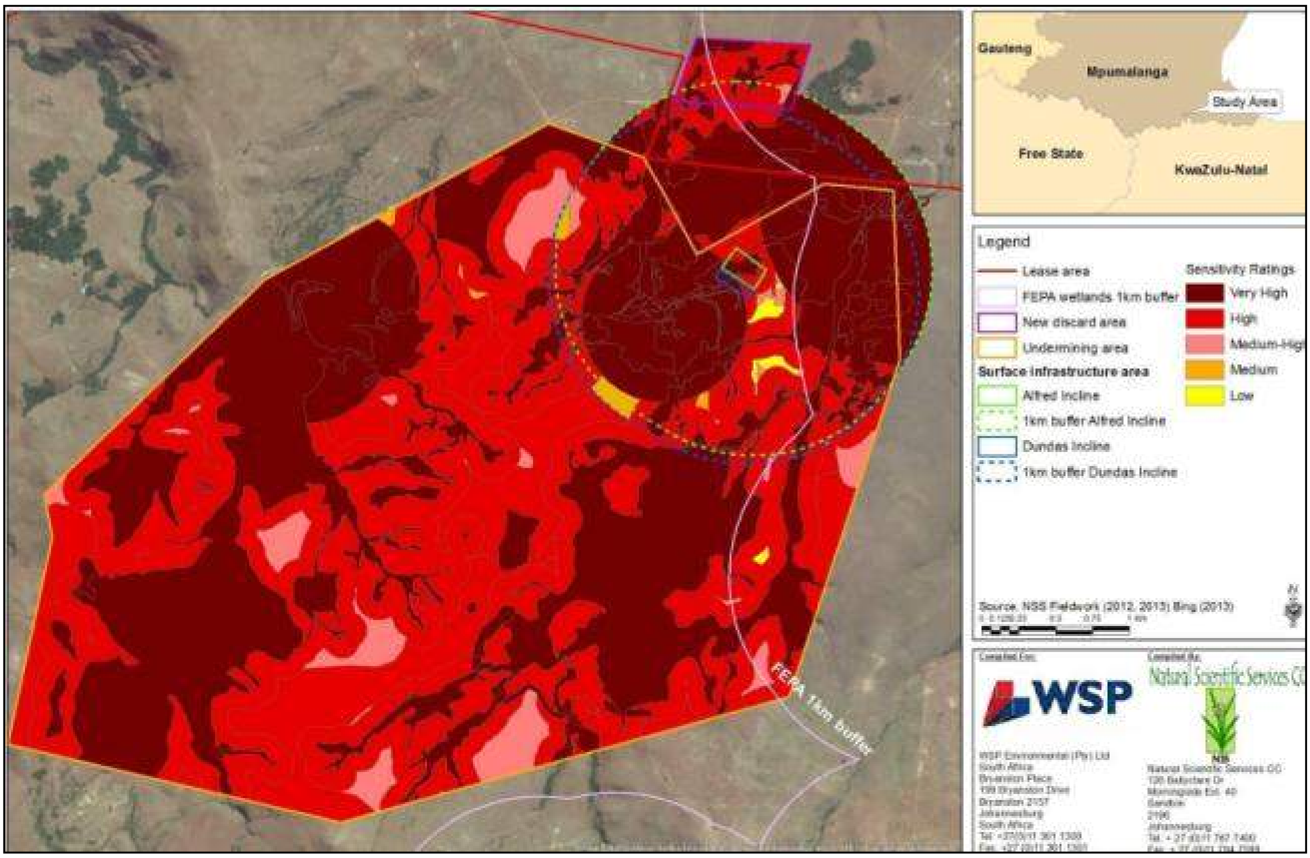

Figure 8-26: proposed Yzermyn Underground Coal Mine Project Overall Biodiversity Sensitivity Map

All four Sensitivity Maps indicate that the proposed Yzermyn Underground Coal Mine Project is situated in a sensitive and conservation important area, and correspond with the MTPA's (2013) Mpumalanga Biodiversity Sector Plan, and the DEA et al's (2013) Atlas of Sensitive Areas for Mining. These combined findings suggest that the proposed Yzermyn Underground Coal Mine Project is flawed.

The sensitivity maps should guide the development of the proposed Yzermyn Underground Coal Mine, where:

- Disturbances should preferentially occur in Low sensitive areas;
- Very High sensitive areas must remain undisturbed;
- High sensitive areas should be subject to limited disturbance and rigorous mitigation;
- Medium sensitive areas may be disturbed if mitigation measures are implemented; and
- Low sensitive areas may be disturbed with minimal mitigation.

8.8.4 Impacts Identified during the Study

Six significant potential impacts were identified for biodiversity. These impacts are anticipated to occur within all the development phases of the proposed Project. A description of these impacts is provided below.

8.8.4.1 Impact 1: Construction of Infrastructure and Resultant Loss of Habitat and Species

Construction of the proposed surface infrastructure will result in complete removal of vegetation and levelling of the area. The plant area will be paved, a cut-off trench will be constructed around the surface infrastructure footprint, and shafts will be created through blasting. The impact will be long-term as it will continue from the construction phase until decommissioning.

Flora

The proposed surface infrastructure footprint will result in direct loss of the following vegetation communities:

- Exposed Rocky Areas (0.65 ha)
- *Andropogon – Helichrysum – Bulbostylis* seasonal seeps (12.36 ha)
- *Andropogon – Hyparrhenia* temporary seeps (28 ha)
- *Hyparrhenia – Cymbopogon – Monocymbium* Mid- to Upper slopes (34.3 ha)
- Alien bushclumps (4.62 ha)
- Cleared Alien bushclumps (1.25 ha)

The loss of these communities will result in a loss of CI plant specimens and small populations. Seventeen CI plant species were recorded within the vegetation communities to be directly lost by the surface infrastructure. Two of these are listed by the TSP as Declining due mainly to habitat destruction: *Boophone disticha* (Tumbleweed/Gifbol) and *Crinum bulbispermum* (Orange River Lily). Endangered, Vulnerable, Rare and other Declining plant species, which have been recorded on nearby farms, may also occur in the footprint and would increase the overall Significance of this impact. Some of the species are rarely recorded mainly because they are inconspicuous in nature, unless in flower. Flowering seasons are either very short or in times when NSS was not in the field.

Fauna

Removal of vegetation for proposed surface infrastructure will cause direct mortality of small, fossorial, and other, less mobile animals and, more importantly, loss of foraging habitat for various fauna including several CI species such as:

- Resident breeding pairs of the Vulnerable White-bellied Korhaan (*Eupodotis senegalensis*), Vulnerable African Gras-owl (*Tyto capensis*) and Near Threatened Secretary Bird (*Sagittarius serpentarius*). Adult birds could fly away from the surface infrastructure area, but chicks would be abandoned, and because of increasing habitat loss, displaced birds might not find suitable habitat that is unoccupied by conspecifics.
- The provincially Near Threatened Cape Grass Lizard (*Chamaesaura anguina anguina*), which was found on multiple occasions in the footprint area, and which is unable to move across cleared, compacted surfaces (Alexander, 2009). These present a significant barrier to individual lizards and, consequently, development of surface infrastructure will fragment the local population. Lizards, which are not killed when vegetation is cleared, would most likely be confined to remaining fragments of suitable rocky grassland habitat because of this species' poor movement capacity. Some displaced or dispersing individuals might not find suitable habitat that is unoccupied by conspecifics.

Wetlands and Aquatic Ecology

The direct loss of wetland seeps and paving of the plant area will cause:

- A change in the water distribution and retention patterns of downstream wetlands. A cut-off trench will be installed around the plant area. The cut-off trench will collect clean water, which will then be returned to the receiving environment. This collection and release of clean water will result in a change in the water distribution and retention patterns of the wetlands. The release of water into the catchment could result in an increase in flood peaks and potential erosion.
- A decline in water inputs into the adjacent river and associated channelled valley bottom wetlands. Presumably, water collected in the surface infrastructure footprint will be dirty, and not returned to the receiving environment. Major impacts associated with the decline in water inputs are discussed further on.
- A loss in the eco-system services provided by these seep wetlands, which include the maintenance of biodiversity, erosion control, and the provision of natural resources.
- An encroachment into the required 1 km buffer around adjacent wetland FEPAs. In accordance with the FEPA guideline documents, no mining is to take place within a 1 km buffer of any wetland/riverine FEPA (Driver et al. 2011)

8.8.4.2 Impact 2: Decline in Water Inputs & Resultant Deterioration in PES and Functionality

This impact was largely assessed using the findings of the groundwater assessment by WSP (2013). The decline in water inputs will be as a result of mine dewatering and the proposed abstraction of water from boreholes CBH2D, CBH3S and CBH7S to supplement the water supply needed for the washing plant. Dewatering activities will take place during the construction and operational phases of the proposed mine, with the impacts associated with de-watering still occurring into the closure phase (until the underground mine voids have filled).

During the construction phase local dewatering of the aquifer will occur around the adit. The cone of depression is expected to be steep around the adit and will not extend more than 500 m away. Limited groundwater will seep into the shaft and boreholes, but this flow will most probably be sealed off during construction of the adit walls. The construction phase is expected to be short-term and the impact is therefore assessed as moderate in comparison to the operational impact. The main impact associated with the decline in water inputs will be due to the dewatering activities and will occur during the operational phase (approximately 15 years) and post-closure (20-50 years after mining ceases and the groundwater levels recover).

Wetlands

The groundwater model has indicated that during the operational phase the extent of the cone of depression on both the shallow weathered and deeper fractured rock aquifers will probably have a significant impact in the immediate vicinity of the mining operations, mainly due to the depth of mining. Groundwater levels in the shallow aquifer may be lowered by up to 10 m in the southern section of the underground workings where mining will be deepest, whilst the deeper aquifer will be lowered up to 55 m during years 11-16 of mining. This lowering in groundwater level will have a negative impact on wetlands fed by the shallow aquifer and the springs within the cone of depression. These springs are one of the main sources of water for the wetlands in the area, supplying water during the drier winter months when the wetlands are not fed by rainfall. Drawdown in the groundwater level of more than 5 m is expected to reduce or dry up fountains, thus affecting much of the central part of the target area. In areas where the drawdown will be greater than 10 m the likelihood of fountains drying up will be much greater. In addition to the fountains a number of the wetlands are fed by groundwater seepage from the shallow weathered aquifer. Since groundwater feeds the wetlands, the lowering of groundwater levels will result in reduced seepage and possibly in drying of the wetlands. This impact will be seasonal, with the most significant effect on wetlands occurring during the dry season.

The decrease in water input, to the wetlands within the study area and surrounds, and the resultant reduction in flow and potential drying up of wetlands will have a HIGH significance on Biodiversity as a minimum of 40% of the underground mining area and surface infrastructure footprint area constitutes wetland habitat. The impact will also extend into and beyond the greater mine lease area. If one uses the same approach of approximately 40% of the area being wetland, this will equate to the loss or deterioration of between 2,000 and 3,000 ha of wetland habitat. It is uncertain whether the drawdown cone also extends into the quaternary catchments V31A and W42A (as the groundwater model did not extend into these catchments. According to information obtained from a peer review by Atha (2013), it is presumed that the deeper aquifer may be confined to fractures, faults and intrusive boundaries. It is anticipated that the near horizontal sedimentary bedding planes alternating with sandstone and shale lithologies along dolerite sills may result in impervious strata. Therefore, the interaction between the quaternary catchments may differ. Further investigations should be undertaken to determine the groundwater impacts within these catchments. From a national and provincial perspective this is HIGHLY significant as it will result in:

- The loss or deterioration of wetlands in areas that are formally Protected and of Highest Biodiversity Importance according to the Mining and Biodiversity Guideline.
- The loss or deterioration of the wetlands will extend beyond the study area and will extend into the wetland FEPAs within the mine lease area and the wetland FEPAs and Wetland Clusters in the immediate surrounds. These systems are also the start of the catchment that feeds the Assegaai River FEPA, and a decline in water input will, therefore, result in a decrease in flow of this river system.
- The drawdown cone will result in the loss or deterioration of wetlands within the Irreplaceable habitat (Mpumalanga Biodiversity Sector Plan) to the south of the underground mining and lease areas.
- The drawdown cone will result in the loss of fountains and the resultant decline in water input for wetlands in the KwaMandlagampisi Protected Environment to the east, and the proposed Mabola Protected Environment.

Aquatic Ecology

Flow regime is regarded as a key driver of aquatic ecosystems, and change in flow regimes is the most serious and continuing threat to the ecological sustainability of rivers. Firstly, flow determines the physical habitat in stream, which in turn determines the biotic composition. The shape and size of river channels, the distribution of riffle and pool habitats, and the stability of the substrate are all largely determined by the interaction between the flow regime and local geology and landform. Therefore, the flow and physical habitat is a major determinant of the distribution, abundance and diversity of aquatic plants, macro-invertebrates and fish.

Secondly, aquatic species have developed life history approaches in direct response to their natural flow regimes. Change in flow can lead to recruitment failure and loss of biodiversity. Thirdly, preservation of the natural patterns of longitudinal and lateral connectivity is essential to the viability of populations of many riverine species. Loss of connectivity can lead to isolation of populations, failed recruitment and local extinction. Finally, the invasion and success of exotic species in rivers is made easier by the change of flow regimes. The impacts of flow change are manifest across broad taxonomic groups including riverine plants, invertebrates and fish (Bunn & Arthington, 2002).

Even though local aquatic systems may be perennial in nature, water abstraction for the proposed mining operation has the potential to change the flow of these resources during the construction, operation and de-commissioning phases, with the impacts extending into the closure phase. If the flow rates of local water resources are lowered, this will lead to changes in channel shape, sedimentation, water quality (discussed further on), aquatic habitat integrity, and faunal communities. Reduced flow rates will also hinder fish migration.

Potentially the worst-affected macro-invertebrate taxa would be those that require moderate to fast-flowing water such as the *Heptageniidae* (flatheaded mayflies), *Hydropsychidae* (caseless caddisflies), *Psephenidae* (water pennies), *Tricorythidae* (stout crawlers) and *Elmidae* (riffle beetles). Six of the fish species, namely *A. uranoscopus, B. brevipinnis, B. argenteus, C. emarginatus, L. polylepis* and *V. nelspruitensis*, have preferences to clear fast-flowing shallow and deep water in rocky habitats. Four of these species, *A. uranoscopus, B. brevipinnis, B. argenteus* and *C. emarginatus*, are intolerant to no-flow conditions. While two of these species i.e. *L. polylepis* and *V. nelspruitensis* are moderately intolerant to no-flow conditions. Therefore, if the flows in these systems change – these species will be lost in these rivers. This is a concern since three of these species are Near Threatened and the Mpumalanga Conservation authorities have indicated these species are of conservation importance in the area.

Flora

Approximately 42% of the vegetation communities identified within the surface infrastructure footprint and 40% within the mine lease area are moisture dependant. If the dewatering activities have a major effect on the wetland systems identified, these vegetation communities and the potential CI species found within these habitats will be affected and may change in structure in the long term.

Along with the large number of Protected CI species, TSP-listed species that would be affected include:

- *Gladiolus appendiculatus* (Vulnerable)
- Alepidea peduncularis (DDT) – located on site
- Bowkeria citrina (Rare)
- Eucomis montana (Declining)
- Gunnera perpensa (Declining) – located on site
- Sandersonia aurantiaca (Declining)

The decline in water input may also result in the loss of riparian vegetation. Riparian vegetation is a source of energy and nutrients which provides the organic matter needed to drive the stream food web and it provides cover for macro-invertebrates and fish populations (Tabacchi et al. 1998). The four fish species that have a high preference for overhanging vegetation include *B. anoplus, B. brevipinnis, P. philander* and *T. sparmanii* (Kleynhans et al. 2007). For the aquatic sampling sites assessed, the main impacts associated with the removal of riparian vegetation will be that of increased risk of erosion, habitat loss of aquatic species, and an increase in alien and invasive plant species.

Fauna

Deterioration or loss of wetland, stream and hydromorphic grassland habitat to changes in the species composition of terrestrial fauna and potential loss of wetland-dependant fauna species. Four CI animal species were observed on site, which would be significantly negatively affected by the predicted drop in ground water and resulting loss of wetland, stream and/or hydromorphic grassland habitat. These species include the Vulnerable African Grass Owl (*Tyto capensis*), the Near Threatened Half-collared Kingfisher (*Alcedo semitorquata*) and Serval (*Leptailurus serval*), and the Data Deficient Swamp Musk Shrew. Desktop research indicated that a large number of potentially occurring CI faunal species may be adversely affected by local loss of these habitats.

The Critically Endangered Rough-haired Golden Mole (*Chrysospalax villosus*) is found in four restricted localities in South Africa: three in Kwa-Zulu Natal and one in Mpumalanga (Bronner 2008). The mine lease area falls within the Mpumalanga population's known area of occurrence. This species, therefore, is highly likely to occur on site, and would be severely compromised by loss of its peripheral wetland habitat (Bronner, 2008). The Vulnerable Sclater‟s Golden Mole (*Chlorotalpa sclateri*) would be similarly threatened. The Endangered Oribi antelope (*Ourebia ourebi*) has been recorded on nearby farms (MTPA pers. comm. 2013), and is likely to occur near larger wetlands with suitable cover on site. The potentially occurring Near Threatened Highveld Golden Mole (*Amblysomus septentrionalis*), African Marsh Rat (*Dasymys incomtus*) and Data Deficient Sloggett's Vlei Rat (*Otomys sloggetti*) could also be adversely affected by local loss or deterioration of wetlands.

The Vulnerable Grey-crowned Crane (*Balearica regulorum*) has been recorded within the pentad to the south-west of the proposed Yzermyn Underground Coal Mine Project, and is likely to make temporary foraging bouts into the study area. The potentially occurring Vulnerable Spotted Shovel-nosed Frog (*Hemisusguttatus*), the provincially Vulnerable Natal Cascade Frog (*Hadromophryne natalensis*), the Near Threatened Karoo Toad (*Vandijkophrynus gariepensis*), and the Rare Aurora House Snake (*Lamprophis aurora*) would also suffer from loss or deterioration of local wetlands, streams or hydromorphic grassland.

8.8.4.3 Impact 3: Decline in Water Quality and Resultant Deterioration in PES and Functionality

The surface water quality baseline and IA report were not available at the time of compiling this IA. The information on water quality and potential contamination thereof has been largely based on the groundwater report (iLEH, 2013) and WSP groundwater reports, and professional experience.

The contamination of water will occur during the construction, operation, decommissioning and closure phases of the mine and will occur due to both surface and groundwater contamination. Based on the assumptions listed at the start of the impact assessment, the main source of surface water quality contamination is:

- The unlined discard dump and coal stockpile area[10].
- The occasional spill or leak from machinery used during construction (minor).
- Increase in sedimentation due to erosion and dust caused by the clearing of vegetation, increased traffic on the sand roads, etc.

Impacts on groundwater quality include:

- The occasional spill or leak from machinery used during construction (minor).
- Seepage from the discard dump during the operational phase of mining. The groundwater model indicates that the plume will move in a northerly and north easterly direction with some contamination moving in a southerly and westerly direction due to dispersion and the effect of increased recharge from the discard dump. During the operational phase, sulphate concentrations of up to 650 mg/l may occur in the shallow weathered aquifer in the immediate vicinity of the discard dump. Sulphate concentrations are expected to increase to above 60 mg/l in the vicinity of the Mawandlane River. Sulphate concentrations exceeding 100 mg/l are, however, not expected to extend more than 300 m from the discard dump during the operational phase. Post-closure sulphate concentrations in baseflow to the Mawandlane River may rise to above 2 000

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[10] Please note: further to the completion of the specialist studies, it was been confirmed that the coal product stockpiles will be located on impervious (concreted) surface. The discard dump will be located on compacted soil, clay and bentonie layer to reduce seepage.

mg/l in the long-term. *(It should be noted that following the completion of the specialist studies, WSP has recommended that a liner be incorporated into the design of the discard dump which will reduce the potential impact on surface and groundwater. This will need to be remodelled to assess the extent of potential contamination, however it is anticipated that the extent of the impact will be reduced)*.

- Potential acid mine drainage (AMD) once groundwater levels have recovered (20-50 years after mining ceases). Based on the findings of the groundwater model, possible decant points for this project, include the adit and the proposed ventilation borehole. As the position of the ventilation borehole is not yet available (WSP, 2013) this groundwater assessment was undertaken for possible decant from the adit. If the ventilation shaft is located at a lower elevation than the adit, decant may take place from the shaft rather than the adit.
- The potential of AMD was obtained from samples collected from the coal seams (Dundas and Alfred) as well as the roof and floor of both seams. Results indicate that samples of the coal and Alfred roof and floor are considered potential acid generating (PAG). PAG can be reduced from the occurrence of calcite veining and cement in soil and sandstone samples, however, according to Atha; no associated calcite has been encountered. No discard material was available for sampling, and should be undertaken once discard material is available. According to the source term assessment developed by Solution H^+ (2013), it is anticipated that the discard from the Dundas seam will have a lower acid rock drainage risk than discard from the Alfred workings. Coal seams should be washed separately. Water in the underground workings will be affected by the coal seam roof and floor rocks. Based on the findings of the samples analysed, water in the Dundas workings is not likely to be significantly affected by acid generation. However, water in the Alfred workings will be affected. It is recommended that water is kept separate for as long as possible. Furthermore, the sulphide sulphur oxidation in coal stockpiles is likely to lead to poor quality runoff, although this will be moderated from lining of the stockpiles and potential of calcite content in the coal. AMD will have the potential to impact on the Assegaai River, as the proposed project is located in the headwaters of the Usustu River Catchment.
- The predicted quality of the decant is included in **Appendix C: Geohydrological Impact Assessment**.

In terms of biodiversity, both fauna and flora are exposed to surface and groundwater contamination as the wetlands are fed by both the shallow weathered aquifers and the deep fractured aquifers. Any contamination within these aquifers will therefore impact on the surface water quality downstream. This contamination will impact on the PES of the wetlands and the eco-services the wetland can provide, the main one of which is the maintenance of Biodiversity.

<u>Aquatic Ecology</u>

According to Dallas & Day (2004) great changes in water quality (WQ) will gradually change the constituent species of aquatic biotic communities until these are no longer recognisable. The changes include:

- A shift in the physical position of a community of aquatic organisms.
- The introduction or loss of key species.
- Reduction in diversity as a result of increases in the concentration of toxins.
- Reduced ecosystem functioning.

According to Dallas & Day (2004), severe deterioration in WQ can lead to a dramatic decrease in aquatic biota and ceased aquatic ecosystem functionality.

The macro-invertebrates families that are sensitive to WQ changes are *Heptageniidae, Baetidae* (>2 sp), *Athericidae, Psephenidae, Chlorocyphidae, Leptophlebiidae Tricorythidae, Chlorolestidae* and *Elmidae* (Thirion, 2007). If the WQ changes, there will be a decrease in these macro-invertebrate families which will lead to a decrease in food supply for the fish species in these rivers. In addition, four of the fish species, namely *A. uranoscopus, B. argenteus, B. brevipinnis, C. emarginatus*, prefer good WQ and are intolerant to modified WQ conditions. While *V. nelspruitensis* are moderately intolerant to modified WQ (Kleynhans et al. 2007). Therefore, if the WQ conditions in these systems are modified – these species will be lost in these rivers.

The impacts, of increased diesel, petrol and oil leaks from machinery used on site, on the aquatic environment are summarised in **Appendix C: Biodiversity Assessment**. The mining activities during the operational phase will also affect the WQ in terms of AMD, low pH and elevated levels of EC, TDS, salts and coal associated metals. The impact of these constituents on the aquatic environment are summarised in **Appendix C:**

Biodiversity Assessment. According to iLEH (2013), the sulphate concentrations in baseflow to the Mawandlane River may rise to above 2 000 mg/l in the long-term. First order groundwater baseflow calculations suggest a volume of around 27 m^3/d in the affected area. This will result in an annual salt load of approximately 20 t/a to the Mawandlane River. Potentially contaminated baseflow may also enter the tributary of the Assegaai River to the north of the discard dump. The average sulphate concentration along the affected area is expected to be above 1 500 mg/l in this river. Baseflow to the tributary is estimated to be around 19 m^3/d, which could result in a salt load of some 10 t/a to the tributary of the Assegaai River (iLEH, 2013). According to Kotze (2001) the ideal sulphate concentration for aquatic organisms is below 80mg/l. When sulphate concentrations are higher than 200 mg/l water becomes unacceptable for human consumption (DWAF, 1996). Therefore, if the concentrations increase to 1 500 mg/l in the tributary of the Assegaai and 2 000 mg/l in the Mawandlane River, water will become completely inhospitable and toxic for any aquatic organisms living in these rivers. Following the specialist study, it is recommended that lining be incorporated into the co-disposal discard dump. This model will need to be re-run in order to quantify the potential impacts associated with the discard dump.

Detailed impacts on aquatic environments are contained in Tables 4-4 and 4-5 in **Appendix C: Biodiversity Impact Assessment.**

Flora

If there is a decline in water quality, the downstream water resources including wetlands, may result in a change in vegetation structure and composition, as described for the previous impact.

Fauna

Terrestrial fauna may be exposed to contaminated surface water resources due to the unconfined nature of the deep fractured aquifer. Impacts of this contamination on faunal species can include aspects such as a decline in general health, reduction in fecundity rates and birth defects.

Two potentially occurring CI species in particular may be adversely affected by changes in water quality: the provincially Vulnerable Natal Cascade Frog (*Hadromophryne natalensis*) and the nationally Near Threatened Plain Stream Frog (*Strongylopus wageri*). Although the presence of either species could not be confirmed on site, suitable habitat exists and both have been recorded within the QDSs wherein the proposed Yzermyn Underground Coal Mine Project is situated. Both frog species are highly dependent on cool, clear, fast-flowing, rocky mountain streams.

The predicted increased sulphate and heavy metal concentrations as well as the increase in turbidity and sedimentation will adversely affect these and other frog species. Increased sulphate concentrations will result in the waters becoming more acidic while high metal concentrations often associated with coal mining are known to damage amphibian DNA resulting in deformations (Zocche et al. 2013). Increased TDS (a measure of turbidity) would decrease the clarity of water. These alterations in water quality would affect not only the two potentially occurring CI frog species, but a much wider spectrum of faunal taxa that utilize streams and wetlands, as described for the previous impact.

8.8.4.4 Impact 4: Alien Species Invasion and Resultant Impacts on Biodiversity

Alien plant species were found in varying degrees within the proposed surface infrastructure area, and included *Acacia mearnsii* (Black Wattle), *Acacia melanoxylon*, *Eucalyptus* and *Populus* species. There was a predominance of alien flora in the seeps associated with System 2. It is possible that these clumps were intentionally planted to provide a source of fuel wood for local communities. The remainder of the site, however, is relatively free from alien invasive plants. No alien animal species such as the Common Myna (*Acridotheres tristis*) and House Sparrow (*Passer domesticus*), were detected within the proposed Yzermyn Underground Coal Mine Project study area

New and existing alien species invasions are likely to be facilitated, especially during the construction of infrastructure, when people, vehicles, and building materials are brought onto site, and vegetation and soils are disturbed. Increased vehicle traffic on the local road network will also contribute to the introduction and spread of alien invasive taxa. Invasive species can negatively impact Biodiversity by:

- Spreading disease and parasites (e.g. the Black Rat, Rattus rattus).
- Displacing indigenous, including CI species.

- Transforming (i.e. degrading and fragmenting) terrestrial and aquatic habitat.
- Altering eco-system functioning and services.

8.8.4.5 Impact 5: Increased Erosion and Sedimentation and Resultant Impacts on Biodiversity

Erosion in the study area is currently limited to roads, cattle paths and some alien-infested areas, but sediment loads were low within the sampled aquatic systems. Increased traffic for the proposed mining project, especially at watercourse crossings on the dirt roads, is likely to cause significant erosion and increased sedimentation of aquatic systems. Dust, erosion and sedimentation are likely to be most severe during the construction phase when there is clearing of vegetation, sudden increased traffic on the roads, storage of topsoil, digging of foundations, blasting of shafts, etc.

Flora

Increased erosion will ultimately result in a change in plant species composition with a reduced water input into the wetland areas.

Fauna

Increased erosion could impact on terrestrial faunal communities through transformation (degradation) of grassland, wetland and riverine habitat.

Aquatic Ecology

According to Long et al. (1998), increased suspended sediment concentrations have the ability to impact on river size, flow volume, bed material and sedimentation rate. These can cause changes in in-stream conditions, loss of available habitat types downstream, and fragmentation of the general system. This in turn may result in population isolation, failed migration during flow events, increased crowding in available pools, increased competition, and local extinction of aquatic species. The impacts of increased sedimentation on aquatic systems are included in the detailed biodiversity report included in **Appendix C: Biodiversity Assessment**. Fish species that require clear water such as *A. uranoscopus, B. argenteus, B.brevipinnis, C. emarginatus* and *V. nelspruitensis*, would be severely negatively affected by increased sedimentation in local systems.

8.8.4.6 Impact 6: Sensory Disturbance of Fauna

Increased traffic, human activity, noise, vibration and lighting from mining operations will disturb a wide spectrum of fauna and may eliminate certain CI animal species from the area. This is because animals generally have very well-developed senses. Highly-sensitive animals may be frightened or disorientated by loud noises, bright lights, etc., and many animals feel threatened by humans. Some species may struggle to communicate if their calls or other behavioural displays cannot be seen or heard by conspecifics.

Of particular concern is the potential impact of noise and vibrations from surface and underground activities (such as blasting) on bats in the old mine adits. The two largest adits are situated 315 – 335 m outside the proposed surface infrastructure layout, and 180 – 300 m outside the proposed underground mining area. The old adits provide significant roosting habitat for the Endangered Swinny's Horseshoe Bat (*Rhinolophus swinnyi*), a large population of the Near Threatened Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*), and the Near Threatened Temminck's Hairy Bat (*Myotis tricolor*) and Natal Clinging Bat (*Miniopterus natalensis*).

In the absence of information that might suggest otherwise, this should be treated as a valid concern given that:

- Bats have exceptionally well-developed sensory systems, and cave-dwelling species are usually highly sensitive to disturbance of their normally dark and quiet roosting habitat (Monadjem et al. 2010).
- The Noise Assessment for the proposed Yzermyn Underground Coal Mine (Collett 2013) indicated that blasting will occur on a daily basis (Collett 2013), and certain operations will continue on a 24 hour basis. During construction and operation, “The highest noise levels are predicted at FH 04,” which is 315 – 415 m from the two largest old mine adits. Moreover, during operation, cumulative noise levels are predicted to exceed the SANS daytime and nightime guidelines at FH 04 and other locations in the study area.
- The old mine adits could cause vibrations and noise from surface and underground activities to resonate or amplify.

Several CI bird species, which have been recorded in the study area, are known to be intolerant of human and vehicle activity (DEC pers. comm. 2013). Due to noise and dust from the proposed mining surface activities and traffic, in particular, these species would likely avoid a wide radius of otherwise suitable habitat around the surface infrastructure footprint and road network for the life of the mine. Confirmed species most likely to be impacted include the Vulnerable White-bellied Korhaan (*Eupodotis senegalensis*), and the Near Threatened Black-bellied Bustard (*Lissotis melanogaster*) and Secretary Bird (*Sagittarius serpentarius*). Other species not detected onsite that could be affected include the Vulnerable Blue- and Grey-crowned Cranes (*Anthropoides paradiseus and Balearica regulorum*).

Lighting at night could negatively affect sensitive nocturnal fauna. Some species may return to the area after the mine has closed, but this is likely to be a slow process that may not see a return of the full spectrum of species once present.

8.9 Archaeology, Cultural and Heritage Assessment

The archaeological, cultural and heritage assessment was undertaken independently by Archeatnos in 2012. The summary of the reports is included below and the detailed assessment report in included in **Appendix C: Archaeological, Cultural and Heritage Assessment**.

8.9.1 Methodology

- Survey of literature;
- Field survey (conducted on 26 – 30 March 2012);
- Oral histories;
- Documentation review and evaluation; and
- Evaluation of Heritage sites. The evaluation of heritage sites is done by giving a field rating of each finding using the following criteria:
  - The unique nature of a site;
  - The integrity of the archaeological deposit;
  - The wider historic, archaeological and geographic context of the site;
  - The location of the site in relation to other similar sites or features;
  - The depth of the archaeological deposit (when it can be determined or is known);
  - The preservation condition of the site;
  - Uniqueness of the site; and
  - Potential to answer present research questions.

8.9.2 Assumptions and Limitations

The following conditions and assumptions have a direct bearing on the survey and the resulting report:

- Cultural Resources are all non-physical and physical man-made occurrences, as well as natural occurrences associated with human activity. These include all sites, structure and artefacts of importance, either individually or in groups, in the history, architecture and archaeology of human (cultural) development. Graves and cemeteries are included in this;
- The significance of the sites, structures and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. The various aspects are not mutually exclusive, and the evaluation of any site is done with reference to any number of these aspects;
- Cultural significance is site-specific and relates to the content and context of the site. Sites regarded as having low cultural significance have already been recorded in full and require no further mitigation. Sites with medium cultural significance may or may not require mitigation depending on other factors such as the significance of impact on the site. Sites with a high cultural significance require further mitigation;
- The latitude and longitude of any archaeological or historical site or feature, is to be treated as sensitive information by the developer and should not be disclosed to members of the public;
- All recommendations are made with full cognizance of the relevant legislation;
- It has to be mentioned that it is almost impossible to locate all the cultural resources in a given area, as it will be very time consuming. Developers should however note that the report should make it clear how to handle any other finds that might occur. In this particular case the area was very large and mountainous making it possible that certain areas may not have been surveyed fully. The vegetation cover in certain areas also is very dense making archaeological visibility difficult; and

- At the time of the site visit, no surface infrastructure design or defined adit location was available.
- Since this is a pre-feasibility study and information relating to the infrastructure of the mine is not available, it is not possible to give mitigation measures. However the importance of sites is indicated and possible mitigation measures are envisaged.

8.9.3 Findings of the Study

The findings of the study are detailed in **Table 8-8**. These sites are illustrated in **Figure 8-27**.

Table 8-8: Archaeological, Cultural and Heritage

Site	Description	Photograph
1	The site consists of two small circular structures made from stone. The stones are nothing more than a foundation and the size thereof is approximately 2,5 m in diameter. It may have been used for ritual initiation purposes during the Late Iron Age, but it also may have another, yet unknown function. **Significance: Medium** Based on its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	
2	The site consists of a semi-circular stone wall of approximately 4 m long and 0,5 m high. It is on a high vantage point and a flat stone on top gives the impression that it may have a defensive purpose. It is therefore suggested that it may be a fortification wall erected during the Anglo Boer War. **Significance: Medium** Based on its historic value, it has a general local significance and is therefore given a rating of Grade B. A phase II study is recommended. This should entail the drawing of the structure after which it may be demolished.	
3	This is a Late Iron Age/ Historical structure. It is a circular stone enclosure used for keeping cattle. The structure is approximately 30 m in diameter and the walls still 0,5 m high. Since no other structure is found nearby, this is a cattle outpost. **Significance: Low** Based on its low cultural significance, it is not considered unique; it has a general local significance and is therefore given a rating of Grade C. This report is seen as ample mitigation and it may therefore be demolished during site development.	
4	This is another Late Iron Age/ Historical site consisting of one circular stone wall. The structure is approximately 30 m in diameter and 0,30 m high. Again this is probably a cattle outpost. It is situated in one of the saddles between the high ridges.	

Site	Description	Photograph
	Significance: Low Based on its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	
5	This is another Late Iron Age/ Historical site consisting of one circular stone wall. The structure is approximately 20 m in diameter and 0,30 m high. Again this is probably a cattle outpost. It is situated in one of the saddles between the high ridges and reasonably close to sites 4 and 6. **Significance: Low** Due to its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development	
6	This is a Historical site consisting of a rectangular enclosure. The structure has measurements of approximately 6 x 4 m and 0,80 m high. Again this is probably a cattle outpost. It is situated in one of the saddles between the high ridges and reasonably close to sites 4 and 5. **Significance: Low** Based on its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	
7	This is another Late Iron Age/ Historical site. It consists of one circular stone wall with a diameter of about 3 m and 0,50 m high. This is a hut most likely used by the cattle herder at one of these outposts (it is reasonably close to these). **Significance: Low** Based on its historic and social value, it has a general local significance and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	

Site	Description	Photograph
8	This is another Late Iron Age/ Historical site consisting of a circular stone walled enclosure. The structure has a diameter of approximately 25 m and 0,50 m high. Again this is probably a cattle outpost. **Significance: Low** It has a general local significance based on its historic and social value and is therefore given a rating of Grade B. This report is seen as ample mitigation and it may therefore be demolished during site development.	
9	This is a small grave yard consisting of at least six graves. It is found at the site of a local homestead. The graves are stone packed and have no headstones or information. **Significance: High** These graves are of a local significance and are therefore given a rating of Grade IIIB. It may therefore be mitigated. There are two options when dealing with graves. The first would be to fence it in and write a management plan for the preservation thereof. This option will come into play if there is no direct impact on the graves. It should be kept in mind that there always is a secondary impact on graves since families may not have access thereto once a mine comes into operation. The second option is to have the graves exhumed and the bodies reburied. This option is preferred when graves cannot be avoided by the development. Before exhumation can be done a process of social consultation is needed in order to find the associated families and obtain permission from them. For graves younger than 60 years only an undertaker is involved in the process, but for those older than 60 years or with an unknown date of death, an undertaker and archaeologist should be involved.	
10	This is another Late Iron Age/ Historical site. It consists of two structures. The first one is similar to the hut remains (site 7) made of stone. The second one consists of a circular stone walled structure with an L-shaped wall attached thereto (second figure in this block). This first structure is a hut most likely used by the cattle herder at the outposts. The second is the cattle kraal linked thereto. **Significance: Medium** It has a general local significance based on its historic value and is therefore given a rating of Grade B. A phase II study will be needed if the site is to be demolished. This would entail drawing a plan of the site.	

Site	Description	Photograph
		
11	This is the ruins of a house and outbuildings from the Historical period. It is found within a wattle and eucalyptus plantation and may therefore possibly be linked to the forestry history of the area. There are two main structures, the first being a house and the second a rondavel. The structures are built from stone. **Significance: Low** It has a general local significance based on its historic value (as it is not considered unique) and is therefore given a rating of Grade C. This report is seen as ample mitigation and it may therefore be demolished during site development.	
12	The site consists of stones packed in an L-shape. The function thereof is unknown, but it may have something to do with the outline of a farm road. **Significance: Low** It has a general local significance based on its historic value and is therefore given a rating of Grade C. This report is seen as ample mitigation and it may therefore be demolished during site development.	
13	This is a recent site inside of the riverbed of one of the streams in the surveyed area. It consists of stone walls which seem to have the function of damming up the river. According to the farmer this was done by the previous farmer (J Uys: Personal communication). **Significance: Low** It has a general local significance based on its historic value and is therefore given a rating of Grade C. This report is seen as ample mitigation and it may therefore be demolished during site development.	

Site	Description	Photograph
14	Site 14 consists of three structures. It is the remains of three buildings built from stone. All of these are connected to the early mining history of the area. Two of these probably are houses, but the third is quite large. It may be communal accommodation or it may have been used for offices. **Significance: Medium** It has a general local significance based on its historic and aesthetic value and is therefore given a rating of Grade B. The buildings should be documented if it is going to be demolished.	
15	Site 15 consists of a number of shafts and related features linked to the early mining history of the area. The shafts are cut into the rock face and seem to run in a horizontal direction. **Significance: Medium** It has a general local significance based on its historic value and is therefore given a rating of Grade B. This report is seen as ample mitigation in this regard and it may therefore be demolished if needed.	
16	This is a small grave yard (amatuna) consisting of at least six graves. Two of these are fenced in by a stone wall. It is found at the site of a homestead. This most likely means that one will find some family graves at all the homesteads in the surveyed area. The graves are stone packed and have headstones made from stone, but without any information. The graves therefore have an unknown date of death, but is seems as if the homestead was abandoned fairly recently. Therefore the graves are more than likely younger than 60 years. It should however be regarded as heritage graves until this can be confirmed. **Significance: High** These graves are of a local significance based on their cultural significance and are therefore given a rating of Grade IIIB. It may therefore be mitigated. There are two options when dealing with graves. The first would be to fence it in and write a management plan for the preservation thereof. This option will come into play if there is no direct impact on the graves. It should be kept in mind that there always is a secondary impact on graves since families may not have access thereto once a mine comes into operation.	

Site	Description	Photograph
	The second option is to have the graves exhumed and the bodies reburied. This option is preferred when graves cannot be avoided by the development. Before exhumation can be done a process of social consultation is needed in order to find the associated families and obtain permission from them. For graves younger than 60 years only an undertaker is involved in the process, but for those older than 60 years or with an unknown date of death, an undertaker and archaeologist should be involved.	
17	Site 17 is a rock shelter with rock paintings against the back wall. No sign of Stone Age artefacts have been found, but these may be concealed under a layer of soil and rodent droppings on the floor of the shelter. The whole rock face have been weathered and there probably were much more paintings originally. It also is possible that the paintings may have been damaged by people who tried to remove it. The panel consists of two sections. On the left hand side one figure is visible and on the right a number of at least eight figures. These are divided by red ochre lines in between. All the figures are monochrome – only red ochre has been used. The figure on the left hand side may be that of a woman. Rock art are usually linked to the San people. It dates to the Late Stone Age. **Significance: High** Every rock art site is unique. The painting has a local significance due to its aesthetic, historical, scientific and social value and is therefore given a rating of Grade IIIB. It may therefore be mitigated. (Normally a site such as this one would be given a rating of Grade IIIA. However, this site is exposed to such an extent that the rock art will not last for very long.) It should therefore be mitigated by having it documented by drawing thereof. It should however never be demolished on purpose (the site should be avoided) and should be preserved as long as natural factors allow.	 
18	This is another area containing a number of shafts and related features linked to the early mining history of the area. The shafts are cut into the rock face and seem to run in a horizontal direction. **Significance: High** The site has a high cultural significance based on its historic and scientific value. The site is given a higher grading as site no 15 for two reasons. Firstly the site is aesthetically more pleasing and accessible which means it should be much easier to utilise for research purposes. Secondly some artefacts close to the entrance were found indicating that this particular shaft dates back to the late 19^{th}/ early 20^{th} century.	

Site	Description	Photograph
	The site receives a field rating of provincial significance, meaning Grade II. The site may therefore not be demolished and should be managed as part of the provincial estate.	

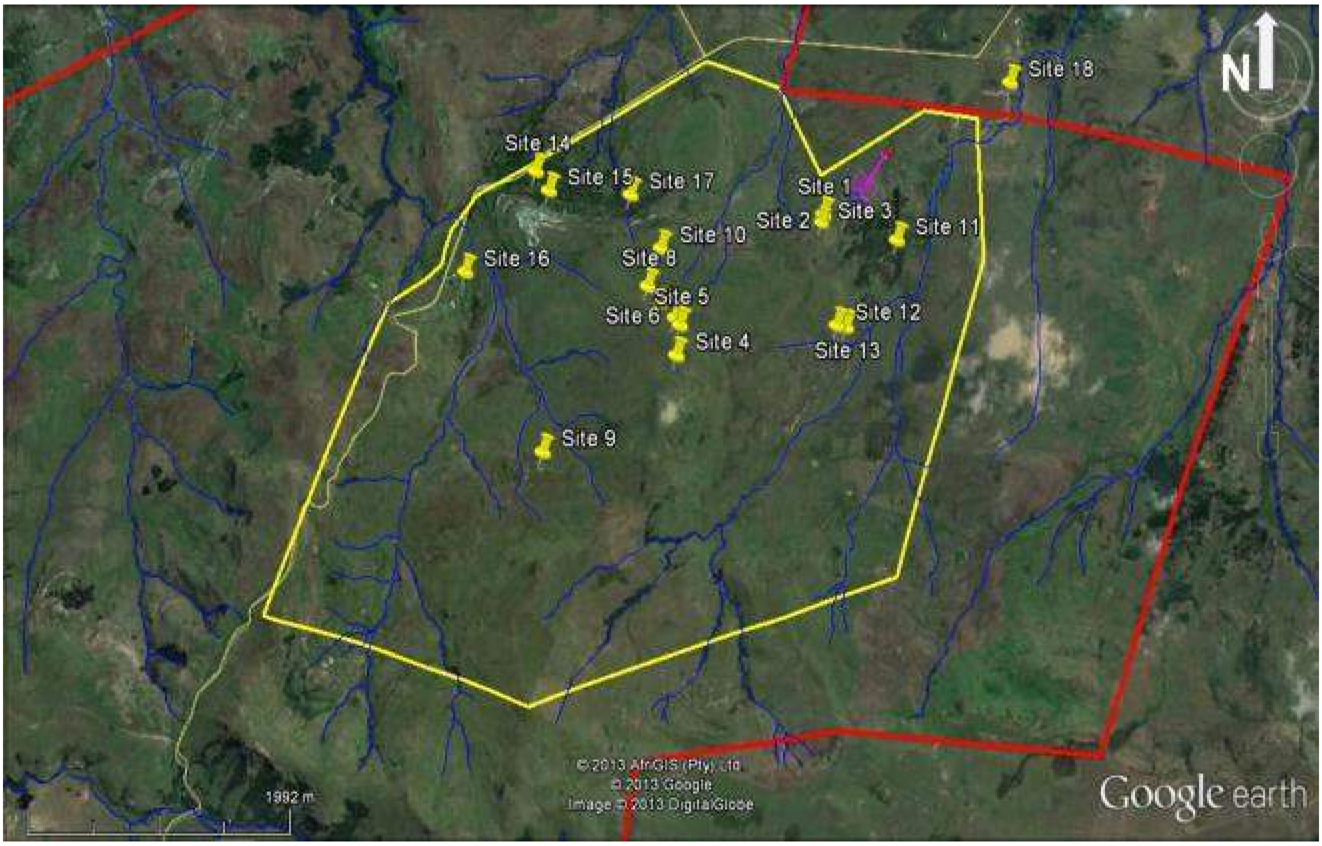


Figure 8-27: Aerial Image indicating Sites of Archaeological Importance (Source: Archaetnos, 2012)

8.9.4 Impacts Identified with the Study

Sites of archaeological, cultural and heritage significance has been documented within the target area and surrounds (Archaetnos, 2012). Construction activities, as well as the influx of construction personnel, could damage, deface or remove the sites located within close proximity to the construction site. This includes the following sites:

- Site 1: Two small circular structures made of stone, which may have been used for ritual initiation purposes during the Late Iron Age, but could also serve another, unknown function;
- Site 2: Semi-circular stone wall that, due to its high vantage point, could have been used for defensive purposes during the Anglo Boer War;
- Site 3: Circular stone enclosure, presumably used for keeping cattle (cattle outpost); and
- Site 11: Ruins of a house and outbuildings and is possibly linked to the forestry or mining history of the area.

Additional sites were identified within the target area, however, due to the distance from the construction site these sites are not at risk.

However, the following sites were noted to be of high significance (Archaetnos, 2012) and the impact of the construction phase on these sites will need to be carefully evaluated. The sites include:

- Site 9: Small graveyard consisting of at least six graves. No information of the occupants, date of death, etc. are available;
- Site 16: Rock shelter comprising rock paintings against the back wall. It is presumed that this rock art can be linked to the San people and potentially dates to the Late Stone Age;
- Site 17: This is a small grave yard at the site of a local homestead; and
- Site 18: Historic mining adits, which can be linked to the mining history of the area.

8.10 Visual Assessment

The visual impact assessment was undertaken independently by VRM Africa. The summary of the reports is included below and the detailed assessment report in included in **Appendix C: Visual Impact Assessment.**

8.10.1 Methodology

The process that VRM Africa follows when undertaking a VIA is based on the United States Bureau of Land Management's (BLM) Visual Resource Management method. This mapping and GIS-based method of assessing landscape modifications allows for increased objectivity and consistency by using a standard assessment criteria and involves the measurement of contrast in the form, line, texture and colour of the proposed landscape modification brought about by a proposed project, against the same elements found in the existing natural landscape (BLM. USDI. 2004).

The first step in the VIA process is determining the existing landscape context. A regional landscape survey is undertaken, which identifies defining landscape features that surround the site of a proposed development, and sets the scene for the VIA process to follow. These features, also referred to as visual issues, are assessed for their scenic quality/worth. A VIA also assesses to what degree people, who make use of these locations (e.g. a nearby holiday resort), would be sensitive to change(s) in their views, brought about by a proposed project (e.g. a mine). (Assessment undertaken up to this point falls within the ambit of the Field Study.)

These people are referred to as receptors and are identified early on in the VIA process. Only those sensitive receptors who qualify as Key Observation Points (KOPs) by applying certain criteria, are used to measure the amount of contrast generated by changes caused by proposed project activities, against the existing landscape (i.e. visual impact).

Visibility is sub-divided into three distance zones based on relative visibility from travel routes or observation points. Proximity to surrounding receptors is evaluated in terms of these distance buffers: foreground zone is less than 6km, background zone is from 6 to 24 km, and seldom seen (beyond 24 km) has no receptors. Viewshed maps are generated that indicate the overall area where the proposed project activities would be visible, and in which distance buffer zone the receptors fall.

The landscape character of the proposed project site is then surveyed to identify areas of similar land use and landscape character. These areas are evaluated in terms of scenic quality (landscape significance) and receptor sensitivity to landscape change (of the proposed site) in order to define the visual objective for the proposed project site. The overall objective is to maintain a landscape's integrity, but this can be achieved at varying levels, called VRM Classes, depending on various factors, including the visual absorption capacity of a site (i.e., how much of the proposed project would be "absorbed" or "disappear", into the landscape). The areas identified on the proposed site are categorised into these Classes by using a matrix developed by BLM Visual Resource Management, which is then represented in a visual sensitivity map. (Assessment undertaken up to this point falls within the ambit of the Baseline Study).

The proposed project activities are then finally assessed from the KOPs around the site to see whether the visual objectives (VRM Classes) defined for the site, are met in terms of measuring the potential change to the site's form, line, colour and texture visual elements, as a result of the proposed project (i.e. are the expected changes within acceptable parameters to ensure that the visual character of the landscape is kept intact and, if not, what can be done by the Atha to ensure that it is). Photo montages are generated to represent the expected change in the views, as seen from each KOP and, if class objectives are not met, to also show how proposed mitigation measures could improve the same views.

Using the impact assessment method provided by the environmental consultant, each proposed project activity is assessed in terms of its potential visual impact. This is based on the contrast rating which was undertaken from each of the surrounding receptors on whether the proposed activities meet the recommended visual objectives defined, to protect the landscape character of the area. Recommendations have been included and mitigation measures provided.

Two site surveys were undertaken on 1 and 2 May 2012 and 1 and 2 July 2013. During the survey seven different locations, which are associated with the various landscape types, were surveyed during the field study to determine scenic quality, receptor sensitivity to landscape change and distance from nearest receptors. Making use of the ASTGTM survey data, a terrain model was generated for the area around the proposed project activity and using the viewshed the receptors for each activity were identified.

8.10.1.1 Visual Resource Management Classes

The table below is utilised to define the VRM Classes that represent the relative value of the visual resources of an area:

- Classes I and II are the most valued;
- Class III represents a moderate value; and
- Class IV is of least value.

The Class I objective is to preserve the existing character of the landscape, where the level of change to the characteristic landscape should be very low, and must not attract attention. Class I is assigned to those areas where a specialist decision has been made to maintain a natural landscape.

The Class II objective is to retain the existing character of the landscape and the level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer, and should repeat the basic elements of form, line, colour and texture found in the predominant natural features of the characteristic landscape.

The Class III objective is to partially retain the existing character of the landscape, where the level of change to the characteristic landscape should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer, and changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

The Class IV objective is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the landscape can be high, and these management activities may dominate the view and be the major focus of the viewer's (s') attention.

This is undertaken making use of the matrix below developed by USA Bureau of Land Management (BLM) Visual Resource Management method as seen below, which is then represented in a visual sensitivity map (**Table 8-9**).

Table 8-9: VRM Matrix Table

		VISUAL SENSITIVITY LEVELS								
		High			**Medium**				**Low**	
SCENIC QUALITY	**A (High)**	II	II	II	II	II	II	II	II	II
	B (Medium)	II	III	III/ IV *	III	IV	IV	IV	IV	IV
	C (Low)	III	IV	IV	IV	IV	IV	IV	IV	IV
DISTANCE ZONES		Fore/middle ground	Background	Seldom seen	Fore/middle ground	Background	Seldom seen	Fore/middle ground	Background	Seldom seen

(A= scenic quality rating of ≥19; B = rating of 12 – 18, C= rating of ≤11)

* If adjacent areas are Class III or lower, assign Class III, if higher, assign Class IV

8.10.2 Assumptions and Limitations

- Although every effort to maintain accuracy was undertaken, as a result of the DEM being generated from satellite imagery and not being a true representation of the earth's surface, the viewshed mapping is approximate and may not represent an exact visibility incidence;
- The use of Google Earth Pro for mapping is licensed for use in this document;
- Some of the mapping in this document was created using Bing Maps (previously Live Search Maps, Windows Live Maps, Windows Live Local, and MSN Virtual Earth) and powered by the Bing Maps for Enterprise framework;
- The information for the terrain used in the 3D computer model on which the visibility analysis is based on is:
  - The Advanced Spaceborne Thermal Emission and Reflection (ASTER) Radiometer Data (ASTGTM_S2 3E014 and ASTGTM_S24E014 data set). ASTER GDEM is a product of Japan's Ministry of Economy, Trade and Industry (METI) and National Aeronautics and Space Administration (*NASA*) in USA. (ASTER GDEM. METI/ NASA. 2011).
- Determining visual resources is a subjective process where absolute terms are not achievable. Evaluating a landscape's visual quality is complex, as assessment of the visual landscape applies mainly qualitative standards. Therefore, subjectivity cannot be excluded in the assessment procedure (Lange 1994). The project deliverables, including electronic copies of reports, maps, data, shape files and photographs, are based on the author's professional knowledge, as well as available information. This study is based on assessment techniques and investigations that are limited by time and budgetary constraints applicable to the type and level of assessment undertaken. VRM Africa reserves the right to modify aspects of the project deliverables if and when new/additional information may become available from research or further work in the applicable field of practice, or pertaining to this study.

8.10.3 Findings of the Study

8.10.3.1 Visual Assessment of the Yzermyn Underground Coal Mine

Figure 8-28 depicts the landscape survey point locality assessed during the visual impact assessment. **Table 8-10** summarises the mine visibility, zone of visual influence and exposure. **Table 8-11** depicts the scenic quality associated with the proposed mine. The receptor sensitivity table is detailed in **Table 8-12**.

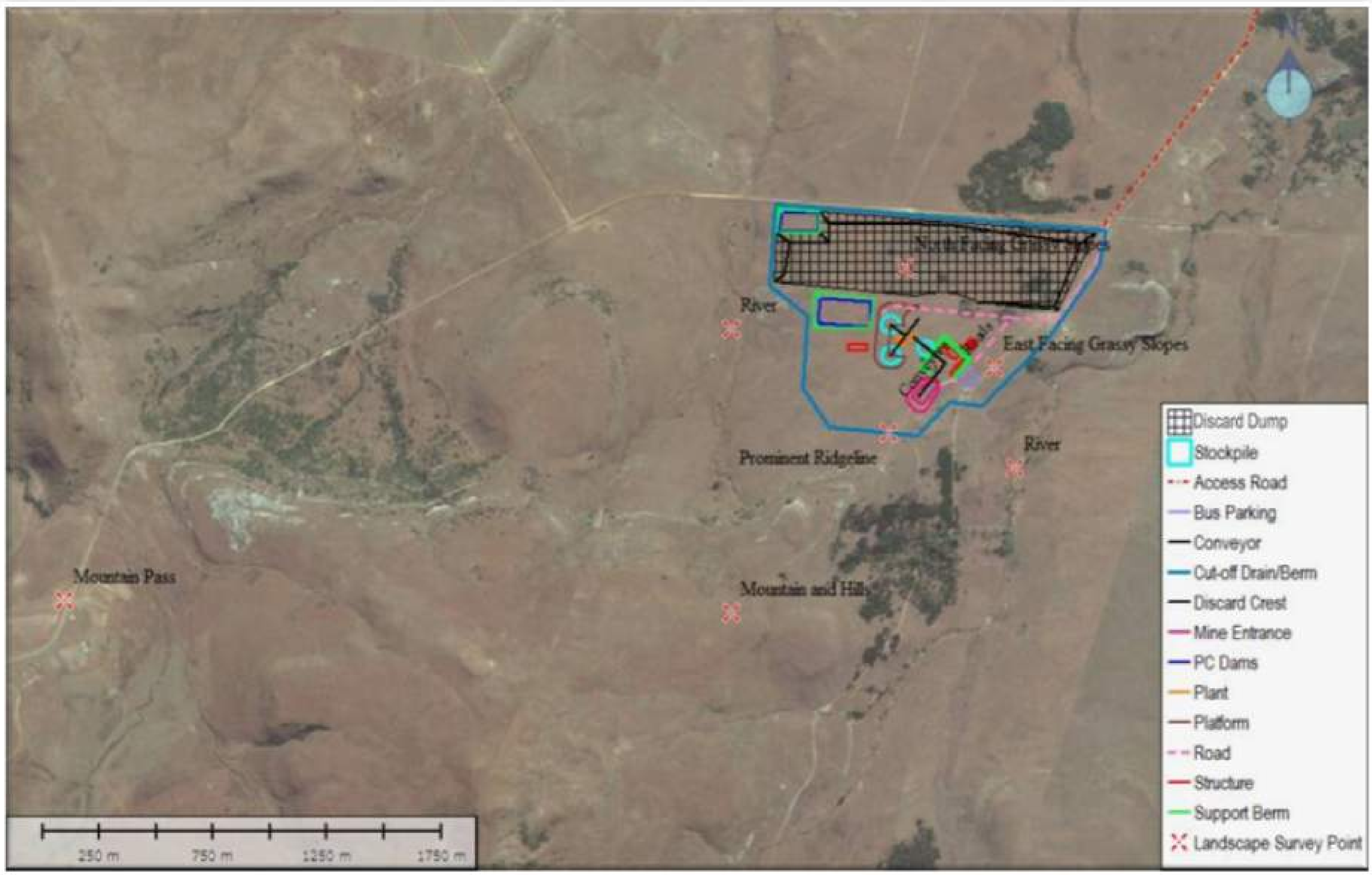


Figure 8-28: Proposed Site Landscape Survey Point Locality overlay onto Satellite Image Map

Table 8-10: Proposed Mine Visibility, Zone of Visual Influence and Exposure

Activity	Landscape	Land Use	Exposure	Viewshed	Zone of Visual Influence	Motivation
Mine: No Activity	Ridgeline	Agricultural	Moderate	High	High	These landscape features located to the south of the proposed mine site refer to the initial site proposal that was assessed during the scoping phase. Due to the remoteness of the location, surrounded by mainly rural agricultural landuse, receptors are reduced and receptor exposure was rated low. Recommendations in the scoping report was that these areas should not be utilised for mining activities as the viewshed generated from these areas would be extensive due to their prominent locations on the hillside. Due to the prominence, the ZVI would be higher as the viewshed would extend to the southern areas. These are more strongly associated with mountain and hill views.
Mine: No Activity	River	Natural	Moderate	High	High	
Mine: No Activity	Mountain	Natural	Moderate	High	High	
Mine: Plant, Workshops and Discard Dump	North facing grassy slopes	Agricultural	Moderate to High	Moderate to High	Moderate to High	Based on the recommendations of the specialist scoping reports, the proposed mine location was relocated to the north. This placed the site onto north facing grassy slopes with less visual prominence. The proposed mine plant and workshops are set back from the gravel road to the north which decreases the exposure to receptors. The discard dump is located adjacent to the gravel road to the north and receptors using this route would be subjected to high levels of exposure. However, it must be noted that the area is remote and predominantly restricted to limited agricultural traffic, moderating the exposure rating. The location of this new site is lower down the mountain on a wide convex foothill with a gentle slope to the north. The site is located below prominent ridgelines to the south-west and raised ground directly to the south and these two factors restrict views towards the mountain pass road. The mine viewshed is mainly north directional has a moderate to high coverage. The zone of visual influence of the site is rated moderate to high due to the northern focus of the viewshed where the terrain is characteristically undulating. This limits the direct influence of the mine to a smaller area around the proposed mine site. There is a small hill top section of the gazetted conservancy area that does fall within the proposed mine viewshed. These elevated locations are all located on mountain tops where access is restricted and hence have very few receptors.

Activity	Landscape	Land Use	Exposure	Viewshed	Zone of Visual Influence	Motivation
Mine: Bus Turning Point	East facing grassy slopes	Agricultural	Moderate	Moderate to High	Moderate	The proposed bus turning point is located on steep east facing grassy slopes. The landuse is agricultural and therefore exposure to receptors would be moderated. As the site is raised above the terrain to the north and east, the viewshed is described as moderate to high. The ZVI of the proposed activity would be moderated by the smaller footprint of the site and the limited number of receptors located within the northern and eastern viewsheds.

Table 8-11: Proposed Mine Scenic Quality

Activity	Landscape	Landform	Vegetation	Water	Colour	Adj. Scenery	Scarcity	Cultural Modification	Total	Scenic Quality	Motivation
Mine: No Activity	Prominent Ridgeline	3	2	3	3	4	3	0	18	B	The mountain, ridgeline and river areas have higher levels of scenic quality due to interesting landform, enhanced colour variation and a higher scenic quality value for the adjacent scenery. As these landscapes are key elements in the landscape, the scenic quality scarcity value is rated high. None of these landscapes have been significantly impacted by cultural modifications, other than minor access roads for the lower areas of the hill. Due to a change in mine planning, the proposed mine site is not located on the ridgeline and no activities are planned close to these mountain landscape features.
Mine: No Activity	River	3	3	4	3	4	4	0	21	A	
Mine: No Activity	Mountain	4	3	2	3	4	4	0	20	A	
Mine: Plant, Workshops	North facing grassy slopes	3	2	2	3	5	2	0	17	B	Land use for most of the low-lying areas is agricultural and utilised for cattle grazing. Scenic quality is moderated by less prominent and undulating terrain, which is more strongly associated with agricultural impacts to vegetation. There are more access roads and there is closer proximity to alien vegetation. Adjacent scenery is still rated high due to the hill features to the south. The overall scenic quality rating is rated moderate to high.
Mine: Bus Turning Point	East facing grassy slopes	2	2	2	2	5	2	0	15	B	

Table 8-12: Proposed Mine Receptor Sensitivity

Photo Point	Landscape	Type Users	Amount of use	Public interest	Adj. land users	Special areas	Receptor sensi-tivity	Motivation
Mine: No Activity	Ridgeline	H	L	H	M	H	H	Should mining activities take place in these areas, public interest would be high due to the prominence of these landscape features. They are located in the northern foothills of a mountainous region to the south which is associated with Wakkerstroom tourism. The importance of the rivers relates to water legislation and management for agricultural usage. Due to the importance of maintaining the landscape integrity of these features in relation to regional tourism and municipal planning, these three landscapes were rated high as special areas. These areas are significant in maintaining biodiversity and regional landscape integrity, therefore they were identified as Class I areas (No-Go) in the scoping phase. As there is no existing precedent for mining in this rural area, the resultant change in landscape character experienced by the rural agricultural users would be strongly felt as an industrial node precedent would be set. The overall receptor sensitivity to landscape change on these sites is rated high. However, due to the change in mine planning, no activities are planned in these areas.
Mine: No Activity	River	H	L	H	M	H	H	
Mine: No Activity	Mountain	H	H	H	M	H	H	
Mine: Plant, Workshops	North facing grassy slopes	M	M	M	M	M	M – H	These sites have a lower elevation which is more associated with the rolling and undulating terrain of the rural agricultural areas to the north. Receptor sensitivity to landscape change on these sites would be moderated as these sites are not directly associated with the hilly areas to the south. However, as there is no existing precedent for mining in this rural area, the resultant change in landscape character experienced by the rural agricultural users would be strongly felt. Local communities in Dirkiesdorp and Wakkerstroom could have a potential positive interest in the proposed mine as a source of potential employment which moderates the receptor sensitivity to landscape change at the site where the mine is proposed.
Mine: Bus Turning Point	East facing grassy slopes	M	L	M	M	M	M	

8.10.3.2 Visual Assessment of the Unpaved Road

The following illustration depicts the visual assessment undertaken at the proposed access route from the site, through Dirkiesdorp and onto the R543 (**Figure 8-29**). The following tables detail the visibility, zones or influence and exposure (**Table 8-13**), scenic quality (**Table 8-14**) and receptor sensitivity table (**Table 8-15**).

Figure 8-29: Proposed Dirkiesdorp Access Route Map

Table 8-13: Proposed Mine Visibility, Zone of Visual Influence and Exposure

Activity	Landscape	Land Use	Exposure	Viewshed	Zone of Visual Influence	Motivation
Access Road via the South	Mountain Pass	District Road	Moderate	High	High	This location point, although not a proposed project access route, was included to take possible increased traffic. This traffic would access the mine from the southern areas, via the old R543 route, a gravel road routed over hilly areas to the south. The district route has moderate exposure as the number of receptors is limited in this remote location. Due to the prominence of the route, the viewshed would be high. Due to the higher scenic qualities of the surrounding hilly area and increased traffic utilising the road, the proposed mine site would be more noticeable and would have a higher ZVI.
Access Road via North (Not applicable)	Road	District Road	High	Moderate	High	This access route would follow a gravel route more to the north and is not a preferred routing option (The preferred option favours access via the R543).
Access Road adjacent to Dirkiesdorp	Road	District Road	High	Moderate	High	The preferred access route is the district road via Dirkiesdorp. This is a gravel road currently utilised to access agricultural areas. It passes through the town of Dirkiesdorp where the exposure levels from residential and educational receptors would be high. Due to the undulating nature of the terrain, the viewshed would be moderated and views of the proposed coal trucks would be localised and moderate. Increased traffic would result in raised dust levels due to the gravel road. This would result in a higher ZVI.
R543 transport route to rail siding	Road	National Road	High	Moderate	Low	The R543 is a regional road linking Wakkerstroom in the south to Piet Retief in the north. The road is tarred and used by many vehicles and trucks. Exposure to tourist and other traffic on the road would be high. However, the undulating terrain along the route would moderate the viewshed of coal trucks. As the route is currently utilised as a transport road with many trucks, the ZVI of increased coal trucks using the road would be rated as low.

Table 8-14: Proposed Mine Scenic Quality

Activity	Landscape	Landform	Vegetation	Water	Colour	Adj. Scenery	Scarcity	Cultural Modification	Total	Scenic Quality	Motivation
Mountain Pass Road Access	Mountain Pass	4	3	3	3	5	4	0	22	A	Although this existing gravel road is currently in a bad state of repair and would not attract traffic, the route has a high scenic quality due to its location in the mountainous area. There are wide, open views of the surrounding hill and valley landscapes with limited cultural modifications. The road also meanders along the side of the mountain, through steep-sided slopes, which adds value to the landform and to the scarcity scenic quality attributes. The road crosses many mountain streams which increases value and colour variation through vegetation diversity. The scenic quality was rated high for this area.
Access Road via North (Not appl.)	Road	2	2	2	2	2	3	0	13	B	This road is located to the north of the site. The road runs from the mine site through to Piet Retief Siding. This route has been removed from the mine plan and is not applicable to the study.
Access Road adjacent to Dirkiesdorp	Road	2	1	2	1	2	1	-2	7	C	The scenic quality comments refer to the section of gravel road which links the proposed mine site to the town of Dirkiesdorp. The terrain is gently undulating and vegetation has been modified to create the road for local agriculture. The road crosses several streams which increases the scenic quality, with changes in vegetation along the river courses adding colour variation to the browns associated with the veld grasses. Adjacent landscapes are fairly fragmented by the undulating terrain and the clumping of alien vegetation (such as Acacia melanoxylon, Acacia mearnsii, Eucalyptus camaldulensis Dehnh). The landscape is common in both the localised and regional area. Cultural modifications along most of the road are rural agricultural in nature and include fences and small, clustered communities. Around the town the landscape becomes cluttered with ad hoc dwellings which increase contrasts of form, colour, texture and line. The scenic quality levels in this area are therefore lowered.

Activity	Landscape	Landform	Vegetation	Water	Colour	Adj. Scenery	Scarcity	Cultural Modification	Total	Scenic Quality	Motivation
R543 transport route to rail siding	Road	2	2	2	2	2	1	0	11	C	The route is aligned though gentle undulating landform with a medium to low scenic quality value. Vegetation has been altered for agriculture and together with the undulating landform, fragments the landscape. There are no obvious water features and alien vegetation is prevalent. Cultural modifications are mainly those of agricultural infrastructure, including some power lines and telephone lines with scattered farmsteads. The overall scenic quality was rated moderate to low along this stretch of road.

Table 8-15: Proposed Mine Receptor Sensitivity

Photo Point	Landscape	Type Users	Amount of use	Public interest	Adj. land users	Special areas	Receptor sensi-tivity	Motivation
Mountain Pass Road Access	Mountain Pass	H	L	H	H	H	H	Receptor sensitivities are higher due to the value that this route offers for existing or potential tourism expansion in the area. However, there is low usage of the area. There are high scenic qualities due to the elevated views and closed landscapes of the valley areas in conjunction with its close proximity to the tourist node of Wakkerstroom.
Access Road via North Not applicable)	Road	M	L	L	M	M	M	This road is located to the north of the site. The road runs from the mine site through to Piet Retief siding. This route has been removed from the mine plan and is not applicable to the study.
Access Road adjacent to Dirkiesdorp	Road	M	L	M	M	L	M	The road is directly adjacent to the town. Currently the road is gravel and vehicles travelling on the road generate dust for the residential area of the receptors. Public interest is higher due to high levels of exposure. Adjacent land users are agricultural whose sensitivity to the landscape modifications would be low as they would benefit from the increased access and improved road. There would be a change in land use associated with the mine and the upgrade to the road could also add value to local receptors.
R543	Road	M	H	L	M	M	L	The R543 would have low receptor sensitivity to the proposed increase in trucks to transport coal as the precedent for transport truck using the route already exists.

8.10.3.3 Visual Assessment of the Piet Retief Coal Siding

Figure 8-30 represents the visual locations assessed at the proposed Piet Retief Siding. The following tables detail the visibility, zones or influence and exposure (**Table 8-16**), scenic quality (**Table 8-17**) and receptor sensitivity table (**Table 8-18**).

Figure 8-30: Proposed Piet Retief Coal Siding Site Map

Table 8-16: Proposed Mine Visibility, Zone of Visual Influence and Exposure

Activity	Landscape	Land Use	Exposure	Viewshed	Zone of Visual Influence	Motivation
Piet Retief coal siding (Jindal)	Railway	Railway siding	Moderate	Moderate	Moderate to Low	Jindal siding is an existing, well established railway siding located in Piet Retief. The viewshed is moderated by localised tree screening in the area and it is contained in a lower lying area. The viewshed does include residential receptors, but they are located some distance away with moderate exposure to the site. As the site is a well-established coal siding, the influence of the expansion of the site is rated moderate to low.

Table 8-17: Proposed Mine Scenic Quality

Activity	Landscape	Landform	Vegetation	Water	Colour	Adj. Scenery	Scarcity	Cultural Modification	Total	Scenic Quality	Motivation
Piet Retief coal siding (Jindal)	Railway	2	0	2	1	2	1	-2	7	C	The site is used for loading coal at the existing railway line siding. The scenic quality is moderate to low as the area lies in close proximity to the town of Piet Retief, which is a timber and industrial node for the region. The scenic quality is lowered by the presence of existing coal stockpiles and trucks at Jindal railway siding.

Table 8-18: Proposed Mine Receptor Sensitivity

Photo Point	Landscape	Type Users	Amount of use	Public interest	Adj. land users	Special areas	Receptor sensi-tivity	Motivation
Piet Retief coal siding (Jindal)	Railway	H	M	M	L	L	M	The area where the proposed coal siding is located is in visual proximity to the upper middle income residential areas of Piet Retief. The current coal siding is partially screened from receptor views by screening trees. The townscape is industrial and the coal siding does already exist, but on a smaller scale than the proposed siding. The adjacent land use is agricultural and industrial. There is a river adjacent to the site which would need to be taken into consideration. Receptor sensitivity would be moderated by the existing precedent as long as the existing smaller scale remains.

8.10.3.4 Summary

The table below (**Table 8-19**) details VRM's assessment pertaining to the proposed Yzermyn Underground Coal Mine.

Table 8-19: Visual Table for Proposed Yzermyn Underground Coal Mine

Activity	VRM Class	Motivation
Mountain areas to the south	Class II	VRM Class II allows low levels of change to the existing landscape. The objective is to retain the existing character of the landscape where proposed activities may be seen, but should not attract the attention of the casual observer.
Mine: Plant, Workshops	Class III	VRM Class III allows for moderate levels of change to the existing landscape. The objective is to partially retain the existing character of the landscape where proposed activities may attract attention, but should not dominate the view of the casual observer. The proposed sites would have a moderate scenic quality. There would be higher rural agricultural receptor sensitivity due to the precedent that would be set should mining rights be granted. Although the Class III objective allows for landscape modification, mitigation would be required to ensure that the change in landscape character is contained as much as possible. Post mining landscapes should be returned back to a state that would not dominate the views of casual observer. This statement is supported by Gert Sibande District Municipality SDF which states that where major mining precincts coincide with high-potential extensive agricultural land and some of the ecological corridors it is essential that mining activity be concentrated within already affected areas, and be managed in such a way that the original agricultural/tourism value of the land is restored once mining activities close down. This would require that a proper Environmental Management Plan for mining activities in the District be put in place, and that it be properly implemented and continuously monitored. This is of critical importance within the proposed tourism and conservation belt, as some of the mining activities are located relatively close to the sensitive environments around Chrissiesmeer. (Gert Sibande District Municipality SDF. 2009)
Mine: Bus Turning Point	Class III	
Access Road adjacent to Dirkiesdorp	Class III	
R543 transport route to rail siding	Class III	
Piet Retief coal siding (Jindal)	Class III	Receptor sensitivities are lower as the existing land use is a coal siding. However, adjacent land user sensitivities would be higher due to closer proximity of the site to the residential area of Piet Retief. Overall the VRM Class is rated as Class III, because mitigation would be required to ensure that the local residential receptors are not exposed to higher levels of visual intrusion from the coal stockpiles, coal dust and movements of the trucks.

8.10.3.5 Key Observation Points

KOPs are defined by the Bureau of Land Management as the people (receptors) located in strategic locations surrounding the property that make consistent use of the views associated with the site where the landscape modifications are proposed. These locations are important in terms of the VRM methodology, which requires that the Degree of Contrast (DoC) that the proposed landscape modifications will make to the existing landscape is measured from these most critical locations, or receptors, surrounding the property.

To define the KOPs, potential receptor locations were identified in the viewshed analysis, and screened, based on the following criteria:

- Angle of observation;
- Number of viewers;
- Length of time the project is in view;

- Relative project size;
- Season of use;
- Critical viewpoints, e.g. views from communities, road crossings; and
- Distance from property.

Making use of the above criteria, the following KOP locations surrounding the proposed Yzermyn Underground Coal Mine were identified, as indicated in the map below (**Figure 8-31**). Please note that the findings of the KOPs associated with the unpaved road, R543 and Piet Retief Siding are detailed in **Appendix C: Visual Impact Assessment**.

- Mine Site KOPs:
  - Gravel Road Eastbound; and
  - Gravel Road Westbound.

The contrast rating, or impacts assessment phase, is undertaken after the inventory process has been completed. The suitability of landscape modification is assessed by assessing the degree of potential contrast from the proposed activity in comparison to the existing contrast created by the existing landscape. This is done by evaluating the level of change to the existing landscape by assessing the line, colour, texture and form, in relation to the visual objectives defined for the area. The following criteria are utilised in defining the DoC:

- None: The element contrast is not visible or perceived;
- Weak: The element contrast can be seen but does not attract attention;
- Moderate: The element contrast begins to attract attention and begins to dominate the characteristic landscape; and
- Strong: The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

As an example, in a Class I area, the visual objective is to preserve the existing character of the landscape, and the resultant contrast to the existing landscape should not be notable to the casual observer and cannot attract attention. In a Class IV area example, the objective is to provide for proposed landscape activities which require major modifications of the existing character of the landscape. Based on whether the VRM objectives are met, mitigations, if required, are defined to avoid, reduce or mitigate the proposed landscape modifications so that the visual impact does not detract from the surrounding landscape sense of place.

As a component in this contrast rating process, visual representation, such as photo montages are vital in large-scale modifications, as this serves to inform stakeholders and decision-making authorities of the nature and extent of the impact associated with the proposed project. There is an ethical obligation in this process, as visualisation can be misleading if not undertaken ethically. In this regard, VRM Africa subscribes to the proposed Interim Code of Ethics for Landscape Visualisation developed by the Collaborative for Advanced Landscape Planning (CALP) (Sheppard, S.R.J.,2005).

Figure 8-32, **Figure 8-33**, **Figure 8-34** and **Figure 8-35** show the photomontage of the anticipated visual impacts from the proposed Yzermyn Underground Coal Mine from the KOPs defined above. **Table 8-20** summarises the contrast rating table (view eastbound) and **Table 8-21** details the contrast rating from the westbound view.

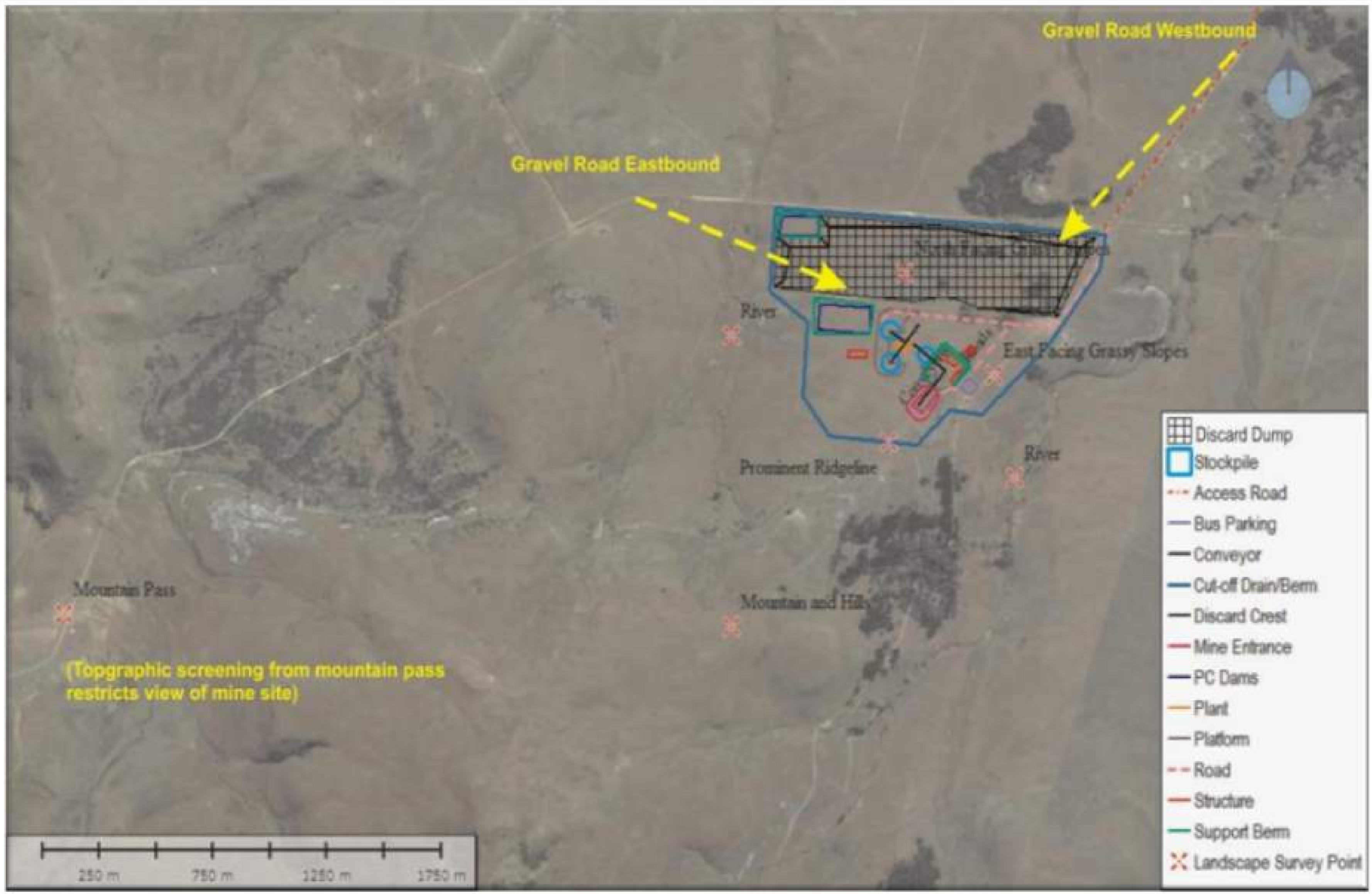


Figure 8-31: Mine Site Key Observation Point Locality Map

Figure 8-32: Photomontage of Existing View (Eastbound)

Figure 8-33: Photomontage of proposed Yzermyn Underground Coal Mine Visual Impact View (Eastbound)

Figure 8-34: Photomontage of Existing View (Westbound)

Figure 8-35: Photomontage of proposed Yzermyn Underground Coal Mine Visual Impact View (Westbound)

Table 8-20: Site Contrast Rating Table - Eastbound

KOP: GRAVEL ROAD EASTBOUND (MINE)							**Project:**		**Component:**
Impact Description	**Class**	**Form**	**Line**	**Colour**	**Texture**	**DoC**	**Degree of Contrast Motivation**	**Objective Met?**	**Mitigation**
Construction	III	S	M	S	S	M/S	There are no other man-made forms within this view, so all construction will generate strong contrast. Lines created will be mostly horizontal, hence only moderate contrast to the existing horizontal view. Colours and textures of man-made materials will be of a stronger intensity and visually of a darker tone, or reflective in nature, and hence will create a strong contrast to existing natural, mid tone and mid intensity colours (ochre's, browns, greens). There are no other greys similar to the discard dump in the view and the black of the coal will be of a much darker and even tone than other dark colours in the view.	No	The existing natural sense of place will be changed completely. Any landscape modifications must be visually contained using screening and continual rehabilitation of the discard dump. The change to the sense of place must be localised as much as possible. Dust controls must be continually implemented. Colour mitigation for structure walls painted earth tones with a grey hue and roof colour slate grey (same colour theme for all structures unless required otherwise for safety warning). Plants, pipes, conveyors and accessory works infrastructure to be painted mid-grey unless required otherwise for safety warning. Retaining walls to be brown in colour.
Operation	III	S	S	S	S	S		No	
Closure	III	M	W	W	W	W	The discard dump will remain, yet it echoes the basic shapes of the existing landscape (long, low, undulating), so only a moderate contrast is generated.	Yes with Mit.	All buildings and man-made infrastructure must be removed. The discard dump must be completed rehabilitated using local grasses.

(Key: N = None, W = Weak, M = Moderate, S = Strong, Mit = Mitigation)

Table 8-21: Site Contrast Rating Table - Westbound

KOP: GRAVEL ROAD WESTBOUND (MINE)							Project:		Component:
Impact Description	**Class**	**Form**	**Line**	**Colour**	**Texture**	**DoC**	**Degree of Contrast Motivation**	**Objective Met?**	**Mitigation**
Construction	III	S	M	S	S	M/S	There are no other man-made forms within this view, so all construction will generate strong contrast. Lines created will be mostly horizontal, hence only moderate contrast to the existing horizontal view. Colours and textures of man-made materials will be of a stronger intensity and visually of a darker tone, or reflective in nature, and hence will create a strong contrast to existing natural, mid tone and mid intensity colours (ochre's, browns, greens). There are no other greys similar to the discard dump in the view and the black of the coal will be of a much darker and even tone than other dark colours in the view.	No	The existing natural sense of place will be changed completely. Any landscape modifications must be visually contained using screening and continual rehabilitation of the discard dump. The change to the sense of place must be localised as much as possible. Dust controls must be continually implemented. Colour mitigation as for Gravel Road Eastbound.
Operation	III	S	S	S	S	S		No	
Closure	III	M	W	W	W	W	The discard dump will remain, yet it echoes the basic shapes of the existing landscape (long, low, undulating), so only a moderate contrast is generated. All modifications fall within the lower, middle ground and hence do not obstruct views of the hills behind.	Yes with Mit.	All buildings and man-made infrastructure must be removed. The discard dump must be completed rehabilitated using local grasses.

8.10.4 Impacts Identified with Study

8.10.4.1 Summary

Due to the potential risks associated with the cumulative visual impacts of the proposed mine, visual significance is defined as high. To mitigate this potential cumulative visual impact, should the proposed mine site receive authorisation, further expansion of the mine into the southern mine licence area should be subject to a Strategic Environmental Assessment (SEA). The SEA would need to assess the resilience and thresholds related to the greater Wakkerstroom area biodiversity and eco-tourism in order to make an informed regional decision on the suitability of mining around Wakkerstroom.

8.10.4.2 Construction Phase

- Mine plant, conveyors, stockpiles, workshop and isolated smaller structures as well as the office block and parking area:
  - Visual intrusion from cut and fill earthworks, plant structures with discordant colours;
  - Lights at night;
  - Movement of construction vehicles;
  - Changes to site and the surrounding area's visual sense of place.
- Adit entrance and adit platform
  - Visual intrusion from blasting and cutting of mine tunnel; and
  - Colour contrast from concrete supporting structures.
- Bus parking area
  - High levels of visual intrusion generated by cut and fill on steep sloping ground.
- Pollution control dam intrusion
  - Visual intrusion from earthworks and dam wall.
- Co-disposal discard dump intrusion
  - Earthworks and associated dust for removal of topsoil.
- Access roads
  - High levels of visual intrusion from dust from earthworks and moving vehicles;
  - Soil erosion along drainage lines; and
  - Clearing of the vegetation to create the road.

8.10.4.3 Operational Phase

- Mine plant, conveyors, stockpiles, workshop and isolated smaller structures as well as the office block and parking area:
  - Visual intrusion from black colours of the stockpiles;
  - Lights at night and pollution; and
  - Movement of loading trucks and vehicles.
- Adit entrance and adit platform

- Visual intrusion of tunnel head support structure;
- Windblown dust from transport of coal and discard; and
- Colour contrast from concrete supporting structures.

■ Bus parking area
- Visual intrusion from discordant colour reflections;
- Sunlight glint from parking vehicles and lights at night; and
- Movement of trucks and vehicles.

■ Pollution control dam intrusion
- Pollution of surrounding streams if dams overflow.

■ Co-disposal discard dump intrusion
- Visual intrusion from strong colour, form and texture change from the establishment of co-disposal discard dump; and
- Windblown dust.

■ Access roads
- High levels of visual intrusion from dust from moving coal trucks;
- Soil erosion on drainage lines; and
- Black coal dust from moving vehicles.

8.10.4.4 Closure Phase

■ Mine plant, conveyors, stockpiles, workshop and isolated smaller structures as well as the office block and parking area:
- Movement of vehicles and their lights at night;
- Removal of structures and wash plant; and
- Dust during decommissioning and removal of structures.

■ Adit entrance and adit platform
- Visual intrusion of tunnel head support structures; and
- Continued utilisation by illegal mining.

■ Bus parking area
- Movement of vehicles and their lights at night;
- Removal of structures and wash plant; and
- Dust during decommissioning and removal of structures.

■ Pollution control dam intrusion
- Pollution of surrounding streams if dams overflow or break, or are not removed.

■ Co-disposal discard dump intrusion
- Visual intrusion from strong colour, form and texture change from the establishment of discard dump; and windblown dust.

■ Access roads

- Not applicable as the tarred road would become a permanent feature serviced by the municipality.
- Visual scarring from disused unpaved access roads.

8.11 Traffic Impact Assessment

8.11.1 Methodology

- Site visits;
- Data collection;
- Assessment of existing traffic conditions;
- Trip generation, distribution and assignment;
- Future conditions;
- Access requirements;
- Preliminary assessment of existing road pavements; and
- Mitigation measures of surrounding networks.

8.11.2 Assumptions and Limitations

The assumptions used to generate the assessment are provided below:

- One heavy vehicle is equivalent to eight passenger car units;
- The construction plant will remain on site for the duration of the construction phase and the impact of the construction on the surrounding road network is therefore considered to be negligible;
- One empty truck will return to the proposed site for every loaded truck that departs from the proposed site;
- All employees will start working with the commissioning of the Project in 2016;
- The distribution between skilled, semi-skilled and unskilled staff will be 30%, 15% and 55% respectively;
- 10% of unskilled workers travel to and from the town of Dirkiesdorp, 10% of unskilled workers travel to and from the town of KwaSema and 80% of unskilled workers travel from other nearby towns;
- All private vehicles transporting employees to/ from the Project site are owned by the skilled employees, i.e. most private vehicle trips are expected during the day-shift;
- One person per private vehicle during the worst case scenario;
- Employees without private vehicles will use minibus taxis which can transport approximately 15 passengers;
- 80% of the skilled employees will work during the day shift (6:00 to 16:00), 15% during the night shift (15:00 to 01:00) and 5% during the dog shift;
- The employee trips, during the worst case scenario, would occur during the AM and PM peak hours of the background traffic;
- 10% of the unskilled workers will travel to and from Dirkiesdorp, 10% of unskilled workers will travel to and from KwaSema and the 80% of unskilled labours, all semi-skilled labourers and all skilled workers will travel to and from “other destinations” namely; Piet Retief (north) or Wakkerstroom and Volksrust (south). A 50:50 split between the north and south was assumed for trips to “other destinations”;

- As the day shift (6:00 to 16:00) and the night shift (15:00 to 01:00) overlap, it was assumed for a worst case scenario that the minibus taxis dropping employees off for the 15:00 shift will not wait for the 16:00 shift to leave and therefore each shift, day and night, will have their own set of minibus taxis;
- The dog shift staff to depart with the minibus taxis which drop off the day shift at 06:00;
- An annual growth rate of 3% for the background traffic;
- According to the South African Manual for Traffic Impact Studies (1), a development of this size requires an analysis for the base year, which has been assumed to be 2016 and a horizon year of 5 years;
- In the case of the intersection of the R543 and Vaalbank Road the speed to consider on the R543 is 60 km / h, the width of the R543 is assumed to be 7 m to 7.5 m and the design vehicle is assumed to be a single unit plus trailer (SU+T), according to TRH 17, Geometric Design of Rural Roads (3), the shoulder site distance at the intersection should be of the order of 225 m;
- The speed in the vicinity of the Piet Retief Railway Siding intersection is 60km / h, the width of the R543 is assumed to be 14 m to 14.5 m and the design vehicle is assumed to be a single unit plus trailer (SU+T);
- The average heavy vehicle is equal to three single-axle loads (E80's); and
- A loaded truck from the Project site is equal to 3.6 E80's and each of the empty, returning trucks, is equal to 0.2 E80's.

8.11.3 Findings of the Study

- It was found that the impact of the proposed Yzermyn Underground Coal Mine on the peak hour traffic operating conditions of the surrounding road network will not necessitate any mitigation measures such as intersection upgrades.
- There are two schools along the haul route which raise public safety issues which need to be addressed for current and future road use.
- The heavy vehicle loading impact of the proposed mine on the existing road network will require the replacement of surfacing at the problem areas identified. At the very least a surface treatment is required.
- The northern shoulder site distance at the intersection of the R543 and the Piet Retief Railway Siding is insufficient but the stopping site distance for traffic approaching from the north is adequate.
- The potential noise as a result of haul trucks operating during the night will have to be investigated and addressed.

8.11.4 Impacts Identified with the Study

8.11.4.1 Construction Phase

- Construction vehicles will have a potential negative impact on pedestrian safety in the vicinity of the mine site;
- Construction vehicles could increase the road accident potential in the vicinity of the mine site;
- Transportation during the night will have a noise impact on the residential areas (social environment), such as Dirkiesdorp, along the transport route;
- The heavy vehicle loading impact of the Project on the existing road network will damage the road surface/ pavement; and
- The impact of the relatively low volume of light vehicles along the proposed haul route (R543) is considered to be insignificant.

8.11.4.2 Operational Phase

- Increased heavy vehicle traffic along the haul route will have a negative impact on pedestrian safety along the route;
- Heavy vehicle traffic between intersection 1 and the mine access cannot be accommodated on the existing dirt road;
- Haul vehicles could increase the road accident potential along the haul route;
- Transportation during the night will have a noise impact on the residential areas (social environment), such as Dirkiesdorp, along the transport route;
- The heavy vehicle loading impact of the Project on the existing road network will damage the road surface/ pavement; and
- The northern shoulder site distance at the intersection of the R543 and the Piet Retief Siding is insufficient which may result in accidents at intersection 3;
- Haul trips to/from Piet Retief Rail Siding will affect the traffic operations at intersections 1, 2 and 3; and
- The impact of the relatively low volume of light vehicles along the proposed haul route (R543) is considered to be insignificant.

8.12 Socio-economic Assessment

8.12.1 Methodology

8.12.1.1 Aim and Objectives

The objective of the SIA is to provide detail of the socio-economic baseline conditions, within the proposed site and surrounding related areas, in order to assess the potential direct, indirect and cumulative impacts of the proposed Yzermyn mining project.

8.12.1.2 Approach

The SIA study comprised three phases in order to facilitate the environmental authorisation requirements and the SIA process. Firstly a prefeasibility phase, which comprised a desktop assessment of the local and regional context, and identified potential socio-economic impacts of the proposed project. Secondly, a scoping phase, which included site visits, preliminary stakeholder engagement and investigation into the local context and potential socio-economic impacts of the project.

The third and final phase was the impact assessment component, which was aimed at establishing the significance of the potential identified socio-economic impacts, and providing relevant social management and mitigation measures to minimise the significance of the potential impacts. The combination of these phases provided the necessary information for the SIA and the Environmental and Social Impact Assessment (ESIA).

8.12.1.3 Preliminary Assessment

The preliminary assessment, including the desktop analysis and site visit, captured the majority of the background information for the local context, including municipal expectations and local stakeholder opinions.

A variety of secondary data sources were identified and considered during the background information review, including:

- Gert Sibande District Municipality (2011) Final Integrated Development Plan, 2011/12 to 2013/14;
- Gert Sibande District Municipality Spatial Development Framework (April 2009);
- Pixley Ka Seme Local Municipality (2011) Integrated Development Plan 200 – 2012;
- Mkhondo Local Municipality (2011) Draft Integrated Development Plan: 2011 – 2016;
- Statistics South Africa (2011) Census 2011;
- Statistics South Africa (2007) Community Survey; and
- Mpumalanga Department of Agriculture, Conservation and Environment (2003) Mpumalanga State of the Environment Report.

The objective of the site visit was to ground-truth background information and to engage with local stakeholders. Limited primary data was collected during the screening study and took the form of initial (informal) discussions with local stakeholders, including

- Dirkiesdorp ward councillor (Mkhondo Local Municipality);
- Nico DenOutsten – CEO Themba Trust;
- Community member – Dirkiesdorp;
- Mr Chris Smit - Local Historian, Wakkerstroom; and
- Mr John Birchmore - Wakkerstroom Shop Owner.

In addition to discussion with local stakeholders, interaction with other members of the WSP Project Team added value in terms of understanding the project concept and local context.

It should be noted that subsequent to the first two phases of the SIA, a draft mining plan, the SLP and other pertinent information was made available. These documents, combined with the background knowledge gained in the first two phases provide a context of the assessment phase contained within this report.

8.12.1.4 Data Collection

Primary data collection was deemed necessary to contribute to the evaluation of the potential impacts of the proposed coal mine. Primary data was collected through a process of interviews with key local stakeholders so as to determine the magnitude and extent of the socio-economic impact at a local level. The aim was to obtain data which will assist with the identification and description of the key socio-economic issues and impacts associated with the project.

WSP developed a range of questionnaires, which were implemented through an interview process with the representatives of local organisations, authorities, land occupiers and other key stakeholders. All interviews and discussions were documented and kept on record for assessment and identification of the key socio-economic issues. The following stakeholders were consulted with:

- Pixley Ka Seme Local Municipality
  - Technical Services
  - Community Services
  - Integrated Development Plan (IDP) Manager
  - Ward Councillor and Ward Committee – Ward 10
- Mkhondo Local Municipality
  - Public Participation Executive
  - Community Development Worker (CDW)
  - Co-ordinator for the Ngema Trust

- Farm Tenants
- Themba Trust - Chairperson Owen Pols (Dirkiesdorp)
- Department of Labour (Piet Retief)

Representatives from the following homesteads were interviewed to determine the livelihoods and capture the key issues and concerns of this community (**Table 8-22**):

Table 8-22: Farm Tenants within Target Area

Farm	Family Name	
Vaalbank 24HT	Mazibuko	
Yzermyn 96 HT	Makhubu	
Zoetfontein 94HT	Makhambi Gule	
Kromhoek 93 HT	Mbatha Mhlambi Ndlangamandu	Malinga Twala

8.12.1.5 Data Analysis

The socio-economic issues were analysed from the information collected through the primary data collection and desktop phases. The issues were considered in two streams. The first of these was the potential negative issues associated with the solar project and associated infrastructure. The second would be to look at the potential positive issues associated with the development.

8.12.1.6 International Finance Corporation Performance Standards

Refer to **Section 3** for a discussion of the IFC Principles.

8.12.1.7 Impact Assessment

Potential socio-economic impacts associated with the project have been evaluated using a recognised risk assessment methodology. This methodology has been developed to ensure all procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment as set out in National Environmental Management Act (107 of 1998) 24(4b) are met. In addition, the impact assessment methodology must ensure that all information requirements of the EIA Regulations (2010) 22(2)(i) and 31(2)(l) are provided and it is aligned with the IFC performance standards.

This system derives environmental significance on the basis of the consequence of the impact on the environment and the likelihood of the impact occurring**.**

8.12.1.8 Reporting and Recommendations

This SIA report provides a culmination of the above phases. The report includes an assessment of the key socio-economic impacts associated with the proposed project, as well as the “no development” alternative. The report makes recommendations for mitigation measures to be considered in the design and operation of the project. These recommendations are in line with the IFC requirements for social consultation, risk avoidance and management measures.

8.12.2 Assumptions and Limitations

It is assumed that the potential impacts relating to noise, air quality, visual, surface and ground water impacts will be addressed by the relevant specialist studies. It is assumed that these studies will assess the significance the potential impacts, and provide suitable management and mitigation measures that will consider the local communities in terms of the sustainable local development and will not impact on their quality of life, health or rights. These studies are referred to within the SIA report for this purpose.

Limited surveys and interviews were conducted, due to the extensive stakeholder engagement process associated with the EIA process. The risk of over-consultation and stakeholder fatigue resulted in limitations to the extent of the SIA primary data collection process. The information and data collected, is considered sufficient for this level of assessment. Further detailed studies have been recommended where necessary.

8.12.3 Findings of the Study

8.12.3.1 Stakeholder Viewpoints

The Yzermyn area is a contentious in terms of mining, with high biodiversity value areas and a conflict in terms of lack of economic development and the largely tourism and agricultural-based local economy. The local and regional government drive for development and service provision often seems to contrast with the rural nature of the area and the key activities and sense of place.

This was reflected by the variety of responses from different stakeholders, and particularly the viewpoints of local communities. Two distinct social viewpoints emerged through the SIA processes from the local communities:

- Firstly, the historically disadvantaged communities (including Yzermyn Farm Community, Dirkiesdorp, eSizameleni) viewed the proposed mine as providing opportunities and development to the local communities, through employment, skills development and infrastructure upgrades. These communities expressed their support for the mining development, if labour and services were sourced locally, and if the mine supported local services and infrastructure development.
- Conversely, the community of Wakkerstroom were of the opinion that the proposed mine will have a significant negative impact on the natural environment. They expressed the opinion that this would result in a loss of biodiversity and water resources, which will ultimately disrupt the natural processes (including local wetlands, birding sites, and scenic vistas), resulting in a negative impacts on the local agriculture and tourism industries, sense of place, as well as other aspects such as a decrease in property values and loss of heritage value. In addition, this community expressed the option that the mine will negatively impact the roads, cause long-term social issues (e.g. loss of employment and social decay), and that could have a permanent and severe impact on the local social environment. They expressed opposition to the mining development on this basis.

The above issues are understood to represent the broad positions of different communities noted during the study. This conflict in perceptions, understanding and motivation seem to be directly related the historical background and location of each group, and how these affect the perceptions of each group.

8.12.3.2 Key Stakeholder Issues and Perceptions

The SIA study revealed a variety of social issues raised by key stakeholders. These included: land owners; surrounding farmers; general/local stakeholders; NGOs; local government departments, representatives from local municipalities, and ward councillors and ward committees. The following key issues were identified through the analysis are listed in **Table 8-23**. A full list of issues raised, per sector. The key issues are summarised below.

Table 8-23: Key Stakeholder Issues and Concerns

Socio-economic	Social	Physical environment
▪ Labour and employment; ▪ Skills development; ▪ Procurement and Local Economic Development (LED); and ▪ Local economic impact.	▪ Social environment; ▪ Potential influx of job; ▪ Infrastructure and services; ▪ Impact on homesteads; and ▪ Health and safety.	▪ Decreased water quality and quantity; ▪ Increase surface water (dewatering); ▪ Loss of farm land; ▪ Decreased local air quality; ▪ Loss of wetlands and biodiversity, and ▪ Visual impacts.

8.12.3.3Key Socio-Economic Findings

It is anticipated that up to 576 employees will be appointed for the operational phase of the proposed mine. **Table 8-24** provides an overview of the total number of employees anticipated for the first ten years of the mine life. This is likely to include contract and direct employees.

Table 8-24: Mine Employee Summary

Category	No. of Positions		
	Year 1	Year 2	Years 3-10
Senior Management	5	6	7
Professional qualified and experienced specialist and mid-management	8	12	15
Skilled technical and academically qualified workers, junior management, supervisors, foreman and superintendents	67	94	137
Semi-skilled and discretionary decision making	200	313	417
Total	**280**	**425**	**576**

The local population appear to be predominantly unskilled, as is reflected by the low employment status and employment sectors (**Table 8-25**). Few people from Wards 1, 2 and 3 of the Mkhondo Local Municipality (covering Dirkiesdorp and Driefontein), are employed in the formal sector (4.8%), and the majority (89.3%) fall under the "Not applicable" section (i.e. potentially seasonal workers, or not working in a recognised sector).

Table 8-25: Summary of Employment Sectors in Wards 1, 2, and 3 of Mkhondo (Stats SA, 2011)

Type of sector	No.	%
In the formal sector	1,908	4.8%
In the informal sector	1,475	3.7%
Private household	685	1.7%
Do not know	187	0.5%
Unspecified	0	0.0%
Not applicable	35,330	89.3%
Total	**39,584**	**100%**

The Department of Labour (regional base in Piet Retief) undertook a skills audit of the Dirkiesdorp and Driefontein areas, which illustrated the number of skilled people within these areas (**Table 8-26**). In comparison to **Table 8-25**, these numbers reflect a low number of people potentially seeking employment, although a substantial number of potential employees (permanent or contract) who could be sourced locally. Note: no data for the Wakkerstroom area was available at the time of the study. A skills audit for the Wakkerstroom/eSizameleni area is, however, being undertaken by the Department of Labour.

Table 8-26: Summary of Skills Audit (Department of Labour, 2013)

Skills Level	Number	Area
General workers	187	Dirkiesdorp and Driefontein
Technicians	2	Driefontein
Drivers and Operators	33	Dirkiesdorp and Driefontein
Trade Workers	26	Dirkiesdorp and Driefontein
Professionals	1	Driefontein
Administrative	23	Dirkiesdorp and Driefontein
Sales and Services	26	Dirkiesdorp and Driefontein
Managers	Nil	-
Total skills available	**298**	

The Historically Disadvantaged South African (HDSA) local communities expressed enthusiasm for the mine and the potential for job opportunities and skills development. The lack of skills and education in this rural area was highlighted as a key issue, namely the lack of skills within the local area, which the mine would need to address. Communities, local leadership and the Department of Labour indicated skills development should be implemented prior to the commencement of any mining related activities, so as to allow local individuals the opportunity to develop the necessary mining-related skills.

In addition, these stakeholders also indicated the need for local economic development. There is a need for local businesses and entrepreneurs to be developed in order to stimulate local growth. Stakeholders expressed that the proposed project could assist through prioritising local labour and local procurement.

Issues were also raised around the loss of tourism and farming in the area due to the mining activities. This was raised as a concern as a result of mining activities, change in nature of the area, loss of groundwater, and increased traffic.

In addition, a number of local stakeholders expressed the need for the proposed mine will employ most of their unskilled to skilled labour force from the local area (particularity from Dirkiesdorp and eSizameleni). The proposed mine will, in terms of the Minerals Resources and Petroleum Development Act (MRPDA) (Act 28 of 2002), consider local areas as potential labour sending area first, specifically Dirkiesdorp, Driefontein (not directly assessed within the SIA but within the ADI) and Wakkerstroom/ eSizameleni. It was noted, however, that the majority of labour and employees are likely to come from outside the ADI due to the lack of skills locally. These areas may include other areas of Mpumalanga, as well as other provinces, such as Gauteng and the North West, as these are known centres of mining.

8.12.3.4 Key Social Issues and Findings

The Wakkerstroom community expressed a strong view that the proposed mining activities will significantly change their sense of place, as the mine will affect the local biodiversity and water resources, resulting in a negative impact on property values and tourism within the Wakkerstroom area. This was not highlighted as a key issue for the Dirkiesdorp or other communities in the immediate areas, but rather a positive change including local development and general social upliftment as a result of the mining activities.

Most communities and local municipalities expressed concern regarding the potential influx of job seekers and labour into the area, which could affect accessibility to social and basic services, specifically healthcare, housing, water and sanitation.

The local municipality expressed concern that mining operations, and their associated activities (e.g. presence of trucks), as well as labour and staff, could have an impact on the local social environment. Specific concern was raised with regards to the impact on roads and water resources. The municipality indicated that the mine would need to facilitate upgrades to existing road systems, as well as assist the municipality with providing local social facilities, such as schools and water treatment facilities.

A number of local stakeholders and municipalities highlighted a range of social and infrastructure projects that are required for the upliftment and general improvement of access to basic and social services in the local area (within the ADI).

According to the SLP (WSP(a), 2013), Atha has selected a number of potential projects for intervention, including assisting the local municipalities with funding for projects, local mobile clinics, educational facilities, business support, and a rural Information, Communication and Telephony (ICT) centre. Most of these projects are an integral part of the District and Local Municipal IDP's, and are likely to provide direct services to the local area. The perception amongst many local stakeholders that the mine is going to provide road infrastructure, houses, and other facilities, is, however, unlikely to be realised.

One of the key localised social impacts identified through surveys of farm tenants, was the potential impacts on the homesteads within, and adjacent to, the mine target area. Potential issues raised included cracking of houses, health and safety (associated with trucks on the nearby access road), dust and noise emissions, and how these may impacts on the neighbouring communities.

8.12.3.5 Key Physical Environmental Issues

One of the key issues raised by local communities was the potential impact of the mine on water resources in the area, including surface and ground water. This included the dewatering of the mine and loss of groundwater resources, Acid Mine Drainage, as well as pollution of rivers and increased river discharge sue to dewatering.

Farmers and local residents expressed the concern for the loss of farmland as a result of the mining activities, not only within the target area, but also adjacent to the site. The farm tenants indicated their concern for dust emissions, and how this may affect their health and households.

The Wakkerstroom community, together with NGO representatives, were particularity concerned about the potential loss of biodiversity, specifically habitats of endemic bird species, including large wetland areas. This concern was not only with regards to the intrinsic value of these species and habitats, but as mentioned above, the loss of tourism and associated economic and social impacts. The visual impact of the mine was also a concern for these stakeholders, as the potential impact of mining operations on tourism and the overall sense of place could affect the local economy and social environment.

8.12.4 Impacts Associated with the Study

8.12.4.1 Summary

The low skills level within the local communities is indicative that the skills that are required by Atha for the mine are unlikely to be found within the local communities. It is therefore imperative that Atha actively engage in a process of skills development to ensure that local individuals (identified through the Department of Labour and other organisations) are eligible for employment opportunities. This will ensure that local communities benefit directly from the mine. Without these measures, this project is unlikely to be socio-economically sustainable within the vulnerable socio-economic landscape which currently exists within the Yzermyn area.

There are, therefore, a number of positive socio-economic impacts that could result from the proposed project, including the potential for employment of local communities and skills development opportunities, as well as facilities and local development potential. There are however, also a number of negative impacts anticipated as a direct and indirect result of the proposed mine. These could include a change in sense of place, loss of environmental and economic assets, and social conflict.

The overall impact of the proposed mine, if mitigated correctly, could be positive for the local socio-economic environment. These management and mitigation measures will require dedicated resources from Atha to ensure they are effective. These measures also need to be implemented prior to the commencement of the construction phase, and carried out throughout the operational and closure phases of the mine to minimise negative socio-economic impacts, and maximise positive impacts.

8.12.4.2 Construction Phase

Increased Health and Risk

The proposed construction phase is likely to produce noise emissions (mainly from blasting, construction and trucks) and dust emissions (mainly from blasting, trucks on unpaved roads, and ore processing), as well as a number of other possible health and safety risks to the local communities, as outlined below.

- **Noise** – In accordance with the Noise Impact Assessment (WSP (c), 2013) (NIA), the area of potential impact during the construction phase is likely to be limited to the immediate area (within proximity to the operational area and adit), specifically the homestead closest to the entrance and operational areas. Noise emissions are likely to be of low significance during the construction phase (WSP (c), 2013).
- **Air Emissions** – In accordance with the Air Quality Impact Assessment (WSP (b), 2013) (AQIA), there are likely to be a number of construction-related activities that may generate particulate matter. This will affect the sensitive receptors immediate adjacent to the operational area and the (unpaved) access road to the site. The AQIA indicates that this is unlikely to have significant impacts on these receptors, due to the temporary nature of the construction phase, and the local climatic conditions topography. Despite this the AQIA has provided recommendation measures that will be required during the construction phase.
- **Traffic** - The presence of trucks could also pose a safety risk to local farm tenants and Dirkiesdorp residents, as individuals (especially children) use the main access road as route to Dirkiesdorp, between homesteads, and to local schools. Large trucks and increase traffic in general could potentially result in an increased number of accidents resulting in injury or even mortality. This will potentially be limited to the preferred access road between Dirkiesdorp and the proposed mine entrance. Refer to Traffic Impact Assessment (TIA) for impact assessment and mitigation and management recommendations (WSP (d), 2013).
- **Communicable Diseases** - The potential influx of labour and job-seekers into the ADI could result in health concerns around communicable diseases, such as HIV/ AIDS and Tuberculosis (TB). There are currently high rates of HIV/ AIDs and related diseases within the ADI, which could further increase with the presence of additional people to the area. This is likely to be limited during construction, with approximately 70 potential employees/staff onsite, however, must be managed. Education and awareness campaigns are vital to managing and mitigating this risk to the local communities, as it has been indicated that labour is likely to be housed within the existing communities possibly within the larger towns of Piet Retief and Volksrust.
- **Crime** - There is the potential for crime events to increase within the local area, with additional, non-residents being present in the local environment. This is likely, however, to be restricted during the construction phase, as the number of people and access to the site will be limited to less than 100 people. It is recommended that education and awareness campaigns are developed and implemented prior to the construction phase, and security is maintained within the mining area as a preventative measure.

Social Tensions and Disruptions due to Construction Activities and Labour Force

The presence of non-residents, perceived "outsiders" and contractors within the local environment could cause localised social tension due to the rural nature of the ADI, and the change in nature of the area during construction. The opposition expressed by certain local communities and stakeholders, could result in conflict causing disruption to the local communities and the construction operations.

Damage and Disruption to Homesteads

It was not anticipated that there would be a requirement to relocate any of the farm tenants that are located near or on the site. The site visit and surveys revealed, however, that there is one homestead located approximately 500 m from the proposed adit entrance, and approximately 100m from the main access road to the target area (family name - Mkhubu). The mining activities are likely to have direct negative impact on this homestead, in terms of vibrations (cracking of houses), dust, noise, safety and visual impacts. These consequences could potentially have a significant impact on the family that resides within this homestead, as well as on their cattle, corps, and quality of life. This is an unacceptable risk to this homestead, which needs to be mitigated, should the mine commence.

Although the mine will not physically displace this homestead (i.e. it is not located within the target area), it is in close proximity to the main operations area, and there is a possibility that these activities will significantly affect this homestead and family in its current location.

Resettlement of this family is recommended, which requires a separate Resettlement Plan in terms of the IFC performance standard (5) for Land Acquisition and Involuntary Resettlement. This requires consideration of subsistence livelihoods, social networks and wider community structures. A household asset register was not undertaken during the SIA, however it is recommended that one is undertaken for the Resettlement Plan, and this family be relocated to another area of the same farm (or alternative site within proximity as appropriate), and/or suitable compensation is provided (in accordance with the Resettlement Plan). Resettlement is required to be undertaken during the preconstruction phase, so as to minimise potential social impacts.

Relocation of a single household is unlikely to have a significant impact on the farm tenant community or the individuals within the household. This is because, although farm tenants appear to be inter-reliant, should suitable relocation within proximity to the other farm tenants be undertaken, the impact is greatly reduced. The negotiation and compensation process, as well as potential conflict from neighbouring families (i.e. the perceived need for compensation to other families) needs to be managed effectively. This could be undertaken through good communications and engagement forums, commencing prior to the construction phase.

Creation of Employment Opportunities

It is anticipated that approximately 70 employment opportunities, with approximately 60 being skilled (operators) and 10 management (supervisory) opportunities, will be generated through the construction phase. Skilled labour is likely to be sourced from outside the ADI, either regionally or nationally. In addition, management level staff are likely to be sourced in India (Atha's current mining operations), and brought into manage local operations and transfer skills to local employees/ trainees on an on-going basis.

Although there may be a small number of additional unskilled opportunities (e.g. security, community liaisons, general labourers and cleaners) that could arise, there is unlikely to be significant opportunities for the local population to be employed during the construction phase, and the opportunities are likely to be temporary.

During the SIA it was noted that there is a high level of unemployment on a local level (within the ADI). Given the potential impacts on the local area, employment (especially unskilled and semi-skilled) should be sourced locally where possible. Employment of youth, women and disabled (currently underrepresented in mining and employment sectors in general), should be included in development of skills and opportunities for employment.

Growth of Skills and Business Development

The proposed mine is unlikely to provide significant skills development opportunities during the construction phase of the project. The limited number of employees during this phase, and the specialist requirements, means that experienced contractors are likely to be sourced from outside the local area to undertake construction activities.

The degree to which downstream economic impacts provide local stimulus to the economy is based on the degree to which value added services can be locally sourced. There may be an opportunity for business and entrepreneurial development within the local area. Atha and its contractors will require services and materials for the construction phase of the proposed mine. There is an opportunity to source these at a local or regional level. It is recommended Atha prioritise local procurement through ensuring that internal procurement policies, as well as agreements with contractors and sub-contractors, include the following conditions such as:

"The procurement of goods and services must be localised wherever feasible and practical. If possible the tender should demonstration of how this will be achieved."

8.12.4.3 Operational Phase

Increased Employment Opportunities

It is anticipated that up to 576 employees will be appointed for the operational phase of the proposed mine. These opportunities are likely to include: senior management; professional qualified and experienced specialist and mid-management; skilled technical and academically qualified workers, junior management, supervisors, foreman and superintendents; and semi-skilled and discretionary decision making.

The SIA revealed that there are a high number of unemployed people in the immediate areas (namely the area encompassing Dirkiesdorp, Wakkerstroom, Piet Retief and Volksrust), as well as throughout the Mkhondo and Pixley ka Seme local municipalities. As mentioned previously, there are low skills levels within the ADI. And therefore the local population may not meet the labour requirements of the mine.

In accordance with the MRPDA, mining operators are required to develop and submit an SLP as part of the application for mining rights. Atha must, therefore, ensure that labour is source locally where feasible for the operational phase. The local area from which local labour should be sourced should target the Dirkiesdorp and Wakkerstroom/ eSizameleni area, as well as the greater Mkhondo and Pixley ka Seme local municipalities. The Gert Sibande District Municipality region should, however, also be considered part of the local labour sending area. A small number of opportunities may be sourced from the immediate area; however these are likely to be mainly unskilled, such as security and cleaning staff. Priority must, therefore, be given to local labour, and skills development must be promoted at a local level (as described in Section 5.7.1 below).

In order to meet the skills requirements for the mine, skills development initiatives will need to be provided to promote the expansion of the required skills in the local context. There is currently very low skilled labour force present within the ADI, as discussed in Section 5.4.1 above. Due to the limited numbers of unskilled, semi-skilled and skilled employment opportunities, the proposed mine will offer little or no economic benefit for the local area without skills development. It is recommended that Atha prioritise the development of skills within local communities at a planning stage to ensure that local community member have an opportunity to apply for the available positions within the mine. Where possible this should be implemented as follows:

- Identify positions available;
- Identify, through discussions with the local communities, individuals with the interest and aptitude for the proposed positions; and
- Provide skills training to individuals to potentially take up positions during the operational phase.

Atha is required to provide portable skills development (other than mining) and basic education and further education opportunities to employees, and potentially local communities. The SLP outlines a skills development programme, including Adult Basic Education and Training (ABET), core skill training, external learnerships, internal learnerships, portable skills, bursaries, internships, portable / marketable skills, mining sector skills, basic education and further education and training. Although these are focussed on internal (employee) training, there is an opportunity for the mine to develop local skills for working within the mine and supporting services sectors.

The promotion of education through providing facilities (as discussed in the SLP under local economic development initiatives) is likely to assist Atha is supporting the development of skills within the local area. The provision of these facilities is vital to improving the social impact of the proposed project. Without sufficient skills training and awareness of what skills are necessary, there are unlikely to be any skilled labour to supply the mine. These facilities must, however, be run by accredited organisations, such as Further Education and Training (FET) College.

Local Economic Development

There are a number of opportunities for the proposed mine to contribute towards the development of local services and business development through the prioritisation of local procurement for the provision of services to the mine (e.g. transport, provision of materials, catering, cleaning, etc.). Atha must, through the establishment of internal and contractor policies, prioritise local business in procurement procedures, and where possible, provide entrepreneurial development initiatives to stimulate local economic and business development.

The presence of the mine could also result in secondary investment in the local area, through the development of infrastructure, and tertiary sector services (e.g. retail, banking, etc.). It is however, imperative that the local community, organisations, leadership and government are involved in the development and procurement, in order to maximise local benefits from the mine for the local communities. Key actions should include:

- Atha must ensure equitable procurement opportunity development, as per their SLP;
- Discussions with local leadership and business forums regarding project supplier requirements and opportunities,
- Identification of potential partnership and supplier businesses in the local area;
- Notifying local leadership and business forums of availability of tenders for appointment; and
- Investigate local entrepreneurial development opportunities (e.g. to supply the mine, such as bakery, vegetables, and transport companies), and which could be sustainable entities in the long-term.

According to the SLP (WSP (a), 2013), Atha has selected the following potential projects for intervention:

- Existing municipal cooperative initiatives funding assistance;
- Sponsorship of local mobile clinics;
- Sinethemba Agricultural & Technical Secondary School;
- Small Enterprises Development Agency (SEDA) office establishment (Small to Medium Enterprises support); and
- Establishment of a rural Information, Communication and Telephony (ICT) centres.

Impact on Water Levels and Water Quality

In accordance with the surface and ground water specialist studies (WSP (e) and (f), 2013), the impact on ground water and surface water is unlikely to be significant within the target area, the immediately surrounding area, or on a regional scale. The quantity of surface water flowing into the local environment is likely to decrease in summer due to activities onsite and diversion of contaminated stormwater runoff into pollution control dams, and increase slightly in winter (from normal volumes) due to the increased runoff from increased hard standing. This is, however, unlikely to affect local users, as although there may be a decrease in seepage near to the adit or entrance, there is unlikely to be significant impacts on the springs and streams that are used by local farm tenants (located approximately 3km from the adit).

The low impacts on surface and groundwater resources are, however, directly dependant on the management of mine water and activities within the mining operations. The recommendations of the surface and ground water specialist studies (WSP (e) and (f), 2013) must, therefore be implemented. It is the responsibility of Atha to ensure that these activities are managed effectively, and they are responsible for the long-term monitoring and management of water resources. In the event that any impacts on water quantity or quality are encountered, Atha is responsible for ensuring that communities receive adequate potable water supply, and that long-term impacts are prevented, managed and mitigated.

Livelihood Displacement

Economic displacement refers to the removal of livelihoods and income for the local population. This is likely to take a number of forms as a result of the mining operations, including:

- Loss of agricultural land - There is the potential for farmers and tenants to be impacted by the loss of grazing land due to the proposed project. The mine is however, proposed to be underground, and the target area is relatively small (in comparison to the remaining available farmlands), and there unlikely to have a significant impact on the farming activities in the area. It is likely that sufficient grazing will be available for commercial and subsistence purposes.
- Loss of stock due to theft which could result from the increase in people in the area and lack of security afforded by existing structures on farms (i.e. fencing, surveillance, etc.). This could become an issue if left unabated, and should be managed through community engagement and the establishment of the community forum.
- Decrease in property values, especially with regards to farm lands within the local area due to the potential for a loss of natural aesthetic, decreased availability of fresh water (ground and surface), and perceptions regarding the change in nature of the area.
- Decreased tourism and potential loss of income and employment due to a reduction in eco-tourism associated with wetlands, birding and natural aesthetics of the local area.

The potential loss of natural resources relates directly to the loss of economic and livelihood sustainability, due to the direct relationship between the local communities and the local natural environment, as listed above. It is imperative that, in order to offset any potential economic or livelihood loss within the local socio-economic landscape, local communities will need to be uplifted, up-skilled and employed by the mining operations.

Economic Contribution

The proposed mine is likely to contribute to the local, regional and national economies in the form of direct and indirect employment, secondary activities and services to the mine, as well as tax revenue, and expenditure on business services in local and regional economies. **Table 8-26** provides an overview of the expected expenditure.

Table 8-27: Expected Regional and National Expenditure/ Contribution

Type of expenditure/ contribution	Description	Anticipated Expenditure (Million Rands -)
Total royalties paid to South Africa government	Once the Mine is expected to be operational in 2015, the estimate royalty during a 10 year period as per the Mine Work Plan (MWP) works out to.	422.57
Total income tax paid by company and employees and large contractors and their employees.	Once the Mine is expected to be operational in 2015, the estimated tax payable during a 10 year period as per MWP.	325
Total value added tax (VAT) per annum paid by mine, contractors and their employees	Total VAT paid by the Company as on 2013 amounts to 2.72 Million Rands. Once the mine reaches operational status and production commences, VAT will be significantly higher resulting in stronger revenues to the local South African Government. Estimated VAT calculations based on 14% of cost of goods produced	562.11

Type of expenditure/ contribution	Description	Anticipated Expenditure (Million Rands -)
	+ Life of Mine (LOM) Capex + SLP costs over a 10 year period.	
	Total Pay-As-You-Earn (PAYE) tax paid to South African Revenue Services (SARS) as on 2013 rates. Once the mine attains operational status, the estimated PAYE tax over a 10 year period would be based on an estimated payroll cost of 97.61 Million Rands.	114064.15
Direct invested (almost) directly back into South Africa.	Assuming an annual Run of Mine (ROM) production of 1.83 mega tonnes per annum and a total revenue of R 750.00 per tonne, approximately 85%-90% (average) of the revenue represents an investment directly back into South Africa	1 235 per annum

Source: Atha Africa Ventures, 2013

In addition to initial foreign Capex investment by the Atha Group (approximately R900 million), Atha is proposing to spend support Capex as outlines in **Table 8-28**. As with the initial capital expenditure, more than 80% of the initial and on-going amounts are proposed to be spent through South African companies (Atha, 2013).

Table 8-28: Overview of Estimated On-going Costs

	Year										
	1	2	3	4	5	6	7	8	9	10	Total
Estimated On-Going Capital (Rands Million)	4.79	8.20	11.21	11.25	11.29	11.29	11.33	11.29	11.29	11.25	103.10

Source: Atha Africa Ventures, 2013

There are, in addition likely to be additional taxes paid by Atha, in terms of taxes on rail, harbours and other logistical costs. The level of regional economic contribution could, however, be limited, as the size of the mine and its operations could be considered moderate in terms of other regional and national economic contributions.

The local economic contribution can be reflected through the estimated expenditure/ provisioning for the execution of the SLP. **Table 8-29** provides an overview of the expected investment of Atha through the implementation of the SLP over the initial ten year period.

Table 8-29: Overview of Estimated Investment

	Year										
	1	2	3	4	5	6	7	8	9	10	Total
SLP Costs (Rands Million)	1.40	15.60	15.70	15.70	16.38	16.38	16.38	16.38	16.38	18.96	149.26

Source: Atha Africa Ventures, 2013

The above investment is likely to be reflected within the local economy through buying power of local employees and subsequently households. It is likely that there will be between 200 and 417 semi-skilled employees directly employed by the mine. These employees can be presumed to be predominantly from the local area (Driefontein, Dirkiesdorp, Wakkerstroom and immediately surrounding areas), as the SLP commits Atha to skilling and employing local labour. There is, therefore, the potential for between 600 and 1 251 people to be supported by the mine, as the SLP indicates an average of three dependents per employees (WSP (a), 2013). The local statistics (drawn from household surveys) indicates between 10 and 30 people per household, with an average of 18 dependants per household (due very high unemployment and large family units). This indicates that the dependency ratio is higher than the average predicted by the SLP, with between 3600 and

12510 people potentially benefitting from the mining operations through direct employment. This is a moderate to significant portion of the local population (wards 1, 2, and 3 of Pixley ka Seme, and wards 5 and 10 of Mkhondo), or between 10% and 33% of this population.

The total local income as a result of direct employment through the proposed mine is therefore between R1 918 712 and R3 437 888, which is likely to be used locally within households to purchase food, household goods, payment for schooling and transport, amongst other requirements, all within the local context. This is an average of between R687 and R800 per employee per month, which will contribute towards household income. The mine is, therefore, likely to have a relatively moderate economic impact on the local population, as current farming employment pays up to R1 200 per employee. The additional income (assumed to be additional, as farming employment is likely to continue during mine operations) will contribute to income of local households, however only be an average of approximately R20 per person per month. This is likely to have some effect on local buying power, although marginal.

The direct and indirect services to the mine (e.g. accommodation, retail, and supply of materials) from within the local and regional area could have the ability to stimulate the local economy. The actual economic impact would need to be further investigated.

Indirect regional contributions are likely to come through the development of regional skills and employment opportunities, and the sourcing of materials and services from within the region. This could be further enhanced by ensuring the local and/or regional procurement of good and services and employment, as well as ensuring that the mine's activities stimulate the local economy, which could in turn contribute on a larger scale.

Increased Health and Safety Risk

There is the potential for the proposed mining operations to result in an increased health and safety risk at a local level. This is likely to be a result of a number of factors, including the following:

- Traffic – There is likely to be a distinct increase in traffic (predominantly large trucks transporting coal to Piet Retief) along the mine access road through Dirkiesdorp and along the R543 towards Piet Retief. The (TIA) indicates approximately 240 trucks per day will travel along these roads during peak operational phase. The presence of these trucks, as well as smaller vehicles, could result in an increase in potential pedestrian injuries and fatalities in the Dirkiesdorp area.
- Blast/vibration – The risk from blasts and vibration as a result of mining activities could result in the collapse of mud structures on homesteads adjacent to the target area, and injury to the occupants or exposure to the elements. A Resettlement Plan is recommended to remove the closest to the target area, and on-going communications through a Community Liaison Forum to manage any unforeseen impacts.
- Noise and dust – There is the potential for the operational phase to cause notable noise and particulate matter emissions from blasting, material removal, coal removal, crushing and screening activities, ventilation shafts, stockpiles, loading activities (with the use of bulldozers or other machinery) and trucks (WSP (b) and (c), 2013). The impact of these emissions are predicted to be medium to high and localised to the area immediately adjacent to the operational area and access road (WSP (b) and (c), 2013). These emissions could result not only in a nuisance factor for local residents, but also health impacts from inhalation and exposure over long periods of time. The AQIA and the NIA provide mitigation measures for the operational phase, so as to reduce these potential emissions (WSP (b) and (c), 2013). Note that it is proposed that the access road be surfaced after three years of operation, as the number of trucks traveling to the site is likely to increase significantly once the mine is in full operation.
- Influx of population – the influx of labour and job-seekers into the ADI could result in health concerns around communicable diseases, such as HIV/ AIDS and TB. There are currently high rates of HIV/ AIDs and related diseases within the ADI, which could further increase with the presence of additional people to the area. Education and awareness campaigns are vital to managing and mitigating this risk to the local communities, as it has been indicated that labour is likely to be housed within the existing communities possibly within the larger towns of Piet Retief and Volksrust. Atha will be required to comply and revise the SLP on a regular basis.
- Fire – the risk of fire was noted to be high within the ADI, due to the presence of grasslands and dry, windy winter conditions. There is a risk from the mining operation through the potential for thermal coal product to

self-combust, and the additional risk from employees and contractors using fires for cooking or warmth, could increase this risk. This could potentially affect the surrounding farmers and farm tenants and their livelihoods (grazing, crops and cattle). Education and awareness training is vital to ensuring that this risk is minimised from the mining operations.

- Crime – the increase in the number of people within the ADI could increase the potential risk of crime and theft within the local area. This could include the theft of livestock (from farmers and farm tenants), theft of personal belongings, as well as physical harm or other criminal offences. It is recommended that education and awareness campaigns are developed and implemented prior to the construction phase, and security is maintained within the mining area as a preventative measure.

Change in Sense of Place

The communities closest to the proposed site, namely Wakkerstroom, Dirkiesdorp and KwaNgema, are characterised by limited development and are predominantly rural in nature. The sense of place appears to be particularly significant to the Wakkerstroom community, as it was indicated during the ESIA process that a number of people have moved to Wakkerstroom for the quality of life and scenic surrounds. Both Dirkiesdorp and KwaNgema are rural settlements, with a dependence on agricultural activities and employment on local farms. The residents of these two settlements are therefore inherently tied to the local area.

It is likely that the nature of the area will be changed due to the proposed mining activities. Factors that may contribute towards this include visual and aesthetic changes to the site, dust, noise and other physical environmental changes, as well as increased traffic, influx of employees and job-seekers, and development in these areas as a result of their proximity to the mine. In addition, cultural and political conflicts could result from the in-migration of labourers, which could affect settlements in close proximity to the mine. The possible transient nature of some of the mine labour and the associated social issues (such as alcohol abuse, influx of sex workers, and potential social unrest) could change the nature of the nearby settlements.

The change in sense of place for the local communities (specifically Dirkiesdorp) could be managed through the implementation of education and awareness campaigns, and the promotion of positive local development. The impact is unlikely to be mitigated completely, and is likely to change the nature of the area is likely to be changed for the duration of the project, and beyond the lifetime of the mine.

The Wakkerstroom community is unlikely to be directly affected by the proposed mine. The impact on biodiversity could, however, limit the tourism within the area. This could result in decrease in local income, a change in economic activities, out-migration of residents, and potentially the degradation of the local aesthetic and culture. This could have a long-term to permanent impact on the town of Wakkerstroom. It is recommended that the Wakkerstroom community be represented on the Community Forum (to be established by Atha in the preconstruction phase), and through this, and the Grievance Mechanisms, work with Atha to maintain the local environment and tourism economy and related activities, so as to ensure these do not degrade over the lifetime of the mine.

Increase in Social Conflict

The potential for influx of labour and job seekers into the ADI could result in social changes such as conflict for resources, conflict of cultures, and a change in nature of the area resulting in social change and potential for disputes. Atha has indicated that outside labour is likely to be housed within the existing communities, possibly within the larger towns of Piet Retief and Volksrust. The local communities are, however, likely to be targeted by jobs seekers for housing, due to their proximity to the site.

Housing with the larger towns for labour and staff is likely to be absorbed by the existing and future development of these urban areas. The influx of jobseekers into smaller communities (e.g. Dirkiesdorp, KwaNgema and Wakkerstroom), could create a shortage of housing and conflict over resources (as these are currently deficient in some of these areas).

In addition, labour conflict with the mining company, regarding aspects such as wages and resources, could result in local social unrest. This could potentially adversely impact the local population should this not be managed properly. Conflict management by the mine (i.e. managing labour demands, issues and communications) is therefore a key aspect to preventing long-term social unrest.

8.12.4.4 Closure Phase

Reduction in Employment Opportunities and Associated Decline in Economic Activities

The mine is proposed to have a lifespan of approximately 15 years. The closure of the mine will result in the loss of an estimated 576 direct jobs, and associated indirect employment through contractors and service providers for the mine, as well as affect the increased local population indirectly. The reduction in economic activities within the area is particularly significant for the local population (within the ADI) as they are currently reliant subsistence agriculture and seasonal farm and mining work. In addition, locally sourced employees may not be able to move to other areas for mining employment (should this be an option). The loss of employment could, therefore, impact the socio-economic environment through the loss of income and livelihoods, and affect this may have on the local economic and quality of life for local populations.

The decreased in employment can be managed through an appropriate mine downscaling and closure plans (as per the SLP (WSP (a), 2013). These plans should ensure that portable/ marketable skills and training is provided to mine staff, so as to ensure that individuals are more likely to gain employment or opportunities elsewhere following mine closure. In addition, providing employees with clear and transparent information on the planned closure could allow individuals to plan and implement personal strategies for furthering their employment opportunities (within mining or other sectors).

Change of Economy back to Subsistence and Agriculture

There is the potential need for the local population of farm tenants (and Dirkiesdorp to a smaller extent) to shift back to subsistence agriculture to sustain household livelihoods following closure. This is likely to impact on spending power of these families, as well as their ability to provide for the household. This should be investigated further in the Mine Closure Plan (as per the SLP (WSP (a), 2013). Once again, skills development and training is likely to play a significant role in the local population’s ability to recover following the closure of the Mine.

8.12.4.5 Residual Impacts

Readjustment of Local Economy

The return of the local economy to agriculture and tourism is likely to take up to 10 years (or longer depending on the degree of impact of the mine on the local physical environment). The grazing lands lost to the mining activities are likely to recover with time, and assuming the land does not subside, the majority of the target area could be returned to full grazing capacity within a five year timeframe, although this is dependent on the full rehabilitation of the site.

The overall impact on grazing land and other social resources is likely to be low, but only if Atha ensure these issues are managed through the mine closure and rehabilitation plan, to prevent long-term or permanent impacts.

Tourism currently plays a key role in the local economy, specifically in the Wakkerstroom area. Tourism is also a key economic and social development goal for the Gert Sibande District Municipality, as well as the local municipalities. Tourism activities in the local area rely predominantly on the natural environment of the Wakkerstroom area, and include outdoor adventure, birding and cultural/ heritage tourism. The extent to which the mine impacts on the sense of place of the surrounding area and changes local physical environment, could therefore have an effect on local tourism-related businesses and have implications for the local economy.

Improve Health and Safety

The co-disposal discard dump for the mine is proposed to be located outside of the original target area, and is likely to remain onsite in the long-term (excess of 20 years), and will need to be managed to ensure acid mine drainage, and water and soil resources are not contaminated. This could be a long-term health and safety risk if not managed correctly.

Following the closure of the mine, it is anticipated that noise and dust emissions will cease, resulting in a minor improvement of health and quality of life. Atha must, however, ensure these issues are managed through the mine closure and rehabilitation plan, to prevent long-term or permanent impacts.

Improved Aesthetics and Sense of Place

There is likely to be a permanent change in sense of place for the farm tenant community, even as the mine becomes inactive. This is however dependant on the closure and rehabilitation plans and implementation. Atha must ensure that the site is rehabilitated to a reasonable level (i.e. closer to its original state), to ensure that any potential negative impacts during the operational phase are reduced in the long-term.

There may be certain enduring impacts, such as economic and infrastructure development, and potentially loss thereof, following closure. These should be managed through the implementation of long-term plans in collaboration with the local municipalities, through the SLP Closure Plan.

9 Detailed Stakeholder Engagement Process

The stakeholder consultation process was conducted from the onset of the project and as part of the overall ESIA process undertaken by WSP in a comprehensive and transparent manner. Although the requirements of the MPRDA and NEMA were taken into consideration, WSP perceives that the requirements of the NEMA, pertaining to stakeholder engagement, are more stringent than the MPRDA. Therefore, WSP followed the NEMA requirements for stakeholder engagement, where prescribed.

The NEMA EIA Regulations of 2010 (GNR.543, Sections 54 – 57) require that an inclusive, transparent process of engagement be undertaken that allows participation by any and all persons and entities who may be affected by and/ or have an interest in a proposed project. Procedures for informing stakeholders about a project and engaging their participation have become standard practice. In the case of this project, WSP undertook a social scan and informal engagement as additional steps prior to the scoping phase of the project.

The stakeholder consultation process was undertaken in English, Afrikaans and Zulu to ensure the widest range of stakeholders were able to participate in the process. According to Section 56 of the NEMA EIA Regulations, WSP must give notice to all potential stakeholders of the project. The statutory requirements were followed in full, comprising:

- Newspaper advertisements;
- Site notices;
- Written notice and distribution of background information documents;
- Public consultation;
- Authorities consultation; and
- Informal stakeholder consultation.

Full details of the scoping stakeholder engagement process are provided in the scoping report.

Please note that due to the DMR timeframe requiring the submission of the final ESIA/ ESMP in mid-October 2013 as to comply with the requirements of the MPRDA, the NEMA and MPRDA stakeholder engagement process in the ESIA/ ESMP phase has been separated into two processes. Draft reports will be placed on public review at different periods and two sets of newspaper advertisements will be published. WSP does not deem it necessary to hold two sets of public meetings and therefore.

9.1 Objectives of the Stakeholder Engagement Process

All issues and concerns that were raised during the scoping and ESIA phases of the project have been included in this report. The objectives of the stakeholder engagement process were as follows:

- To ensure an open and transparent ESIA and consultation process;
- To identify and inform stakeholders of the proposed Yzermyn Underground Coal Mine and associated environmental authorisation process;
- Establish an ongoing line of communication between the stakeholder and the project team (Atha and WSP);
- Provide an opportunity for stakeholders to raise all issues, concerns and questions and ensure that these are considered in the environmental authorisation process for the project;
- Ensure that stakeholders have an opportunity to make a meaningful contribution towards decision making by all commenting authorities as well as the lead authority;
- Identify all the significant issues that need to be addressed in the ESIA; and

- Compile an issues trail of all issues, concerns and questions raised during the full stakeholder engagement process and other stakeholder consultation processes.

9.2 The Roles and Responsibilities of the Stakeholders

Registered stakeholders have the right to bring to the attention of the competent authority any issues that they believe may be of significance to the consideration of the application.

The rights of stakeholder are qualified by certain obligations, namely:

- Stakeholders must ensure that their comments are submitted, in writing, within the timeframes that have been approved by the competent authorities, or within any extension of a timeframe agreed by the Proponent, EAP or competent authorities;
- Serve a copy of the comments submitted directly to the competent authorities, the Proponent or the EAP; and
- Disclose to the EAP any direct business, financial, personal or other interest that they might have in the approval or refusal of the application.

9.2.1 Role of Stakeholders

The roles of stakeholders in a stakeholder engagement process usually include one or more of the following:

- Assisting in the identification and prioritisation of issues, and/ or potential impacts that need to be investigated;
- Making suggestions on alternatives and means of preventing, minimising and managing negative impacts and enhancing project benefits;
- Assisting in, or commenting on, the development of mutually acceptable criteria for the evaluation of decision options;
- Contributing information on public needs, values and expectations;
- Contributing local and traditional knowledge; and
- Verifying that their issues have been considered.

9.2.2 Responsibility of Stakeholders

In order to participate effectively, stakeholders should:

- Become involved in the process as early as possible;
- Register as a stakeholder;
- Advise the EAP of other stakeholders who should be consulted;
- Contribute towards the design of the public participation process (including timeframes) to ensure that it is acceptable to all stakeholders;
- Follow the process once it has been accepted;
- Read the material provided and actively seek to understand the issues involved;
- Give timeous responses to correspondence;
- Be respectful and courteous towards other stakeholders;
- Refrain from making subjective, unfounded or ill-informed statements; and
- Recognise that the process is confined to issues that are directly relevant to the application.

9.3 Approach to Stakeholder Engagement

Our approach to stakeholder engagement is based on the following principals:

- Undertake meaningful and timely participation with stakeholders;
- Focus on important issues during the ESIA process;
- Undertake due consideration of reasonable alternatives;
- Take accountability for information used;
- Encourage co-regulation, shared responsibility and a sense of ownership over the project lifecycle;
- Apply "due process" particularly with regard to public participation as provided for in the NEMA EIA Regulations and MPRDA Regulations; and
- Consider the needs, interests and values of stakeholders.

9.4 Stakeholder Database

The identification and registration of stakeholders has and will be an ongoing activity during the course of this study. Neighbouring farms as well as other stakeholders were identified as interested and/ or affected parties. Specific attention has been paid to the local communities, organisations, government departments and other active organisations in the area (NGOs, etc.).

These stakeholders were, where possible, individually notified of the proposed underground coal mine. WSP also notified the public of the proposed project through the erection of site notices and publication of newspaper advertisements. Furthermore, WSP utilised the assistance of the Wakkerstroom Tourism organisation who forwarded all email correspondence regarding the proposed project onto an existing database[11]. WSP considers that an effective notification process has been undertaken and exceeds the requirements of the NEMA.

WSP has developed and is maintaining an electronic database for the duration of the project which includes details of all stakeholders who have requested to be notified of the progress of the ESIA process. A copy of the stakeholder database is included in **Appendix G-1**. Please note that contact details of all stakeholders have not been included in the database.

9.5 Authority Correspondence

The prescribed environmental authorisation application form (in terms of the activities identified within **Section 3**) was submitted to the MDEDECT on 13 August 2012. The MDEDECT acknowledged receipt of the application form and assigned a reference number **17/2/3 GS 131**, however, the acknowledgement letter was not signed. Subsequent requests to obtain a signed copy of the acknowledgement of receipt have been uneventful. WSP will continue to request this information and make the signed letter of receipt available to all registered stakeholders upon request (once receipt has been obtained).

Mindset compiled an MRA which was submitted to the DMR on 19 March 2013. A letter of acknowledgement was received by Atha on 25 April 2013. Due to errors in the letter of acknowledgement, the DMR drafted an updated letter which was received on 14 May 2013, and provided Atha with the following reference number (**MP 30/5/1/2/2/10069 MR**).

[11] Please note that WSP does not have access to this database, although it has been conveyed that the database includes a wide range of stakeholders that are interested and/ or affected by the proposed project.

WSP compiled a waste management license during the onset of the ESIA process which was to be submitted to the DEA in accordance with the NEMWA. However, landowner consent could not be obtained resulting in WSP submitting a combined environmental authorisation and waste management license application to the DEA on 20 June 2013. Initially, the DEA requested additional information on 5 July 2013 for which WSP submitted on 10 July 2013. A letter of acknowledgement was received on 24 July 2013 and a reference number (**14/12/16/3/3/3/85**) was assigned. Please note that communication with the MDEDECT has continued although the MDEDECT will be seen as a commenting authority to the proposed Yzermyn Underground Coal Mine.

Furthermore, the relevant municipalities were notified of the proposed Yzermyn Underground Coal Mine project and meetings to discuss the project were arranged. Numerous meetings with the MDEDECT, DMR and local municipalities were held during 2012 and 2013. WSP has arranged a meeting with the DEA to discuss the proposed project on in September 2013. The outcome of this meeting will be made available to registered stakeholders in the final ESIA/ ESMP document prior to submission to the relevant decision-making authorities. All discussion points recorded to end August 2013 have been recorded in the issues trail (**Appendix G-2**) and all authority meeting minutes are available in **Appendix G-3**, and meetings with stakeholders is included in **Appendix G-4.**

WSP will continue to notify the authorities of the ESIA phase progress including all review periods and proposed meetings.

9.6 Stakeholder Notification

9.6.1 Newspaper Advertisement

The NEMA EIA Regulations require that an advertisement be placed in either a local newspaper or a Government Gazette. Should the project have a potential impact that extends beyond the boundaries of the metropolitan or local municipality, the project should be advertised within at least one provincial or national newspaper. For the proposed project, WSP is required to place an advertisement in one local and one national newspaper. However, to ensure that the widest range of potential stakeholders was notified of the proposed project, WSP advertised the project in local, regional and national newspapers. Newspaper advertisements, announcing the proposed Yzermyn Underground Coal Mine project and inviting stakeholders to register, were placed in the following publications during the scoping phase:

- The Citizen on 24 August 2012 (national newspaper);
- The Khanyisa on 23 August 2012 (regional newspaper);
- The Excelsior News on 24 August 2012 (local newspaper); and
- The Volksrust Recorder on 24 August 2012 (local newspaper).

A copy of the newspaper advertisements is included in **Appendix G-5.**

Please note that additional newspaper advertisements will be published in the abovementioned newspapers informing stakeholders of the location and period of public review of the draft ESIA/ ESMP documents. This information will be updated in the final ESIA/ ESMP prior to being submitted to the relevant decision-making authorities.

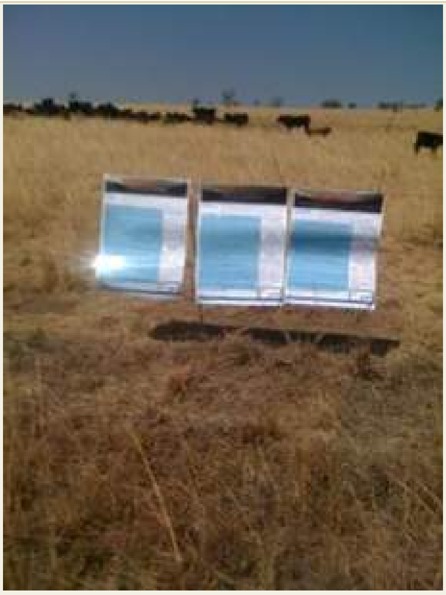
9.6.2 Site Notice

The NEMA EIA Regulations require that a site notice be fixed at a place conspicuous to the public at the boundary or on the fence of the site where the activity to which the application relates is to be undertaken. WSP placed site notices on the boundary fence closest to the unpaved road and erected additional notices at the following conspicuous locations in Dirkiesdorp, Wakkerstroom, Volksrust and Piet Retief:

- Single location on the boundary fence of the target area (English, Afrikaans and Zulu), coordinates: 27°12'44.25"S, 30°19'12.70"E;
- Wakkerstroom Mini Mart (Afrikaans), coordinates: 27°21'23.73"S, 30°08'26.80"E;
- Wakkerstroom Information Centre/ Trading Post (English), coordinates: 27°21'22.29"S, 30°08'28.85"E;
- Wakkerstroom Slaghuis (English, Afrikaans and Zulu), coordinates: 27°21'01.39"S, 30°08'50.88"E;
- Wakkerstroom on Badenhorst Street, adjacent to the information board (English, Afrikaans and Zulu), coordinates: 27°21'19.66"S, 30°08'28.40"E;
- Dirkiesdorp Medical Centre fence (English and Zulu), coordinates: 27°10'38.19"S, 30°24'10.05"E;
- Dirkiesdorp at the Thembisa Station (English and Zulu), coordinates: 27°10'25.36"S, 30°24'15.51"E;
- Vulindlela General Dealer (English and Zulu), coordinates: 27°04'44.91"S, 30°31'20.84"E;
- Engen in Piet Retief (English), coordinates: 27°00'08.14"S, 30°48'10.05"E;
- DIY Store opposite Post Office in Piet Retief (English), coordinates: 27°00'16.05"S, 30°48'05.42"E;
- Bottle Store opposite Engen in Volksrust (English and Afrikaans), coordinates: 27°22'05.39"S, 30°53'11.08"E;
- Engen in Volksrust (English), coordinates: 27°22'05.43"S, 30°53'09.94"E; and
- Mobile clinic servicing the Dirkiesdorp and KwaGema rural areas, coordinates: 27°10'37.18"S, 30°24'09.58"E.

The purpose of the site notice was to notify the public of the proposed Yzermyn Underground Coal Mine and invite the public to register as stakeholders and attend a public meeting (arranged during the scoping phase). Proof of site notices erected is provided in **Table 9-1** below. The site notices erected are included in **Appendix G-6**.

Table 9-1: Proofs of Site Notices (Scoping Phase)



Boundary of proposed Yzermyn Underground Coal Mine location

Wakkerstroom Mini Mart

Die Vlei Slaghuis

Wakkerstroom Information Board

Wakkerstroom Post Office

Dirkiesdorp Community Clinic

Dirkiesdorp Thembisa Station

Vulindlela General Dealer

Engen Fuel Station in Piet Retief


DIY Store, opposite the Piet Retief Post Office

The Bottle Store opposite the Engen Fuel Station in Volksrust

Engen Fuel Station in Volksrust

9.6.3 Background Information Documents and Letters of Invitation

According to the NEMA EIA Regulations 2010, written notice must be given to the:

- Owner or person in control of the land if the applicant is not the owner;
- Occupiers of the site where the activity is to be undertaken;
- Owners and occupiers of land adjacent to the site where the activity is to be undertaken;
- The municipal councillor of the ward in which the activity is to be undertaken as well as any organisation of ratepayers that represent the community in the area;
- The municipality which has jurisdiction in the area;
- Any organ of state having jurisdiction in respect of any aspect of the activity; and
- Any other party as required by the competent authority.

The purpose of the background information document (BID) is to provide background project information about the proposed project, outlined the environmental authorisation process and invite stakeholders to attend a public meeting. The BID further provided an opportunity for registration of stakeholders. A copy of the BID and letter of invitation is contained in **Appendix G-7**.

Furthermore, letters of invitation were also compiled and sent with the BIDs. BIDs were sent to notify the public of the proposed Yzermyn Underground Coal Mine project via email on 27 August 2012. Furthermore, WSP distributed BIDs to residents of Wakkerstroom and Dirkiesdorp during 22 – 24 August 2012. Occupiers of the site where the mining activities are proposed were notified of the public meeting on 14 September 2012.

This mechanism of notification is suitable for all groupings, except for the local communities, many of whom do not have access to these forms of communication. In order to ensure an encompassing notification process was followed, sms notifications were sent to stakeholders in local communities for which cell phone numbers were available and copies of the BID were distributed as hand-outs to the local communities, local ward councillors and traditional leaders as well as left at the following locations:

- Wakkerstroom Country Inn, coordinates: 27°21’19.37”S, 30°08’26.26”E;
- Wakkerstroom public library, coordinates: 27°21’.12.51”S, 30°08’30.87”E;
- Wakkerstroom Mini Mart, coordinates: 27°21’23.73”S, 30°08’26.80”E;
- Wakkerstroom Information Centre/ Trading Post, coordinates: 27°21’22.29”S, 30°08’28.85”E;
- Wakkerstroom Slaghuis, coordinates: 27°21’01.39”S, 30°08’50.88”E;
- Dirkiesdorp Medical Centre, coordinates: 27°10’38.19”S, 30°24’10.05”E;
- Thembisa Trust Mission Centre, coordinates 27°10’32.23”S, 30°24’15.04”E;
- Vulindlela General Dealer, coordinates: 27°04’44.91”S, 30°31’20.84”E; and
- Mobile clinic servicing the Dirkiesdorp and KwaGema rural areas.

9.6.4 Stakeholder Memo

WSP compiled a stakeholder progress memo which was circulated to registered stakeholders on 26 October 2012. The purpose of the memo was to update all registered stakeholders with regards to the progress of the ESIA process. Please note that this is not a legal requirement and is being circulated to ensure that all stakeholders are kept informed of the proposed project. A copy of the memo is available in **Appendix G-8**.

9.7 Stakeholder Meetings

9.7.1 Scoping Phase: Information Focus Group Meetings

WSP arranged informal meetings with previously identified key stakeholders (i.e. non-profit organisations and farmers whose land comprises the target area) as part of an initial scan aimed at understanding the local social and institutional dynamics. The proposed project was introduced to these key stakeholders in order to gain an understanding of the local perceptions and views regarding the project. WSP met with following list of stakeholders during 22 – 24 August 2012 and also met with the farmers on 10 December 2012:

- NGOs
  - World Wildlife Fund – South Africa (WWF-SA);
  - Endangered Wildlife Trust;
  - BirdLife South Africa;
  - Members of the Wakkerstroom Bird Club;
  - Enkangala Grassland Trust; and
  - African Crane Conservation Programme.
- Farmers

– Mr Johan Uys; and

– Mr BP Greyling.

Please note that no minutes were taken during the informal meetings.

9.7.2 Scoping Phase: Public Meetings

Two public meetings were arranged and held for the proposed project. The aim of the meetings was to detail the project and provide an opportunity for stakeholders to raise issues, concerns and queries related thereto. Both meetings were held in English and translated into Zulu and, where necessary, Afrikaans. All questions, concerns and issues were recorded, and copies of the meeting minutes are contained in **Appendix G-4**. The two public meetings were held at the following venues:

- Themba Trust Mission House in Dirkiesdorp on 26 September 2012 from 17h00 – 18h30; and
- Town Hall in Wakkerstroom on 27 September 2012 from 17h30 – 20h30.

The photo montage below was taken at the two public meetings, discussed above (**Figure 9-1**).

Dirkiesdorp Public Meeting on 27 September 2012

Wakkerstroom Public Meeting on 28 September 2012

Figure 9-1: Images of the Public Meetings held on 27 and 28 September 2012

9.7.3 Stakeholder Meetings during the Environmental and Social Impact Assessment Phase

WSP has held two ESIA public feedback meetings during the draft ESIA/ ESMP public review period. The purpose of the meetings was to provide all registered stakeholders with the opportunity to comment on the project via WSP and the greater project team. Furthermore, the meetings will aim to provide all attendees with the following information:

- The environmental authorisation process undertaken to date;
- Any and all project detail updates;
- Specialist findings and associated mitigations and recommendations;
- Department correspondence; and
- The way forward in terms of the environmental authorisation process.

The meetings will be chaired by WSP and attended by Atha and Mindset project representatives. Minutes of these meetings in contained in Appendix F and all comments obtained have been recorded in the issues trail.

9.8 Issues Trail

All concerns, comments, viewpoints and questions (collectively referred to as ‘issues’) have been documented together with the responses issued from the project team, and have been recorded into an issues trail. The issues trail details the outcome of all stakeholder engagement and consultation with authorities and stakeholders to date. Comments raised and included in the issues trail will assist WSP in identifying potential impacts associated with the project. A copy of the issues trail is included in **Appendix G-2**. The issues trail records the following:

- List of all issues raised;
- Record of who raised the issues;
- Record of where the issues were raised; and
- Response to the issues (given by the project team).

All comments and issues submitted to WSP during the ESIA phase will be incorporated into the existing issues trail to ensure all stakeholder concerns are sufficiently captured. Registered stakeholders will have a period of 21 days to review the final ESIA/ ESMP documentation prior to submission to the DEA. Please note that due to time constraints with the MPRDA, no final report will be issued for review prior to submission to the DMR. However, WSP will compile an updated stakeholder engagement document that will include all issues raised during the extended NEMA public review period which will be submitted to the DMR.

9.9 Public Review

9.9.1 Scoping Report

9.9.1.1 Public Review of Draft Scoping Report

Copies of the draft scoping report were placed on public review for a period of 37 days from 25 March to 7 May 2013 (MPRDA process) and 73 days from 25 March to 10 June 2013 (NEMA process) at the following venues:

- Wakkerstroom Public Library
  - Corner of R543 and Badenhorst Street, Wakkerstroom, 2480

- Wakkerstroom Country Inn
  - 124 Badenhorst Street, Wakkerstroom, 2480
- Themba Trust Mission House in Dirkiesdorp
  - 27°10’35.29”S; 30°24’13.86”E, off R543 Regional Road in Dirkiesdorp
- Piet Retief Public Library
  - 10 Retief Street, Piet Retief, 2380
- Volksrust Public Library
  - Joubert Street, Volksrust, 2470
- WSP Environment and Energy’s website:
  - www.wspenvironmental.co.za

All comments received were recorded and included in the issues trail. All stakeholders and commenting state departments were notified of the public review period as well as the locations of the draft scoping reports via fax and email. The following commenting authorities and non-profit organisations were sent a copy of the draft scoping report (**Table 9-2**).

Table 9-2: List of Stakeholders that received a copy of the draft Scoping Report

Department	Name	Contact Detail
MDEDECT	Nellisiwe Mlangeni	+27 17 811 4930 Ext 114
DWA	Ntombethu Makwabasa	+27 31 336 2810
DMR	Aubrey Tshivhandekano	+27 13 653 0500
DEA	Kathleen Saunders	+27 13 759 7385
SAHRA	Moses Makhweyane	+27 13 712 3576
MPTA	Frans Krige	+27 13 254 0279
WWF-SA	Charles Makuwerere	+27 11 477 1213
WWF-SA/ Ekangala Grassland Trust	Angus Burns	+27 13 318 6158
EWT/ African Crane Conservation Programme	Glenn Ramke	+27 17 730 0001
BirdLife South Africa	Dr Charmaine Uys/ Carolyn Ah Shene-Verdoorn	+27 11 789 1122
Wakkerstroom Bird Club	Brian Guerin, John McAllister, John Barrow	+27 17 730 0269
Pixley ka Seme Municipality	Zanele Mvusi/ Sibusiso Mabaso	+27 17 734 6127
Khondo Municipality	S Mathebuca	+27 79 511 5533

WSP is of the opinion that the correct methods prescribed in the NEMA EIA Regulation and MPRDA were complied with. The same public review period will be followed for the ESIA and EMPR documents once these have been compiled. All registered stakeholders will be notified about the location of the draft ESIA/ ESMP documents.

9.9.1.2 Final Submission of Scoping Report

All issues raised during the scoping phase of this project were incorporated into the final scoping report prior to finalisation and submission to DMR (17 May 2013) and DEA (20 June 2013) for review. WSP is expecting to receive an acceptance letter from the DEA of the final scoping report in September 2013. All registered stakeholders have been informed of the next phase of the stakeholder engagement process (i.e. the public review period and the ESIA phase meetings).

9.9.2 Social and Environmental Impact Assessment/ Environmental and Social Management Programme

9.9.2.1 Public Review of Draft Environmental and Social Impact Assessment Report / Environmental and Social Management Programme

The draft ESIA/ ESMP document was made available to relevant state departments and registered stakeholders for a period of:

- 30 days for the MPRDA draft ESIA/ ESMP from 10 September to 11 October 2013 (review period takes cognisance of Mpumalanga school holidays as well as the public holiday that occurs during the review period); and
- 60 days for the NEMA draft scoping report from 17 October to 17 December 2013.

The draft reports were made available at the following venues:

- Wakkerstroom Public Library
  - Corner of R543 and Badenhorst Street, Wakkerstroom, 2480
- Wakkerstroom Country Inn
  - 124 Badenhorst Street, Wakkerstroom, 2480
- Themba Trust Mission House in Dirkiesdorp
  - 27°10’35.29”S; 30°24’13.86”E, off R543 Regional Road in Dirkiesdorp
- Piet Retief Public Library
  - 10 Retief Street, Piet Retief, 2380
- Volksrust Public Library
  - Joubert Street, Volksrust, 2470
- WSP Environment and Energy’s website:
  - www.wspenvironmental.co.za

All registered stakeholders and commenting departments were notified of the public review period as well as the location of the draft ESIA/ ESMP via fax and email, post and sms. Issues received from stakeholders will be incorporated into the issues trail for submission to the relevant authorities, as detailed in **Section 9.8**.

9.9.2.2 Final Submission of the ESIA/ ESMP

All issues raised during all project phases will be incorporated into the final ESIA/ ESMP which will be submitted to the DMR and the DEA for their review and decision-making in terms of the relevant legislation. Once a decision has been reached, all registered stakeholders will be informed of the decision and afforded the opportunity to appeal the decision.

9.10 Stakeholder’s Capacity to Participate

The BID, letter of invitation, newspaper advertisements, and site notices were distributed in English, Afrikaans and Zulu on initiation of the ESIA process. During the scoping phase, public meetings a translator was available to clarify any questions raised regarding the proposed Yzermyn Underground Coal Mine, the process, answer questions, and to allow for comments to be provided in the local language. WSP will ensure that a translator is present during the ESIA meetings in order to prevent any breakdown of communication. It is WSP's opinion that those on the database have sufficient understanding of the project and the ESIA process to be able to participate in the stakeholder engagement process.

9.11 Key Issues and Concerns

The main issues identified during the scoping and ESIA phases of the project are outlined in **Table 9-3** below.

Table 9-3: Summary of Key Issues identified during the Scoping and ESIA Phases

Key Issues
Water Issues
■ Impact of surface and groundwater, including wetlands and river systems; ■ Acid mine drainage associated with the mine; and ■ Concerns regarding the supply of water and where the mine will source the water from.
Biodiversity Issues
■ Impact on biodiversity within the area (fauna and flora, including ecosystems) and the conflict of listed threatened ecosystems; ■ Impact on the protected areas in the area and potential impact of the expansion thereof; ■ Aquatic biodiversity concerns (including the impact on the biodiversity and water quality of the Heyshope Dam); ■ Omission of a Red Data bird species in the scoping report; ■ Impact on the ecological corridor north of the prospecting right; ■ Omission of reference to the proposed Mabola Protected Environment in the Scoping Report; ■ Impacts the proposed mine may have on the declared KwaMandlagampisi Protected Environment and potential impact the mine may have on the proposed Mabola Protected Environment; ■ Cognisance of buffers associated with the declared and proposed protected environments; and ■ Conflicts associated with the buffer zone surrounding wetlands/ springs/ seeps, etc.
Archaeological, Cultural and Heritage Issues
■ Concerns pertaining to the destruction of archaeological, cultural and/ or heritage artefacts associated with mining.
Visual and Aesthetic Issues
■ Loss of 'sense of place' resulting from the proposed Yzermyn Underground Coal Mine.
Infrastructure Issues
■ Concerns over infrastructure and structures (e.g. roads, wash plant, etc.) located in a sensitive environment and the impact thereof.
Health and Safety
■ Impact on the health and safety of employees and community members; ■ Issues associated with fires as a result of the proposed project; and ■ Issues relating to stock-theft resulting from the influx of people to the mine area.
Traffic Issues
■ The impact that additional heavy vehicle mining traffic will have on the state of the existing road networks/ infrastructure; and ■ Health and safety resulting from increased traffic from the proposed project.

Key Issues
Legislation Issues
■ Issues surrounding the MPRDA Section 49 Motivation; ■ Incomplete acknowledgement application from MDEDECT; ■ Issues surrounding the proposed Mabola Protected Environment, of which intent to declare has recently been published.
Socio-Economic Issues
■ Economic impact of properties in the area (loss of property value); ■ Economic development associated with the project (positive); ■ Economic growth and local economic development (positive); ■ Employment opportunities and skills development (positive); ■ Local economic development initiatives (positive); ■ Perceptions that the protection of the environment outweighs poverty eradication *viz.* job employment; ■ Impact on the environmental resources of the area, thereby impacting on eco-tourism; ■ Relocation of farm tenants due to mining activities; and ■ False perception of employment opportunities in Wakkerstroom as a result of the proposed project.
Legal Issues
■ Legacy issues associated with prospecting right renewal, Section 11 transfer and mining EMP.
Land Issues
■ Rezoning of the land on which the proposed Yzermyn Underground Coal Mine is proposed.
Financial Issues
■ Cost accounting request for implementing each mitigation measure in order to identify feasibility of applying proposed measures.
Commercial
■ Shareholder requests; and ■ Conflicting land uses associated with the proposed project, including the omission of the Subdivision of Agricultural Land Act 70 of 1970.
Technical Issues
■ Request to include cumulative impacts associated with the project; ■ Underestimation of area that may be disturbed from surface infrastructure and related services; and ■ Additional information pertaining to the proposed pollution control dam.

Refer to **Appendix G-2** for a detailed record of all issues raised and responses issues by the project team.

10 Environmental and Social Impact Assessment

The potential environmental impacts associated with the proposed Yzermyn Underground Coal Mine have been evaluated according to their significance, which is a result of the consequence and likelihood of the impact. *Consequence* is a function of impact severity, duration and spatial scale, whereas impact *likelihood* is a function of the frequency of the activity and frequency or periodicity of the effect/ impact. Consequence multiplied by likelihood computes the significance of the potential impact.

WSP's risk assessment methodology was used for the rating of the impacts. All impacts were assessed with and without mitigation/ management measures in place. Furthermore, cumulative impacts are also taken into consideration.

The following environmental aspects were evaluated in order to identify the anticipated impacts for each in the construction, operation and closure phases:

- Geology;
- Topography;
- Soils, Land Use and Land Capability;
- Biodiversity;
- Surface Water;
- Groundwater;
- Air Quality;
- Noise;
- Archaeology, Cultural and Heritage;
- Traffic;
- Visual; and
- Socio-economic.

These aspects are discussed in detail in the following sections and are rated with and without mitigation measures in **Table 10-2 – Table** 10-4. Mitigation measures are detailed in the ESMP in **Section 11.**

10.1 Potential Anticipated Impacts Identified During the Scoping Phase

Potential impacts identified during the scoping phase of the proposed Yzermyn Underground Coal Mine are listed in **Table 10-1**. These impacts were assessed with limited information available at the time of compiling the scoping report and a number of potential impacts detailed below will not take place following the receipt of information obtained during the ESIA phase of the project. Identified impacts are discussed in detailed in **Section 10.2.**

Table 10-1: Potential Impacts identified during the Scoping Phase

Environment	Anticipated Impact (without mitigation measures)
Geology	■ The proposed Yzermyn Underground Coal Mine may have an impact on the rock masses that influence the groundwater and topography on the project site, and may impact post-mining slope stability. ■ Excavation of rock for the sinking of the adit and mine entrance will influence the underlying geology of the site as a void will be created, that may have a steep gradient or stepped high-walls. ■ Resultant impacts from blasting and vibrations may impact on geology. Drilling and blasting may cause unintended collapse of underground workings. ■ The extraction of coal from the underground mine will result in the permanent removal of geology. ■ Apart from specific rock types or outcrops which are of scientific interest or cultural significance, the direct impact of mining on geology is seldom highly significant unless the long-term effects on groundwater or topography have important ramifications. ■ Disturbance and removal of the geological strata due to excavation of box-cut and incline shafts and subsequent removal of the coal.
Topography	■ The topographical impact on the underground mine in the target area may influence surface water, groundwater and result in subsidence[12]. ■ Disturbance of topography as a result of the excavation of the box-cut, stockpiling of the resultant soil to create a foundation for the associated mining infrastructure and the stockpiling of the overburden to create visual berm. ■ Potential aesthetic impact resulting from the plant area, discard dump, adit entrance, soil and product stockpiles and mine infrastructure (admin offices). ■ Potential failure of underground pillars may cause subsidence, impacting on the topography of the area. ■ Site clearing and topsoil removal and establishment of initial box-cut and access ramps.
Air Quality	■ The generation of dust from the construction, operational and closure phases of the mine is anticipated (land clearing, drilling, blasting, crushing, milling, transport of product via road and conveyor, stockpiling waste rock, soil and product, etc.). - Dust may impact on the health and safety of employees and the surrounding community through respiratory, visual and aesthetic impacts. - Dust may containing toxic materials and may have direct on the community and fauna in the area. - Dust fallout retards vegetation growth and reduces the palatability of plants to animals. ■ Drilling, blasting and abrasion of hard rock overburden may generate dust. ■ Vehicle activity associated with mining may generate dust. ■ Topsoil and overburden removal and stockpiling, drilling and blasting and discard dump may contribute to the generation of dust. ■ The transportation of coal product results in a release of volatile organic compounds (VOCs) from

[12] Following the completion of the scoping phase, it was noted that due to the structural stability of the underground geology, subsidence is not likely to occur. Furthermore, no depillaring or reclamation of pillars will be undertaken as part of the mining operations.

Environment	Anticipated Impact (without mitigation measures)
	vehicle exhausts. ▪ Methane gas may be produced as a result of the coal extraction activities. ▪ Spontaneous combustion of coal produces CO_2, noxious gases and smoke which may impact on the receiving environment as well as the health and safety of the community. ▪ Spontaneous combustion underground may cause safety impacts on the mine employees and could render the surface unusable, therefore impacting on soils, surface water, biodiversity and land use. ▪ Demolition of infrastructure during decommissioning and closure may have an impact on the surrounding air quality (generation of dust).
Soil, Land Use and Land Capability	▪ Excavation and soil stockpiling during site preparation may result in the dilution of highly fertile organic components within the soil and may result in the loss of topsoil on the site. ▪ Excavation and soil stockpiling may result in the ingress of alien invasive plant species to the area, impacting on the future sustainable land use potential and land capability after mining. ▪ Mining activities may cause erosion (e.g. stormwater runoff), resulting in a loss of fertile topsoil resources that could impact on surrounding surface water bodies. ▪ Compaction of soil may concentrate surface water runoff from the site, resulting in downstream erosion, flooding or loss of biodiversity. ▪ Leachate from waste rock dumps or product stockpiles may contaminate soils from infiltration, resulting in surface and groundwater contamination. ▪ Soil contamination may occur from spillages and leakages of hydrocarbons, contaminated water, plant runoff, etc. onsite. ▪ Contamination from the poor management of wastes generated onsite. ▪ Impact on soil degradation at the adit/ mine entrance area. ▪ Potential loss of grazing capacity, cultivated agriculture and commercial forestry (land use) as a result of mining activities. ▪ Potential acid mine drainage could result in acidic and saline soils, making conditions unsuitable for vegetation growth. ▪ Subsidence of mine area may impact on the land capability and land use of the area. ▪ Loss of sensitive and conservation land, resulting on an impact in tourism to the Wakkerstroom area. ▪ Mining may not comply with land use potential and land capability of the area. ▪ Undermining may limit future land use and land capacity of the target area.
Biodiversity	▪ Mining and associated activities may have an impact on the site specific ecosystem, and could result in a loss of vulnerable, critically endangered, endangered and near threatened sensitive species (flora and fauna). ▪ The mining activities may have a potential loss of Red Data species that could occur within the site. ▪ Mining and associated activities may disturb indigenous flora in the area. ▪ Resultant impacts on the flora and fauna may have a direct impact on ecological sensitivity in the area and may resulting in a loss of tourism. ▪ Potential impact on habitat corridors, or isolation of sensitive areas may result in the degradation of indigenous flora and fauna species, and changes in populations reliant on movement or interchange between habitats. ▪ Potential impact on biodiversity through mishandling of dangerous goods *viz.* diesel, hydraulic oil, onsite chemicals, etc. ▪ Mining activities may result in the generation of alien vegetation, which may encroach and impact

Environment	Anticipated Impact (without mitigation measures)
	on the sensitive ecosystem. ▪ Mining activities may impact on the groundwater table, impacting sensitive areas such as wetlands within the surrounding area. ▪ Potential subsidence may have an impact on slopes and ridges in the target area, resulting in a loss of potentially unique habitat conditions. This may affect sensitive breeding species. ▪ Contamination from the poor management of wastes generated onsite. ▪ Potential loss of habitats resulting from uncontrolled burning regimes. ▪ The accumulative effect of emissions into the air could have an adverse effect on the flora and fauna populations. ▪ Release, spillages and leakages of chemicals, hydrocarbons and sewage may lead to a depletion of the natural ecosystem. ▪ Impact of traffic and transport activities on flora and fauna species (construction, operation, decommissioning).
Hydrology and geohydrology	▪ Impacts on surface water and groundwater recharge due to modification of infiltration rates from compaction of surfaces in surface infrastructure area. ▪ River diversion could alter overall gradient of streams, therefore impacting on flow rates, discharge rates and erosion/ sedimentation patterns downstream[13]. ▪ Oxidisation of sulphur compounds (iron pyrite) in the ore result in acid mine drainage which decreases acidity. The runoff may affect surface water quality, groundwater and biodiversity in the area. ▪ Potential impacts on surface water as a result of runoff contamination from the discard dump, plant area and product stockpile area. ▪ Potential surface and groundwater contamination from spillages and release of process water from plant areas that diffuse and infiltrate the surrounding environment. ▪ Potential pollution or impact on the hydrology and geohydrology resulting from incorrect storage and management of dangerous goods (hazardous and chemical materials) and/ or other contaminants. ▪ Pumping of groundwater required for safe mining conditions may have a direct impact on the water table (reducing natural groundwater recharge), and could have impacts on sensitive ecosystems such as wetlands, springs and resultant loss of flora and fauna species. ▪ Pumping of groundwater also increases the volume of discharge in the area, potentially altering downstream ecosystems and biota. ▪ Release, spillages and leakages of chemicals, hydrocarbons and sewage (treated sewage) may lead to an impact on the surface and groundwater of the area. ▪ Physical disruptions of aquifers may occur from blasting, causing groundwater to seep to lower aquifers, which could result in cross contamination of aquifer resources. ▪ Potential impact from failures from mining activities and infrastructure (e.g. pollution control dam, sewage treatment plant, etc.).
Noise and Vibrations	▪ Noise will be generated from drilling, blasting, mining operations, transportation, crushing, machinery etc. which may have a negative impact on the surrounding biophysical and socio-economic environment. ▪ Construction and operational activities may lead to an increase in noise levels over the ambient environment levels. ▪ Vibrations from blasting may impact on the underlying geology of the site, and could result in displacement of sensitive fauna species.

[13] Potential for river diversions was clarified during the ESIA phase, and therefore no river diversions will occur.

Environment	Anticipated Impact (without mitigation measures)
	■ Vibrations could cause failure underground which could impact on the health and safety of employees, as well as the subsidence of topography.
Traffic	■ There may be an increase in traffic within the immediate area which would result in the generation of dust, noise, air emissions and hydrocarbon spillages. ■ Increase traffic could cause road deterioration and have a negative impact on the movement of affected parties in the region (all phases of the project).
Visual	■ The mining and associated activities may have an impact on the aesthetics of the area and impact on the general 'sense of place'. ■ The generation of dust and smoke may have visual impact within the surrounding area, resulting in associated health and safety impacts.
Archaeology, Historic and Cultural	■ The proposed mine may have an impact on sites of archaeological, historic and cultural importance/ significance. ■ Artefacts such as structures dating to the Iron Age, Stone Age and early 19th century may be impacted on from mining and associated activities (e.g. mining employees), including subsidence in the area. ■ Bushman paintings could be affected from mining and associated activities (mining employees), including subsidence in the area. ■ Identified and unidentified graves may be impacted on from mining related activities and subsidence in the area. ■ Impacts of the gird connection link on sites of heritage significance.
Socio-economic	■ Coal may be directly supplied to Eskom where it will be burnt to generate electricity which is distributed throughout Southern Africa. Due to increased development and demand for electricity, there is an increased need for coal mines to continue to produce coal for supply to Eskom; some coal will also be exported. ■ Job opportunities may be made available to the surrounding local citizens in the Dirkiesdorp, Wakkerstroom and Vaalbank communities. ■ Training may be provided to employees resulting in an improvement of the local skills base. ■ The mine may invest in social capital by undertaking a Social and Labour Plan, and promote sustainable local economic development in the surrounding areas; ■ Support may be given to the local and national economy by the purchase of goods and services. ■ The export of coal will contribute towards: – Local development within the Pixley ka Seme and Khondo Local Municipalities; – South Africa's foreign revenue; and – The generation of export income. ■ Socio-economic conditions in the project area will be impacted on both positively and negatively. ■ The proposed mine may have negative impacts on the health and safety of the surrounding community and future employees from the generation of dust, air emissions (noxious gases and smoke), noise, vibrations, traffic, and contamination of surface and groundwater on downstream water users. ■ The mine may have an aesthetic impact on the surrounding communities. ■ The 'sense of place' may be affected, thereby impacting on the surrounding community. ■ The mine may have a direct impact on the biophysical environment, thereby impacting the tourism and recreational patterns in the region. ■ The project may have positive impacts on public infrastructure and services, such as upgrading roads, installing power lines, etc. The project may create social upliftment through the construction of educational facilities.

Environment	Anticipated Impact (without mitigation measures)
	■ The project may create employment opportunities for the surrounding community. ■ Increase in economic growth and local economic development. ■ Training and skills development may be provided to unskilled labourers in the area, thereby expanding the local skills base. ■ There may be an increase in foreign workforce. ■ The mine may result in an increase of individuals into the area. ■ Increased individuals may result in the establishment of illegal settlements. ■ The increase in individuals in the area may impact on social pathologies, such as social ills, crime, etc.

10.2 Impacts Identified during the Environmental and Social Impact Assessment Phase

Impacts identified during the ESIA phase of the project have been detailed by the relevant specialists in **Section 8**, whereas additional non-specific impacts are included within **Table 10-2** to **10-4 a**nd have been rated accordingly.

Table 10-2: Construction Phase Environmental and Socio-economic Impacts

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.1	Geology	Construction	Removal of overburden and rock as a result of constructing the adit, and ventilation shaft, and the removal of overburden layers for infrastructure development.	5	3	3	3.7	5	5	5.0	18.3	
				4	3	2	3.0	5	5	5.0		15.0
1.2			Blasting and subsequent removal of geology.	5	3	3	3.7	5	5	5.0	18.3	
				4	3	2	3.0	5	5	5.0		15.0
1.3	Topography	Construction	The development of the adit and construction of infrastructure (building structures, access roads, fencing, etc.) as well as the co-disposal discard dump facility.	3	5	3	3.7	5	4	4.5	16.5	
				3	4	3	3.3	5	4	4.5		15.0
1.4			Disturbance of natural lie of the land resulting from site clearing, topsoil removal and development of adit.	3	5	3	3.7	5	4	4.5	16.5	
				3	4	3	3.7	5	4	4.5		15.0
1.5			Disturbance of natural/ or existing flow of topography and the free drainage of the area resulting from surface infrastructure.	4	4	4	4.0	5	4	4.5	18.0	
				3	4	3	3.3	5	3	4.0		13.3
1.6	Soils, Land Use and Land Capability	Construction	Site clearance resulting in the removal and stockpiling of topsoil resulting in long-term loss of organic components and fertility status.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
1.7			Change of land use from natural and grazing land to mining, resulting in a loss of agricultural potential (limited to surface infrastructure area).	4	4	2	3.3	5	5	5	16.7	
				3	4	2	3.0	5	3			12.0

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.8			Loss of soil resources during the site establishment resulting in increased erosion: - Affecting the fertility area with respect to the rehabilitation potential and natural ecology for future rehabilitation purposes - Change in plant species composition with a reduced water impact into the wetland areas. - Impacting on terrestrial faunal communities through transformation (degradation) of grasslands, wetlands and riverine habitat.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
1.9			Compaction of soil resources from vehicles and foot traffic resulting in increased erosion and loss of prolific soils.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5.0		18.3
1.10			Leakages and spillages of hydrocarbons from construction vehicles, machinery and equipment as well as the spillage of sewage from chemical toilets.	3	2	1	2.0	4	3	3.5	7.0	
				3	1	1	1.7	4	2	3		5.1
1.12			Carbonaceous and explosive residue contamination of soils as a result of the development of the adit entrance and removal of face coal.	4	3	3	3.3	4	4	4.0	13.3	
				3	2	2	2.3	3	4	3.5		8.2

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.13	Biodiversity	Construction	Construction of the surface infrastructure will result in complete removal and levelling of the affected area (0.6 km^2).	5	5	3	4.0	5	5	5.0	**20.0**	
				5	4	2	3.7	5	5	5.0		**18.3**
1.14			Facilitation of alien invasive species resulting from construction activities as people, vehicles and building materials are brought onto site. This can cause spreading of diseases and parasites (*viz.* from the Black Rat), displacement of indigenous Conservation Important species, transforming terrestrial and aquatic habitats and altering ecosystem functioning and services	5	5	3	4.0	5	4	4.5	**19.5**	
				2	3	2	2.3	5	3	4.0		**9.3**
1.16			Loss of Exposed Rocky Areas, *Andropogon – Helichrysum – Bulbostylis* seasonal seeps; *Andropogon – Hyparrhenia* temporary seeps; *Hyparrhenia – Cymbopogon – Monocymbium* mid- to upper slopes; alien bush clumps; and cleared alien bush clumps. Removal of these communities will result in the loss of Conservation Important flora species including endangered, vulnerable, rare and other declining species.	5	5	2	4.0	5	5	5.0	**20.0**	
				5	4	2	3.7	5	5	5.0		**18.3**
1.17			Fragmentation of habitats and isolation of small areas resulting from site clearing activities resulting in degradation of the areas and/ or changes between populations reliant on movement or interchange between habitats and scattered populations.	5	5	2	4.0	5	5	5.0	**20.0**	
				5	4	2	3.7	5	5	5.0		**18.3**
1.18			The creation of atypical/ non-natural habitat (i.e. the mine) with the presence of humans for prolonged periods thereby natural ecological processes and affecting ecosystem functioning in the immediate area.	5	5	2	4.0	5	5	5.0	**20.0**	
				5	4	2	3.7	5	5	5.0		**18.3**

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.19			Collection of flora or fauna species for either medicinal purposes, firewood or hunting and poaching resulting in a depletion of CI species.	5	3	2	3.3	4	4	4.0	13.3	
				5	3	2	3.3	2	2	2		6.6
1.20			Removal of vegetation for proposed surface infrastructure resulting in mortality of small, fossorial, and other, less mobile animals and, more importantly, loss of foraging habitat for various fauna including several CI species, such as the Endangered Swinny's Horseshoe Bat and other CI bat species, the potentially occurring Endangered White-tailed Mouse, resident breeding pairs of the vulnerable White-bellied Korhaan, the vulnerable African Grass-owl, and near threatened Secretary Bird.	5	5	2	4.0	5	5	5.0	20.0	
				5	4	2	3.7	5	5	5.0		18.3
1.21			Generation of dust during clearing activities resulting in the outflow of biodiversity from the project site.	3	2	3	2.7	5	5	5.0	13.3	
				3	1	3	2.3	4	3	3.5		8.2
1.22			Generation of noise during construction activities resulting in the outflow of biodiversity from the project site.	3	2	3	2.7	5	5	5.0	13.3	
				3	1	3	2.3	4	3	3.5		8.2
1.24			Removal of vegetation and topsoil within the surface infrastructure area resulting in the degradation of system 1 and system 2 wetlands as defined in the ESIA document. This has a number of effects including A change in the water distribution and retention patterns of downstream wetlands. Decline in water inputs into adjacent river and associated channelled valley bottom wetlands and loss in ecosystem services provided by the wetlands.	5	5	2	4.0	5	5	5.0	20.0	
				5	4	2	3.7	5	5	5.0		18.3

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.25			Encroachment of 1 km FEPA boundary (wetland boundary) resulting from the construction of the co-disposal discard dump facility.	5	4	5	5.0	5	5	5.0	25.0	
				5	4	5	4.7	5	5	5.0		23.3
1.26			Spillages and leakages from construction vehicles, machinery and equipment, as well as the spillage of sewage from chemical toilets resulting in the degradation of biodiversity.	3	2	1	2.0	4	3	3.5	7.0	
				3	1	1	1.7	4	2	3		5.1
1.27	Surface Water	Construction	Site clearing resulting in a change to the surface flow dynamics of the area affecting the flow regime of surrounding watercourses (degradation of wetlands, change of in-stream conditions, changes in species composition of terrestrial fauna, etc.).	5	5	2	4.0	5	5	5.0	20.0	
				5	4	2	3.7	5	5	5.0		18.3
1.28			Leakages and spillages of hydrocarbons from construction vehicles, machinery and equipment as well as the spillage of sewage from chemical toilets could result in the contamination of surface watercourses.	3	2	1	2.0	4	3	3.5	7.0	
				3	1	1	1.7	4	2	3		5.1
1.29			Increase in impervious areas as a result of compaction of soils resulting in the siltation of adjacent watercourses.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5.0		18.3
1.30			Erosion of topsoil resulting from increased peak flow from hardstanding areas such as compacted soils.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.31	Groundwater	Construction	Leakages and spillages of hydrocarbons from construction vehicles, machinery and equipment as well as the spillage of sewage from chemical toilets could result in the contamination of groundwater. This in turn can infiltrate the shallow aquifer.	3	2	1	2.0	4	3	3.5	7.0	
				3	1	1	1.7	4	2	3		5.1
1.34			Potential dewatering as a result of intersecting a water bearing fault that could be connected with a shallow aquifer which feeds the seep wetlands.	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7
1.35			Dewatering as a result of seepage into the adit workings during construction. This could extend up to 500 m resulting in the lowering of the groundwater thereby impacting springs/ fountains and seep wetlands in the area.	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7
1.36			Exposure of adit rock face to oxygen resulting in acid rock drainage from the construction activities.	4	5	3	4.0	4	4	4.0	16.0	
				4	5	3	4.0	4	3	3.5		14.0
1.37			Incorrect compaction of liner underlying the co-disposal discard dump facility resulting in seepage of contaminants into the shallow aquifer.	5	5	4	4.7	5	4	4.5	21.0	
				5	5	4	4.7	3	2	2.5		14.0
1.38	Air Quality	Construction	Generation of dust (PM_{10} and dust fallout) during the construction phase from land clearing, vegetation removal and stockpiling of soil, unpaved road emissions, loading and unloading of topsoil, construction of access roads and surface infrastructure, blasting for the development of the adit and wind erosion from exposed areas.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
1.39			Emission of NO_2, SO_2, CO and VOC from construction vehicles.	3	2	3	2.7	5	5	5.0	13.3	
				3	1	3	2.3	4	2	3.0		7.0

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.40			Impact on sensitive receptors within 500 m of the proposed project.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
1.41			Impact on air quality resulting from fires during the construction phase (including veld fires, spontaneous combustion and illegal fires within the mining area).	3	1	3	2.3	4	4	4.0	9.3	
				3	1	1	1.7	2	3	2.5		4.2
1.42			Generation of Greenhouse Gases resulting from construction phase.	3	5	5	4.3	5	4	4.5	19.5	
				3	1	3	2.3	4	2	3.0		7.0
1.43	Noise	Construction	Generation of noise resulting from land clearing, earthworks, grading, bulldozing, unloading of materials and transportation activities. Blasting activities can also impact on the generation of noise.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
1.44	Archaeological, Cultural and Heritage	Construction	Identification of any historical, archaeological or cultural artefact during land clearing activities.	4	2	5	3.7	2	3	2.5	9.2	
				3	2	5	3.3	2	2	2.0		6.6
1.45			Damage or destruction of any identified aspect of archaeology, cultural or heritage (sites 1, 2, 3 and 11, as detailed in the ESIA report) during construction activities.	3	5	2	3.3	4	3	3.5	11.7	
				3	5	2	3.3	2	2	2.0		6.6
1.46			Damage or destruction of any aspect of archaeology, cultural or heritage (sites 9, 16, 17 and 18, as detailed in the ESIA report) during construction activities.	3	5	3	3.7	4	3	3.5	12.8	
				3	5	2	3.3	2	2	2.0		6.6

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.47	Traffic	Construction	Increase in vehicle volume to the area, resulting in the generation of dust, vehicle fumes and noise.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
1.48			Construction vehicles as well as haul trucks may impact pedestrian safety.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		6.7
1.49			Construction vehicles as well as haul trucks may increase the occurrences of road accidents around the project site.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		6.7
1.50			Increase in traffic during the construction phase could result in the deterioration of the unpaved road.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		6.7
1.51	Visual	Construction	Visual intrusion from cut and fill earthworks, plant structures with discordant colours. Lights at night. Movement of construction vehicles. Changes to site and the surrounding area's visual sense of place.	4	5	4	4.3	5	5	5.0	21.7	
				3	5	3	3.7	5	3	4.0		14.7
1.52			Increase in heavy construction vehicles in and around the site resulting in a negative effect on the visual aesthetics of the area.	3	5	3	3.7	5	4	4.5	16.5	
				2	5	2	3.0	5	3	4.0		12.0
1.53			Visual intrusion from blasting of adit entrance. Colour contrast from concrete supporting structures.	4	5	4	4.3	5	5	5.0	21.7	
				3	5	3	3.7	5	3	4.0		14.7

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.54			Visual intrusions resulting from the construction of the PCD and co-disposal discard dump facility.	4	5	4	4.3	5	5	5.0	21.7	
				3	5	3	3.7	5	3	4.0		14.7
1.55			Dust may be generated from the removal of vegetation, movement of construction vehicles and wind erosion resulting in visual nuisance within the area.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
1.56	Socio-economic	Construction	Employment opportunities resulting from the construction phase.	1	3	3	2.3	3	1	2.0	4.7	
				2	4	3	3.0	5	4	4.5		13.5
1.57			Increased health and safety issues resulting from noise emissions and dust emissions during the construction phase.	4	4	3	3.0	5	3	4.0	14.7	
				2	4	3	3.0	3	3	3.0		9.0
1.58			Health and safety impacts on pedestrian safety associated with the increase in construction vehicles within the area.	4	5	4	4.3	5	4	4.5	19.5	
				2	4	3	3.0	3	3	3.0		9.0
1.59			Unmanaged contractors might cause an increase in influx of job seekers and the establishment of informal settlements.	3	4	3	3.0	5	4	4.5	15.0	
				2	4	3	3.0	3	2	2.5		7.5
1.60			Construction and closure activities could contribute to social ills, such as HIV/ AIDS, petty crime, stock theft, etc.	4	5	4	4.3	5	4	4.5	19.5	
				2	4	3	3.0	3	3	3.0		9.0

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
1.61			The presence of non-residents, perceived "outsiders" and contractors within the local environment could cause localised social tension due to the rural nature of the area, and the change in nature of the area during construction. The opposition expressed by certain local communities and stakeholders, could result in conflict causing disruption to the local communities and the construction operations.	3	4	3	3.0	5	4	4.5	15.0	
				2	4	3	3.0	3	2	2.5		7.5
1.62			Impacts (health and safety, nuisances and damage to structures) to the homestead situated approximately 500 m from the construction site (family name – Mkhubu).	4	5	4	4.3	5	4	4.5	19.5	
				2	4	3	3.0	3	3	3.0		9.0
1.63			Growth in skills development resulting from the employment of unskilled labour from nearby communities.	1	3	3	2.3	3	1	2.0	4.7	
				2	4	3	3.0	5	4	4.5		13.5
1.64			Opportunities for entrepreneurial development as a result of the construction activities.	1	3	3	2.3	3	1	2.0	4.7	
				2	4	3	3.0	5	4	4.5		13.5

Table 10-3: Operational Phase Environmental and Socio-economic Impacts

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.1	Geology	Operation	Permanent loss in a natural, non-renewable resource and associated geology.	5	3	3	3.7	5	5	5.0	18.3	
				4	3	2	3.0	5	5	5.0		15.0
2.2	Topography	Operation	The natural lie of the land will be altered from the structures associated with the proposed Yzermyn Underground Coal Mine (stockpiles, co-disposal discard dump facility, adit entrance, etc.). This alteration of the land will have further impacts on surface water flow dynamics as the natural drainage pattern is disrupted. Alteration of slope direction and slope percentages, thus creating the potential for erosion.	3	5	3	3.7	5	4	4.5	16.5	
				3	4	3	3.7	5	4	4.5		15.0
2.3			Altering slope direction and percentages of the co-disposal discard dump, thus creating the potential for erosion. A possibility exists for the siltation of drainage works.	3	5	3	3.7	5	4	4.5	16.5	
				3	4	3	3.7	5	4	4.5		15.0
2.4			Concurrent replacement of overburden and topsoil and resultant re-vegetation during the operational phase may have improvements for natural surface flow dynamics.	3	5	3	3.7	5	4	4.5	16.5	
				3	4	3	3.7	5	4	4.5		15.0
2.5	Soils, Land Use and Land Capability	Operation	Reduction in land capability (grazing potential) due to erosion and alien invader plant species proliferation	5	5	3	4.0	5	4	4.5	19.5	
				2	3	2	2.3	5	3	4.0		9.3
2.6			Spillage of oils, greases, diesel etc. especially during all project phases may resulting in the contamination of existing	3	2	1	2.0	4	3	3.5	7.0	

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
			soil resources. Poorly maintained equipment could result in soil contamination due to the leakage of oils, greases, diesel, chemicals, etc.	3	1	1	1.7	4	2	3		**5.1**
2.7			The increase in runoff and associated erosion could result in a loss of soils for rehabilitation purposes.	5	5	2	4.0	5	5	5	**20.0**	
				5	4	2	3.7	5	5	5		**18.3**
2.8			By establishing infrastructure over topsoil or fertile soils, potential fertile soils may be sterilised.	5	5	2	4.0	5	5	5	**20.0**	
				5	4	2	3.7	5	5	5		**18.3**
2.10			The establishment of infrastructure could result in an increase of runoff and could have an effect on the natural drainage of the area, which could lead to an increase in the erosion potential of the area.	5	5	2	4.0	5	5	5	**20.0**	
				5	4	2	3.7	5	5	5		**18.3**
2.11			Potential failures of the co-disposal discard facility as well as the PCDs will result in the contamination of soils and loss of soil resources.	5	5	2	4.0	5	5	5	**20.0**	
				5	4	2	3.7	5	5	5		**18.3**

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.12	Biodiversity	Operation	Dewatering activities will need to be undertaken during the operational phase resulting in the lowering of the shallow and deep aquifers, drying springs/ fountains and seep water into wetlands. This impact will be seasonal, with the most significant effect on wetlands occurring during the dry seasons	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7
2.13			Changes in the water distribution and retention patterns of downstream wetlands. Decline in water inputs into adjacent river and associated channelled valley bottom wetlands and loss in ecosystem services provided by the wetlands.	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7
2.14			Encroachment resulting in the operation and expansion of the co-disposal discard dump facility during operation into the required 1 km buffer around adjacent FEPA wetlands.	5	4	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7
2.15			Spillages and leakages from construction vehicles, machinery and equipment, as well as the spillage of sewage from chemical toilets resulting in the degradation of biodiversity.	3	2	1	2.0	4	3	3.5	7.0	
				3	1	1	1.7	4	2	3		5.1
2.16			Even though local aquatic systems may be perennial in nature, water abstraction for the proposed mining operation has the potential to change the flow of these resources during the operation phase. If the flow rates of local water resources are lowered, this will lead to changes in channel shape, sedimentation, water quality, aquatic habitat integrity, and faunal communities. Reduced flow rates will also hinder fish migration.	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.17			Dewatering activities effecting wetland systems could result in the change in structure of vegetation communities and CI species found within these habitats.	5	5	5	5.0	5	5	5.0	**25.0**	
				4	5	4	4.3	5	5	5.0		**21.7**
2.18			The decline in water input resulting in the loss of riparian vegetation thereby increasing the risk of erosion, habitat loss of aquatic species, and an increase in alien and invasive plant species.	5	5	5	5.0	5	5	5.0	**25.0**	
				4	5	4	4.3	5	5	5.0		**21.7**
2.19			Contamination within aquifers from the operational phase resulting in the impact on the surface water quality downstream. This contamination will impact on the PES of the wetlands and the eco-services the wetland can provide (maintenance of biodiversity).	5	5	5	5.0	5	5	5.0	**25.0**	
				4	5	4	4.3	5	5	5.0		**21.7**
2.20			Changes in water quality will gradually change the constituent species of aquatic biotic communities until these are no longer recognisable. The changes include a shift in the physical position of a community of aquatic organisms; the introduction or loss of key species; reduction in diversity as a result of increases in the concentration of toxins; and reduced ecosystem functioning. The mining activities during the operational phase will also affect the water quality in terms of acid mine drainage, low pH and elevated levels of EC, TDS, salts and coal associated metals.	5	5	5	5.0	5	5	5.0	**25.0**	
				4	5	4	4.3	5	5	5.0		**21.7**

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.22			Erosion and dust generation effecting the aquatic ecology of the area resulting in the increased suspended sediment concentrations that have the ability to impact on river size, flow volume, bed material and sedimentation rate.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
2.23			The introduction of alien invasive species resulting in the spreading of diseases and parasites (from the Black Rat), displacement of indigenous Conservation Important species, transforming terrestrial and aquatic habitats and altering ecosystem functioning and services.	5	5	3	4.0	5	4	4.5	19.5	
				2	3	2	2.3	5	3	4.0		9.3
2.23			The predicted increased sulphate and heavy metal concentrations as well as the increase in turbidity and sedimentation will adversely affect fauna in the area.	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7
2.24			Increased traffic, human activity, noise, vibration and lighting from mining operations will disturb a wide spectrum of fauna and may eliminate certain CI animal species from the area.	3	2	3	2.7	5	5	5.0	13.3	
				3	1	3	2.3	4	3	3.5		8.2
2.25			The vehicular activity will result in the creation of dust and coal dust which will increase the deposits these materials on plant leaves, blocking stomata and inhibiting evapotranspiration.	3	2	3	2.7	5	5	5.0	13.3	
				3	1	3	2.3	4	3	3.5		8.2

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.26			Lighting at night could negatively affect sensitive nocturnal fauna. Some species may return to the area after the mine has closed, but this is likely to be a slow process that may not see a return of the full spectrum of species once present	3	2	3	2.7	5	5	5.0	13.3	
				3	1	3	2.3	4	3	3.5		8.2
2.27	Surface Water	Operation	Alteration of the flow characteristics of the watercourses in the vicinity of the development may be affected by the discharge of treated seepage water into Catchment 19 (up to 1,779%). This could result in the increase of flood risk in the catchment.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5.0		18.3
2.28			Total flows are generally expected to decrease by a maximum of 6.9% at Catchment 16 and 4.0% at Catchment 17 due to the containment of flows within the PCDs.	5	5	3	4.0	5	4	4.5	19.5	
				2	3	2	2.3	5	3	4.0		9.3
2.29			Peak flows are also expected to increase during the wet season at Catchment 16 and 19 due to the influence of the storm water infrastructure.	5	5	3	4.0	5	4	4.5	19.5	
				2	3	2	2.3	5	3	4.0		9.3
2.30			The change in runoff to the Assegai River from the decrease in total flow (from Catchment 16 and 17) as well as the increase contribution from Catchment 19, altering the riverine ecosystems.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5.0		18.3

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.31			The increase in peak flows within the watercourses has the potential to lead to erosion impacts within the watercourses adjacent to the proposed Yzermyn Underground Coal Mine.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
2.32			Potential impact on geomorphology and associated watercourse ecology due to changes in flow.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
2.33			Surface water impacts from the stored coal and from the co-disposal discard dump facility and associated PCDs should these not be located on properly designed and monitored impermeable layers which have the potential to impact surface water through potential contaminated baseflow contribution.	5	4	5	4.5	5	4	4.5	20.0	
				5	4	2	3.7	5	5	5		18.3
2.34			There is also the potential for pollution of the receiving watercourses due to spills from machinery. In addition, through the storage of mining machinery, as well as the operations of fuel store, workshops and car washes, there is the potential for an increase in petroleum hydrocarbons within the runoff.	3	2	1	2.0	4	3	3.5	7.0	
				3	1	1	1.7	4	2	3		5.1
2.35			Potential siltation of the natural surface watercourses due to a potential increase in erosion.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.36			The contamination of clean water systems due to incorrect management of dirty water systems and not having the necessary management systems in place, resulting in dirty water runoff into the natural watercourses.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
2.37			The illegal discharge of excess water could impact the quality and quantity of the surface water resources.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
2.38	Groundwater	Operation	Dewatering during operation will result in a cone of depression forming around the mining area, resulting in an impact in the immediate vicinity of the mining operations	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7
2.39			Lowering on the groundwater level by 5 m or more will result in the drying of springs/ fountains and wetlands within the vicinity of the mine.	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7
2.40			Lowering of groundwater levels will result in reduced seepage resulting in the drying of the wetlands. This impact will be seasonal, with the most significant effect on wetlands occurring during the dry season.	5	5	5	5.0	5	5	5.0	25.0	
				4	5	4	4.3	5	5	5.0		21.7

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.41			The impact of dewatering may extend up to 2 km from the mining area. Groundwater levels in the fractured rock aquifer could be lowered by more than 60 m along the south-western border of the underground workings.	5	5	5	5.0	5	5	5.0	**25.0**	
				4	5	4	4.3	5	5	5.0		**21.7**
2.42			Abstraction of water from the boreholes may result in the drying of springs/ fountains. The resultant cone of depression in both the shallow and deeper aquifers is not expected to extend more than 1 km from the boreholes. If these boreholes are pumped during mining, the cumulative impact of mine dewatering and groundwater abstraction will result in a drawdown of 80 m in CBH2D and 32 m in CBH3S.	5	5	5	5.0	5	5	5.0	**25.0**	
				4	5	4	4.3	5	5	5.0		**21.7**
2.43			Seepage from the discard dump is expected to occur during the operational phase of mining resulting in the contamination of the shallow and deep aquifers. This could also affect the quality of the Mawanlane River, thereby affecting the Assegai River.	5	4	5	4.5	5	4	4.5	**20.0**	
				5	4	2	3.7	5	5	5		**18.3**
2.44			Spillages of hydrocarbons and or other chemicals during the construction and operational phases could lead to the contamination of groundwater should these come into contact with each other.	3	2	1	2.0	4	3	3.5	**7.0**	
				3	1	1	1.7	4	2	3		**5.1**
2.45			The removal of coal may result in the oxidisation of sulphate rich ore bodies and the generation of acid mine drainage.	4	5	3	4.0	4	4	4.0	**16.0**	
				4	5	3	4.0	3	2	2.5		**10.0**

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.46			Failure of PCDs, dirty water systems and discard dump features may result in the contamination of groundwater and surface water bodies.	4	5	3	4.0	4	4	4.0	16.0	
				4	5	3	4.0	4	3	3.5		14.0
2.47	Air Quality	Operation	Generation of dust resulting from the transportation of mining vehicles on the unpaved road (first three years of operation).	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
2.48			The contribution of dust and particulate matter resulting from wind erosion. Areas of concern predominantly include exposed areas, coal stockpiles, co-disposal discard dump, conveyors, tips/ feedbins, and fines around the crushing equipment within the plant.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
2.49			Generation of dust resulting from the transportation of the coal from site to the Piet Retief Siding.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
2.50			Emissions of NO_2, SO_2, CO and VOC from mining vehicles may impact on the ambient air quality of the area.	3	2	3	2.7	5	5	5.0	13.3	
				3	1	3	2.3	4	2	3.0		7.0
2.51			A homestead is located in close proximity to the site which could be affected by the operational activities (dust).	4	5	4	4.3	5	4	4.5	19.5	

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
				2	4	3	3.0	3	3	3.0		**9.0**
2.52			Generation of Greenhouse Gases resulting from the operational phase.	3	5	5	4.3	5	4	4.5	**19.5**	
				3	1	3	2.3	4	2	3.0		**7.0**
2.53			Impact on air quality resulting from fires during the operation phase (including veld fires, spontaneous combustion and illegal fires within the mining area).	3	1	3	2.3	4	4	4.0	**9.3**	
				3	1	1	1.7	2	3	2.5		**4.2**
2.54	Noise	Operation	Generation of noise from operational activities such as conveyor belts, loading activities and the saleable coal stockpiles, PCD water pumps and the dewatering pump located in close proximity to the adit.	4	2	3	3.0	5	5	5.0	**15.0**	
				4	1	3	2.7	4	2	3.0		**8.0**
2.55			Generation of noise from mining vehicles, equipment and machinery. The increase in mining traffic will also contribute to this impact.	4	2	3	3.0	5	5	5.0	**15.0**	
				4	1	3	2.7	4	2	3.0		**8.0**
2.56			Impact of noise on sensitive receptors within 500 m of the proposed project.	4	2	3	3.0	5	5	5.0	**15.0**	
				4	1	3	2.7	4	2	3.0		**8.0**

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.57	Archaeological, Cultural and Heritage	Operation	Identification of any historical, archaeological or cultural artefact during the operational phase.	4	2	5	3.7	2	3	2.5	**9.2**	
				3	2	5	3.3	2	2	2.0		**6.6**
2.58			Damage or destruction of any identified aspect of archaeology, cultural or heritage (sites 1, 2, 3 and 11, as detailed in the ESIA report) during operational activities.	3	5	2	3.3	4	3	3.5	11.7	
				3	5	2	3.3	2	2	2.0		**6.6**
2.59			Damage or destruction of any aspect of archaeology, cultural or heritage (sites 9, 16, 17 and 18, as detailed in the ESIA report) during operational activities.	3	5	3	3.7	4	3	3.5	12.8	
				3	5	2	3.3	2	2	2.0		**6.6**
2.60	Traffic	Operation	Increase in traffic as a result of the operational activities.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		**8.0**
2.61			The northern shoulder site distance at the intersection of the R543 and the Piet Retief Railway Siding is insufficient which may result in accidents at intersection 3.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		**6.7**

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.62			Increase in vehicle volume to the area, resulting in the generation of dust, vehicle fumes and noise.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		**8.0**
2.63			Mining vehicles as well as haul trucks may impact pedestrian safety.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		**6.7**
2.64			Mining vehicles as well as haul trucks may increase the occurrences of road accidents around the project site.	4	1	3	2.7	4	3	3.5	**9.3**	
				4	1	3	2.7	2	2	2		**5.3**
2.65			Increase in traffic during the operational phase could result in the deterioration of the unpaved road.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		**6.7**
2.66			Increase in traffic during the operational phase could result in the deterioration of the regional R543 road from Dirkiesdorp to the Piet Retief Siding.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		**6.7**
2.67	Visual	Operation	Visual intrusion from black colours of the stockpiles (saleable coal and co-disposal discard dump facility), lights at night and pollution. Movement of loading trucks and vehicles.	4	5	4	4.3	5	5	5.0	21.7	
				3	5	3	3.7	5	3	4.0		14.7

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.68			Generation of dust from operational activities associated with the mine. Wind-blown dust can also have an impact.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
2.69			Unnatural intrusions from the wash plant, adit entrance, security fence, administrative surface infrastructure (change house, offices, etc.) and workshops could impact on the visual aesthetics of the area.	4	5	4	4.3	5	5	5.0	21.7	
				3	5	3	3.7	5	3	4.0		14.7
2.70			Increase in vehicle transport will affect the natural aesthetics of the area.	3	5	3	3.7	5	4	4.5	16.5	
				2	5	2	3.0	5	3	4.0		12.0
2.71			Discolouration of surrounding plants as dust settles.	3	5	3	3.7	5	4	4.5	16.5	
				2	5	2	3.0	5	3	4.0		12.0
2.72			Pollution of surrounding watercourses from potential acid mine drainage.	4	5	3	4.0	4	4	4.0	16.0	
				4	5	3	4.0	4	3	3.5		14.0

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.73			Soil erosion on existing drainage lines as a result of mining operations.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
2.74			Loss of biodiversity as a result of the operational phase of the mine.	5	5	3	4.0	5	5	5.0	20.0	
				5	4	2	3.7	5	5	5.0		18.3
2.75	Socio-economic	Operation	The operation of the mine will provide employment opportunities for 546 people, resulting in employment opportunities and skills development for the local communities.	1	3	3	2.3	3	1	2.0	4.7	
				2	4	3	3.0	5	4	4.5		13.5
2.76			The economic development associated with the proposed Yzermyn Underground Coal Mine will result in a positive impact should the projects identified in the SLP be implemented.	1	3	3	2.3	3	1	2.0	4.7	
				2	4	3	3.0	5	4	4.5		13.5
2.77			Due to dewatering and potential contamination from operational activities, communities reliant on surface and groundwater as their main source of supply can be affected.	5	5	4	4.7	5	4	4.5	21.0	
				5	5	4	4.7	3	2	2.5		14.0
2.78			The employment of local people could lead to the growth in the multiplier factor as the impact will extend to family members and other supporting services (businesses).	1	3	3	2.3	3	1	2.0	4.7	
				2	4	3	3.0	5	4	4.5		13.5

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.79			The mining operations will contribute towards the Gross Domestic Product (GDP) of the country as a whole.	1	3	3	2.3	3	1	2.0	**4.7**	
				2	4	3	3.0	5	4	4.5		**13.5**
2.80			The increase of permanent employment during the operational phase in the area could result in an increase in traffic on the surrounding road system.	5	4	3	4.0	5	3	4.0	**16.0**	
				3	4	3	3.3	2	2	2.0		**6.7**
2.81			Economic displacement refers to the removal of livelihoods and income for the local population. This is likely to take a number of forms as a result of the mining operations loss of agricultural land, loss of stock to theft, decrease in property values and decrease in tourism.	5	5	3	4.0	5	4	4.5	**19.5**	
				2	3	2	2.3	5	3	4.0		**9.3**
2.82			The potential loss of natural resources relates directly to the loss of economic and livelihood sustainability.	5	5	3	4.0	5	4	4.5	**19.5**	
				2	3	2	2.3	5	3	4.0		**9.3**
2.83			There is the potential for the proposed mining operations to result in an increased health and safety risk at a local level, resulting from increase in traffic, generation of noise and dust, increase in health issues (HIV/ AIDS), increased uncontrolled fires and increase of crime.	4	5	4	4.3	5	4	4.5	**19.5**	
				2	4	3	3.0	3	3	3.0		**9.0**

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
2.84			Impact of sense of place due to the predominantly rural nature of the area.	5	5	3	4.0	5	4	4.5	19.5	
				2	3	2	2.3	5	3	4.0		9.3
2.85			Cultural and political conflicts could result from the in-migration of labourers, which could affect settlements in close proximity to the mine.	5	5	3	4.0	5	4	4.5	19.5	
				2	3	2	2.3	5	3	4.0		9.3
2.86			Social issues as a result of the mine such as alcohol abuse, influx of sex workers and social unrest can change the nature of the nearby settlements.	4	5	4	4.3	5	4	4.5	19.5	
				2	4	3	3.0	3	3	3.0		9.0
2.87			Reduction of the biodiversity resulting in a reduction of tourism in the area.	4	5	4	4.3	5	5	5.0	21.7	
				3	5	3	3.7	5	3	4.0		14.7
2.88			Social changes resulting from the mine including conflict for resources, conflict of cultures, and a change in nature of the area resulting in social change and potential for disputes.	3	4	3	3.0	5	4	4.5	15.0	
				2	4	3	3.0	3	2	2.5		7.5
2.89			Labour conflict with the mining company, regarding aspects such as wages and resources, could result in local social unrest.	4	5	4	4.3	5	4	4.5	19.5	
				2	4	3	3.0	3	3	3.0		9.0

Table 10-4: Closure Phase Environmental and Socio-economic Impacts

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
3.1	Geology		N/a									
3.2	Topography	Closure	The final replacement of overburden, topsoil and resultant re-vegetation will result in the restoration of natural surface flow dynamics.	3	5	2	3.7	2	5	3.5	12.3 (+)	
				5	4	3	4.0	5	4	4.5		18.0 (+)
3.3			The discard dump will remain a permanent feature and form part of the future topography of the area.	3	5	2	3.7	2	5	3.5	12.3 (+)	
				5	4	3	4.0	5	4	4.5		18.0 (+)
3.4	Soils, Land Use and Land Capability	Closure	Reduction in land capability (grazing potential).	4	4	2	3.3	5	5	5	16.7	
				3	4	2	3.0	5	3			12.0
3.5			Spillage of hydrocarbons or other chemicals during the closure phases.	3	2	1	2.0	4	3	3.5	7.0	
				3	1	1	1.7	4	3	3.5		5.8
3.6			Demolition of infrastructure and the rehabilitation of the disturbed land.	3	5	2	3.7	2	5	3.5	12.3 (+)	
				5	4	3	4.0	5	4	4.5		18.0 (+)

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
3.7	Biodiversity	Closure	Direct impacts on fauna and flora species resulting from excavations and reworking of soils (loss of naturally encroaching vegetation onto the site).	5	5	3	4.0	5	5	5.0	20.0	
				5	4	2	3.7	5	5	5.0		18.3
3.8			Increased erosion resulting from closure activities as a result of the compaction of soils. This could cause an increase in turbidity and sedimentation.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5		18.3
3.9			Surface and groundwater contamination as a result of seepages from the co-disposal discard dump facility, acid mine drainage and runoff of sulphates causing degradation to fauna, flora and aquatic ecosystems.	5	5	2	4.0	5	5	5.0	20.0	
				5	4	2	3.7	5	5	5.0		18.3
3.10			Disturbance of vegetation and soils, as well as the increased traffic during the closure phase will contribute to the spread of alien invasive taxa.	5	5	3	4.0	5	4	4.5	19.5	
				2	3	2	2.3	5	3	4.0		9.3
3.11			Increased traffic, human activity, noise, vibration and lighting from closure and decommissioning activities may disturb the remaining fauna and flora species from the area.	5	3	2	3.3	4	4	4.0	13.3	
				5	3	2	3.3	2	2	2		6.6
3.12			Lighting at night could negatively affect sensitive nocturnal fauna. Some species may return to the area after the mine has closed, but this is likely to be a slow process that may not see a return of the full spectrum of species once present.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
3.13			Incorrect management and storage of dangerous goods and chemicals, including waste and sewage, could result in the pollution of soils and watercourses which may impact negatively on plants and subsequently animals	3	2	1	2.0	4	3	3.5	7.0	
				3	1	1	1.7	4	2	3		5.1

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
3.14	Surface Water	Closure	Decreased watercourse flow due to containment of runoff in PCDs	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5.0		18.3
3.15			Decreased water quality due to the closure activities (damage and removal of vegetation and hardstanding, compaction of soils, and the erosion of bare soils and stockpiled soils).	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5.0		18.3
3.16			During the closure phase there is expected to be an increase in runoff due to the loss of vegetative cover and increased impervious areas and soil compaction.	5	5	2	4.0	5	5	5	20.0	
				5	4	2	3.7	5	5	5.0		18.3
3.17			There is expected to be water quality impacts to the adjacent watercourses due to contributions of runoff arising from the closure phase, including an increase in turbidity due to erosion from the construction site and contributions of hydrocarbons from any onsite spills.	5	5	4	4.7	5	4	4.5	21.0	
				5	5	4	4.7	3	2	2.5		14.0
3.18	Groundwater	Closure	The potential of residual impacts (migration of contaminants for large distances in a downstream direction) after closure is unlikely due to the occurrence of various dolerite dykes, which forms barriers to compartmentalise groundwater flow.	5	5	4	4.7	5	4	4.5	21.0	
				5	5	4	4.7	3	2	2.5		14.0
3.19			Flooding of underground workings and decant of groundwater from the underground mine.	4	5	4	4.0	4	4	4.0	16.0	
				4	1	3	2.7	4	2	3.0		8.0
3.20			Decant of contaminated groundwater from the underground mine.	4	5	4	4.0	4	4	4.0	16.0	
				4	1	3	2.7	4	2	3.0		8.0

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
3.21			Contaminated Groundwater from underground workings.	5	5	4	4.7	5	4	4.5	21.0	
				5	5	4	4.7	3	2	2.5		14.0
3.22	Air Quality	Closure	Emissions of NO_2, SO_2, CO and VOC from mining vehicles may impact on the ambient air quality of the area.	3	2	3	2.7	5	5	5.0	13.3	
				3	1	3	2.3	4	2	3.0		7.0
3.23			Generation of dust resulting from demolition of infrastructure and final replacement of overburden and topsoil.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
3.24			Impact on air quality resulting from fires during the closure phase (including veld fires, spontaneous combustion and illegal fires within the mining area).	3	1	3	2.3	4	4	4.0	9.3	
				3	1	1	1.7	2	3	2.5		4.2
3.25	Noise	Closure	Demolition activities during closure will result in an increase in noise pollution in the area. The increase in traffic will also contribute to this impact.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
3.26	Archaeological, Cultural and Heritage	Closure	Identification of any historical, archaeological or cultural artefact demolition and closure activities.	4	2	5	3.7	2	3	2.5	9.2	
				3	2	5	3.3	2	2	2.0		6.6
3.27			Damage or destruction of any identified aspect of archaeology, cultural or heritage (sites 1, 2, 3 and 11, as detailed in the ESIA report) during activities associated with closure.	3	5	2	3.3	4	3	3.5	11.7	
				3	5	2	3.3	2	2	2.0		6.6

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
3.28			Damage or destruction of any aspect of archaeology, cultural or heritage (sites 9, 16, 17 and 18, as detailed in the ESIA report) during activities associated with closure.	3	5	3	3.7	4	3	3.5	12.8	
				3	5	2	3.3	2	2	2.0		6.6
3.29	Traffic	Closure	Vehicle traffic in the area will result in the generation of dust, vehicle fumes and noise.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0
3.30			Vehicles utilised during the closure phase may impact pedestrian safety.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		6.7
3.31			Vehicles utilised during the closure phase may increase the occurrences of road accidents around the project site.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		6.7
3.32	Visual	Closure	Movement of vehicles associated with the closure phase and light impact from security lights.	3	5	3	3.7	5	4	4.5	16.5	
				2	5	2	3.0	5	3	4.0		12.0
3.33			Visual intrusion from strong colour, form and texture change from the co-disposal discard dump.	4	5	4	4.3	5	5	5.0	21.7	
				2	5	2	3.0	4	2	3.0		9.0
3.34			Removal of structures and infrastructure (depending on closure objectives and targets at closure).	4	5	4	4.3	5	5	5.0	21.7	
				5	4	3	4.0	5	4	4.5		18.0 (+)
3.35			Generation of dust during closure and decommissioning activities.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		8.0

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
3.36			Visual scarring of access roads.	4	2	3	3.0	5	5	5.0	15.0	
				4	1	3	2.7	4	2	3.0		**8.0**
3.37			Continued utilisation of mine by illegal miners.	4	5	4	4.3	5	5	5.0	21.7	
				2	5	2	3.0	4	2	3.0		**9.0**
3.38	Socio-economic	Closure	Closure phase will provide temporary employment to the community.	1	3	3	2.3	3	1	2.0	**4.7 (+)**	
				2	4	3	3.0	5	4	4.5		13.5 (+)
3.39			The closure of the mining operations will result in a loss of employment opportunities.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		**6.7**
3.40			The closure of mining operations will have negative impacts on the Regional Municipal and broader South African economics.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		**6.7**
3.41			The closure of the mining operations will result in a negative impact on the multiplier effect previously provided by the mining operations.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		**6.7**
3.42			The decommissioning and closure activities could manifest in the prevalence of social ills such as HIV/ AIDS due to the presents of more contractors.	4	5	4	4.3	5	4	4.5	19.5	
				2	4	3	3.0	3	3	3.0		**9.0**
3.43			The increase of temporary employment during the closure phase in the area could result in an increase in traffic on the surrounding road system.	5	4	3	4.0	5	3	4.0	16.0	
				3	4	3	3.3	2	2	2.0		**6.7**

Ref.	Environment	Phase	Impact Description	Severity	Duration	Extent	Consequence (A+B+C)/3	Frequency	Probability	Likelihood (E+F)/2	Environmental Significance (Without Mitigation)	Environmental Significance (With Mitigation)
3.44			Opportunity may arise for local communities to purchase redundant equipment and machinery during closure.	1	3	3	2.3	3	1	2.0	**4.7 (+)**	
				2	4	3	3.0	5	4	4.5		**13.5 (+)**
3.45			Return of land to natural capability, thereby resulting in an opportunity for agricultural sustainability.	1	3	3	2.3	3	1	2.0	**4.7 (+)**	
				5	4	3	4.0	5	4	4.5		**18.0 (+)**
3.46			Return of land to natural capability resulting in an increase of sense of place.	1	3	3	2.3	3	1	2.0	**4.7 (+)**	
				5	4	3	4.0	5	4	4.5		**18.0 (+)**
3.47			Cultural and political conflicts could result from the in-migration of labourers, which could affect settlements in close proximity to the mine pertaining to temporary employment opportunities during the closure phase.	3	4	3	3.0	5	4	4.5	**15.0**	
				2	4	3	3.0	3	2	2.5		**7.5**
3.48			Social issues as a result of the mine such as alcohol abuse, influx of sex workers and social unrest can change the nature of the nearby settlements pertaining to temporary employment opportunities during the closure phase.	4	5	4	4.3	5	4	4.5	**19.5**	
				2	4	3	3.0	3	3	3.0		**9.0**
3.49			Return of land to natural capability resulting in an increase of tourism in the area.	1	3	3	2.3	3	1	2.0	**4.7 (+)**	
				5	4	3	4.0	5	4	4.5		**18.0 (+)**

10.3 Cumulative Impacts

Cumulative impacts are those impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/ or receptors as the proposed Yzermyn Underground Coal Mine. Cumulative impacts are therefore generally impacts that act with others in such a way that the sum is greater than the parts. This is, however, not always the case – sometimes they will simply be the sum of the parts, but that sum becomes significant.

This section considers the cumulative impacts that would result from the combination of the proposed Yzermyn Underground Coal Mine and other actual or proposed future developments in the broader project area.

10.3.1 Geology

As the geology of the underlying area will have been removed during the construction phase, a lasting unseen impact will remain.

10.3.2 Topography

Topography may return to its pre-mine state if rehabilitated correctly. Co-disposal discard dump facility could create long-term topographic impacts if not reprocessed or adequately rehabilitated, which will result in visual impacts, surface and groundwater contamination and dust generation.

10.3.3 Soils, Land Use and Land Capability

Cumulative impact relating to soils in the and around the surface infrastructure area could occur if current mining activities and/ or future development activities result in medium to long-term exposure of bare soils without any preventative measures put in place, as this would lead to increased soil erosion and subsequent downstream impacts. This would be especially serious in the vicinity of any of the streams in the area.

The potential of loss of soil resources and the associated increase in erosion could alter the fertility of the area with respect to the rehabilitation potential and natural ecology, which will result in a cumulative impact from the site.

The proposed underground mine has the potential to impact the local and regional water quality. Limited cultivated agriculture is located within the hydrological catchments in the vicinity of the proposed mine. This agriculture has the potential to increase sediments and nutrients within the watercourses due to runoff. Although these are no other mines noted within the contributing catchment, this runoff, in combination with the runoff from the Dirkiesdorp Township, is also expected to lead to a reduction in water quality.

10.3.4 Biodiversity

Within the greater southern Mpumalanga study region there are currently numerous applications for mining (MTPA pers. comm. 2013). If these applications are approved, the potential cumulative impacts of anthropogenic land use in the region would include:

- Water, air, noise and light pollution;
- Reduction and deterioration of regional groundwater;
- Deterioration and loss of wetland habitat, species, ecosystem functioning and services;
- Deterioration of aquatic habitat, species, ecosystem functioning and services;
- Increased erosion, sedimentation and invasion of alien species;

- Loss and deterioration of threatened terrestrial floral communities, vegetation types, ecosystem functioning, services and faunal habitats; and
- Reduction in the richness and abundance of floral and faunal species, and extirpation of locally restricted populations or species.

If further development in addition to the current application is approved for the area, the impact on the wetland habitat and the species it supports is considered to be of significance, with these systems being affected.

The development of the mine together with other developments (both current and proposed) has the potential to cumulatively impact on fauna in the broader project area. This is associated with a potential influx into the area. Along with the influx of people come an array of anthropogenic impacts such as increased pressure on local fauna through persecution and poaching. Increases in domestic animals may negatively affect faunal diversity. Domestic dogs and cats out-compete native carnivores and actively predate many indigenous species. Furthermore, increased development in the region results in isolation of natural areas, which may lead to decreases in faunal diversity, not only locally, but on a regional scale through population declines as a result of genetic isolation.

10.3.5 Surface Water

Cumulative impacts are the combined, incremental effects of human activity that pose an environmental risk. They result when the effects of an action are added to, or interact with, other effects in a particular place and within a particular time. With regards to the hydrological impacts, the following can be noted:

- The level of development within the contributing catchment is relatively low, within only the township of Dirkiesdorp being located in the lower portions of the catchment. As a result, the anthropogenic impacts of human development in altering the flow conditions of the local and regional watercourses (either through water abstractions, or through increased urban runoff) are expected to be limited. As a result, the cumulative impact of the mine on water flows is expected to be limited.
- The land use within the contributing catchments is largely grassland, with limited agriculture. This agriculture has the potential to increase sediments and nutrients within the watercourses due to runoff. Although these are no other mines noted within the contributing catchment, this runoff, in combination with the runoff from the Dirkiesdorp townships, is expected to lead to a reduction in water quality. The influence of the proposed mine in potentially impacting water quality will thus have a cumulative impact when these land uses are taken into account.

The Assegai River Catchment has been identified by the DWA as being important catchments in the country, as they are a key source of water supply to industry, commercial agriculture and rural communities. With further mining developments in the area, this catchment is likely to come under increased pressure, not only in terms of water abstraction/ discharge, but also in terms of the potential contamination of these rivers by diffuse sources of pollution.

10.3.6 Groundwater

The cumulative impacts that would result from a combination of the proposed Yzermyn Underground Coal Mine and other existing or proposed future developments in the region include a cumulative impact on surface and groundwater quality as well as cumulative impacts on streams and wetlands.

10.3.7 Air Quality

Cumulative air quality impacts that would result from a combination of the project and other existing or proposed future developments in the area include existing mining operations (Jindal, Kangra Coal, etc.) and expansion of existing mines (Kangra Coal Savmore Colliery).

10.3.8 Noise

The cumulative impact resulting from the proposed Yzermyn Underground Coal Mine will have a result on the natural ambient noise levels within the project area due to the distance the project is located from noise generating activities (R543 road, Dirkiesdorp Town, etc.). Furthermore, there will be a cumulative impact due to the nature of the surrounding area which comprises rural homesteads, grazing and subsistence farming.

10.3.9 Archaeological, Cultural and Heritage

Increased development in the project area will have a number of cumulative impacts on heritage resource. For example, mining could, over the long term, increase human activity that could change, alter or destroy heritage resources.

Cumulative impacts that could result from a combination of the proposed Yzermyn Underground Coal Mine and other existing or proposed future developments within the project area include site clearance and the removal of topsoil, increased human activity, increased emissions, dewatering of mine workings and the destruction of paleontological resources (positive and negative).

10.3.10 Visual

Cumulative visual impact is anticipated from potential future expansion of the proposed Yzermyn Underground Coal Mine to the western areas of the prospecting area. Expansion of the proposed project to the mountainous areas to the south-west would result in significant loss of visual resources which have potential to be included in the larger conservancy area. Furthermore, cumulative visual intrusions may arise as a result of landscape decay caused by unforeseen and sudden closure.

The cumulative impacts that would result from a combination of the proposed Yzermyn Underground Coal Mine and associated existing or proposed future developments in the project area include:

- Additional change in the character and the visual resource value of the landscape, since more manmade structures will be introduced into the area;
- A change in the sense of place of the project area as the area will become more urbanised;
- Increased visual impact at night caused by the combination of light sources, and
- Increased development in the area will result in excessive dust emissions, as increased traffic will be utilising unpaved roads, larger areas will be cleared of vegetation and the creation of additional stockpiles.

10.3.11 Socio-economic

A cumulative impact assessment of the proposed mine is considered within the context of similar the land uses within the study are. There appear to be two mines within proximity to the proposed target area. The Savmore Colliery underground coal mine (owned by Kangra) located approximately 20km north east of the site, and approximately 35km west of Piet Retief. There also appears to be an opencast coal mine located between the proposed target area and Piet Retief (46km north west of the target area and 5km from Piet Retief), seemingly owned or operated by Jindal Mining SA.

The SIA study indicated that there are few people from the within the ADI employed by these mines (approximately two known, and 30 to 40 potentially employed by existing mining operations[14]) within the ADI. The mine employees are likely to be accommodated in Piet Retief (Jindal Mining and Kangra) and Driefontein (Kangra).

There may be some overlap between the Kangra mine and the proposed Yzermyn mine, as both are likely to draw employees and labour from the Driefontein area. And with the proposed expansion of the Kangra mine (ERM, April 2013), there could be a cumulative increase in the number of job seekers coming into the area.

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[14] Determined through Department of Labour skills audit and interviews with local stakeholders

The Cumulative impact on the socio-economic environment is unlikely to be significant on a regional level due to the existence of labour sending areas such as Driefontein and Piet Retief in proximity to both mines. The local impact is, however likely to be of high significance, due to the low level of employment and low household income within the Mkhondo Local Municipality, especially around the Dirkiesdorp and Driefontein areas.

It is unknown as to the extent of the cumulative biophysical environmental impacts on the socio-economic environment, however due to the location and distance (greater than 20km) of the existing mines in relation to the proposed target area, biophysical issues such as surface water are unlikely to be significant from a cumulative perspective (WSP (e), 2013). The overall socio-economic impact is therefore likely to be of moderate significant given the local high impact and the lower regional impact.

11 Environmental and Social Management Programme

Responsibility for the ESMP will reside with Atha, but there will be links with other functional clusters in areas such as workplace health and safety.

Table 11-1 addresses the dual objectives of the ESMP, namely to fully disclose the environmental and social commitments to be undertaken by Atha, and to provide managers and staff with a clear framework for ESMP implementation. The ESMP is structured by major environmental components that are managed as programmes, e.g. water; biodiversity; socio-economic, then identifies the cross-linkages to other environmental aspects, the phase of the project in which the management action will be required, the location of responsibility for implementation; and the estimated cost to implement the mitigation.

The management/ mitigation table has the following characteristics:

- Mitigation and management measures are discussed in relation to aspects (for example the management of biodiversity). This groups related impacts and management/ mitigation measures, and permits easy cross-referencing to management programmes and plans;
- The table presents a schedule for the implementation of management/ mitigation activities, sub-divided by project phase;
- The schedule shows, at a glance, the timing of the many actions required under the ESMP. It is particularly useful where management/ mitigation measures extend across phases (as is frequently the case); and
- The estimated costs associated with each mitigation act as an indication of the funds that will need to be made available in order to adequately implement the mitigation measure developed.

11.1 Checking and Corrective Action

Checking, and if necessary implementing corrective action, form a component of the ESMP management cycle. They ensure that the:

- Required ESMP management activities are being implemented; and,
- Desired outcomes are being achieved.

This component includes four key activities. These are:

- Monitoring identified environmental and social quality variables as defined in the objectives and targets;
- Ongoing inspections of the operational controls and general state of the operations;
- Internal audits to assess the robustness of the ESMP or to focus on a particular performance issue; and
- External audits to provide independent verification of the efficacy of the ESMP.

11.1.1 Monitoring

The environmental variables that are to be monitored are described in the ESMP. Monitoring results must be structured and presented for review on an ongoing basis so that, if objectives and targets are not met, corrective action can be taken. The results of social and environmental monitoring should be evaluated and documented. Periodic reporting of progress and monitoring results should be made to the senior management of the Atha, as a function of the Atha's management system. Reports should furnish the information and data needed to determine compliance with relevant legal requirements and progress on implementing the management program.

11.1.2 Inspections: construction phase

Owing to the transient nature of the construction phase, the greatest source of information is that obtained through ongoing visual inspection. At the same time, some potential impacts are difficult to monitor quantitatively, such as soil erosion and waste management. An ongoing but pragmatic inspection regime will be developed that allows for potential transgressions to be identified proactively so that mitigation can be quickly and effectively implemented.

11.1.3 Internal and external audits

Where the monitoring data and the inspection reports highlight problems, an internal audit can be used to ascertain the source of the problem and to define actions to prevent its recurrence. The three key areas for audit are facilities (are they operating properly?), project procedures (are they properly designed and correctly implemented?) and finally, and perhaps most importantly, the contractor's performance.

International lending institutions and commercial banks may have their own requirements for external and independent monitoring verification, as well as regular audits of the ESMP implementation.

11.1.4 Corrective action

There are several mechanisms for implementing corrective action during all project phases:

- Verbal instruction

Verbal instructions are likely to be the most frequently used form of corrective action and are given in response to minor transgressions that are evident during routine site inspections. Verbal instructions are also used to create further awareness amongst contractors, as often the transgressions are a function of lack of awareness.

- Written instructions

Written instructions will be given following an audit. The written instructions will indicate the source or sources of the problems, and proposed solutions to those problems. The implementation of these solutions can also be assessed in a follow-up audit and further written instructions issued if required. All written instructions will be centrally logged to ensure that there is an auditable record of such instructions and how they were responded to.

- Contract notice

A contract notice is a more extreme form of written notice because it reflects the transgression as a potential breach of contract. If there is not an adequate response to a contract notice, then the next step can be to have the contractor removed from the site and the contract cancelled. Contracts will be drafted with this in mind.

11.1.5 Reporting

The findings of all of the above will be structured into instructive reporting that provides information to all required parties on ESMP compliance and performance, together with clearly defined corrective action where this is seen to be required. Both the monitoring and inspections are reported on continuously. Within the reporting structure, it is necessary to create a review function that continuously assesses the reporting and prescribes any necessary corrective action. Reporting will include the provision of information on performance to external stakeholders and surrounding communities.

11.2 Management Review

The final component of the ESMP management cycle is a formal management review that takes place at defined intervals, both during the construction and operational phases. The purpose of the management review is for senior project management to review the environmental management performance during the preceding period and to propose measures for improving that performance in the spirit of continuous improvement.

11.3 Liaison

Throughout the project, ongoing liaison will be maintained with authorities and communities alike to ensure the following:

- Timeous advance warning of any project activities that may have some adverse impact on surrounding communities, e.g. vegetation clearing/ spillages/ accidents; and
- Ongoing feedback on the environmental performance of the project.

11.4 Estimated Costing

During the public meeting on 27 September 2013, it was requested that estimated costs be included in the ESMP in order to identify if adequate capital existed to implement the mitigation measures developed.

Impact identification numbers are consistent between the ESIR and ESMP, facilitating cross-referencing.

Table 11-2 describes the management plans and programmes within which management and mitigation measures will be implemented. The rationale is to cluster related measures in a cohesive and systematic structure, ensuring clear roles and responsibilities, together with integrated and efficient implementation.

11.5 Administration Actions

Table 11-1 below details administrational requirements prior to the commencement of the construction phase. Included in the table are must occur initially prior to the commencement of the construction phase, they are applicable across the life of mine and must be applied during the operational and closure phases as well.

Table 11-1: Administrative Actions

Management Measure	Phase	Responsible Person
Administration		
The overall responsibility for environmental and social management and costs associated with the implementation of the ESMP lies with Atha.	Construction Operation Closure	Environmental Coordinator Plant Manager
Atha is to ensure that all permanent and temporary employees, sub-contractors and contractors understand, are aware of the requirements and adhere to the ESMP.	Construction Operation Closure	Environmental Coordinator Plant Manager Contractor
Atha will appoint a staff member directly involved with the construction and operational activities as the Environmental Coordinator.	Construction Operation	Environmental Coordinator
The Environmental Coordinator will be responsible for ▪ Ensuring continual implementation of the ESMP; ▪ Monthly internal monitoring of activities to ensure compliance with the ESMP; ▪ Ensuring environmental awareness among all members of the workforce; ▪ Implementing preventative and corrective actions in accordance with the ESMP and outcomes of any environmental audits; ▪ Reporting all environmental incidents observed onsite in the environmental incidents register in accordance with the requirements of the ESMP and relevant South African environmental legislation; and ▪ Developing and maintaining the records of a Grievance Mechanism by means of which stakeholder issues will be received, recorded and responded to.	Construction Operation Closure	Environmental Coordinator
The Environmental Coordinator will ensure that all compliant and non-compliant findings, as well as a list of all environmental incidents, are recorded and made available to the DMR, DEA, DWA, SAHRA and MDEDECT on request.	Construction Operation Closure	Environmental Coordinator
Observations and findings of non-compliance reported during internal and external audits and incidents reported in the environmental complaints register will be closed out by Atha on approval of suitable rectification or mitigation measures.	Construction Operation Closure	Environmental Coordinator Plant Manager

Management Measure	Phase	Responsible Person
It is the contractor's responsibility to monitor the performance of sub-contractors and construction workers to ensure that points relayed during the induction training are properly understood and being complied with. If necessary, the Environmental Coordinator/ translator should be called to explain aspects contained in the ESMP.	Construction Operation	Environmental Coordinator Contractor
Main delivery and entrance routes will be clearly signposted and printed delivery maps will be made available to all employees, contractors and sub-contractors.	Construction Operation	Environmental Coordinator Plant Manager Construction Officer
Adequate parking for all employees, contractors and sub-contractors will be made available and should not impact negatively on neighbouring farmers.	Construction Operation Closure	Environmental Coordinator Plant Manager
All vehicles, machinery and equipment will be inspected monthly to ensure good working order.	Construction Operation Closure	Environmental Coordinator Plant Manager
It is the Plant Manager's responsibility to monitor the performance of employees to ensure that points relayed during the induction training are properly understood and being complied with. If necessary, the Environmental Coordinator/ translator should be called to explain aspects contained in the ESMP.	Operation	Environmental Coordinator Plant Manager
Awareness and Training		
Atha is to ensure that the ESMP forms part of the formal site induction for all employees, contractors and sub-contractors, preferably in their native language. All contractors, sub-contractors and employees will acknowledge their understanding of the ESMP and environmental responsibilities by signing the induction attendance register.	Construction Operation Closure	Environmental Coordinator Plant Manager Contractor Construction Officer
An environmental awareness programme will be implemented for all onsite personnel describing key environmental issues and potential impacts thereof.	Construction Operation Closure	Environmental Coordinator Plant Manager
Contractors, sub-contractors and labourers will be trained in health and safety policies and procedures, environmental awareness and emergency preparedness.	Construction Operation Closure	Environmental Coordinator Plant Manager Contractor Construction Officer
Sufficient training will be provided to all employees, contractors and sub-contractors to ensure that designated tasks are undertaken adequately.	Construction Operation Closure	Environmental Coordinator Plant Manager Contractor Construction Officer
No employee, contractor or sub-contractor will be permitted to operate critical machinery, vehicles or equipment without undertaking necessary safety training by a competent individual.	Construction Operation Closure	Environmental Coordinator Plant Manager Contractor Construction Officer

Management Measure	**Phase**	**Responsible Person**
In-service training, where applicable, will be provided to contractors and labourers.	Construction Operation Closure	Environmental Coordinator Plant Manager Contractor Construction Officer
Contractors are to hold toolbox talks on a monthly basis.	Construction Operation Closure	Environmental Coordinator Plant Manager Contractor Construction Officer
Employees will be trained to reduce littering along the haul routes/ transport routes utilised.	Construction Operation Closure	Environmental Coordinator Plant Manager

Table 11-2: Environmental and Social Management Programme

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
Geology and Mine Management Plan						
Refer to Ref. 2.2; 2.4; 3.25; 3.35; 4.31; 7.1; 7.2; 8.7; 7.8; 10.11; 10.13; 12.1						
1.1	Geology	Construction	Formulate and implement a blasting design that will ensure the least impact on the environment.	1	Draw up a detailed blasting design according to best practices and ensure that this is being implemented.	Project Manager Mining Engineer Construction Manager
1.2	Geology	Construction	The minimal amount of soils will be stripped on the sections to be blasted in order to reduce the potential for air blasts.	2	Draw up a blasting design plan clearly indicating the positions of blasting holes.	Project Manager Construction Manager
				3	Draw up a procedure for undertaking blasting, including blasting schedules (date and time of blasting operation), utilisation of warning sirens (procedure for implementation to ensure safety during blasting operations), reduction of fly-rock, reduction of dust during blasting, etc.	Project Manager Mining Engineer Construction Manager
				4	Brief contractors on the procedures to be undertaken prior to and during blasting operations.	Project Manager Mining Engineer Construction Manager
1.3	Geology	Construction Operation	Blasting may only be undertaken by registered personnel.	5	Appoint registered persons to undertake blasting operations.	Project Manager Construction Manager
1.4	Geology	Construction	Blasting schedules will be distributed to all surrounding residents.	6	The blasting schedules, clearly indicating the date and time of blasting operations, will be recorded and will be distributed to all neighbouring landowners and/ or tenants of the site and neighbouring properties.	Mining Engineer Environmental Coordinator
1.5	Geology	Construction	Warning sirens will sound prior to the	7	Warning sirens and procedures will be	Mining Engineer

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			initiation of blasting to inform the surrounding employees and other stakeholders and to ensure safety of all people in the vicinity of the blast area.		implemented to ensure safety during blasting operations.	
				Refer to Action Reference No. 4		
1.6	Geology	Construction Operation	The blasting area will be cordoned off prior to each blasting activity.	8	Prior to any blasting activity the area will be cordoned off and clear signs will be erected to inform all employees in the area of the proposed blasting area.	Mining Engineer Construction Manager
				Refer to Action Reference No. 4		
1.7	Geology	Operation	Underground mining operations will remain within the approved mining plan and therefore no geological strata will be removed outside of the target area.	9	Draw up a mining plan clearly indicating where mining will be undertaken and where required safety measures should be implemented.	Project Manager Mine Manager
				10	Ensure that all structures are established as per the mining plan.	Project Manager
1.8	Geology	Operation	Atha will ensure the implementation of safety measures (i.e. stabilising poles).	Refer to Action Reference No. 11 and 12		
Topography Management Plan						
Refer to Ref. 3.2; 3.4; 3.5; 3.7; 3.8; 3.9; 3.10; 3.11; 3.35; 4.9; 4.11; 4.12; 4.20; 5.4; 7.7; 7.8; 10.11; 10.13; 12.1						
2.1	Topography	Construction Operation Closure	The areas on which new infrastructure will be placed, constructed, installed or sunk will be clearly demarcated and communicated to contractors and staff members.	11	Draw up a plan clearly defining the layout of access routes, construction areas and allowable laydown and construction areas to be utilised.	Project Manager Construction Manager
				12	Brief contractors and employees as to the routes to be used and enforce implementation thereof.	Project Manager Construction Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
2.2	Topography	Construction	All structures and infrastructure must be designed and operated with the aim of closure in mind.	13	Detailed design drawings will be developed with the aim of closure (i.e. stability) in mind. Buffer zones/ boundaries indicated in this ESMP must be complied with, and may result in a re-design of the site. These buffer zones/ boundaries are detailed in **Appendix H-1**.	Project Manager Construction Manager Civil Engineer Mining Engineer
				14	Implement the design drawings during the construction phase.	Construction Manager
2.3	Topography	Construction Operation	Contractors and employees will be limited to the clearly defined access routes and areas to be constructed in order to limit site disturbance.	Refer to Action Reference No. 11 and 12		
2.4	Topography	Construction Operation	Structures built from steel or concrete are to be painted a green natural tone fitting with the surrounding environment. Roofs of tall structures should be painted green. Plants, pipes, conveyors and accessory works infrastructure to be painted green. Retaining walls to be painted a natural colour similar to the surrounding environment. Similar colour theme for all structures unless required otherwise for safety warning. If no shading structures planned, incorporate shading trees into parking design (such as *Acacia sieberiana, Olea africana, Disa cotinifolia, Cussonia spicata, Dombeya rotundifolia, Leucosidea sericea, Halleria lucida, Combretum erythrophyllum, Calodendron capense, Rhus lancea, Celtis Africana, Greyia sutherlandii, Heteropyxis natalensis, Erythrina*	15	Detail design drawings will ensure that the infrastructure is designed in such a way to have the least impact on the topography.	Project Manager Construction Manager Civil Engineer Mining Engineer
				16	Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the Yzermyn Underground Coal Mine. Avoid high pole top security lighting along the periphery of the site and use only movement-activated lights at potential points of illegal entry to the site. Lighting on the adit, plant and stockpile areas should be down-lights and localised to those areas where workers are operating at the time. Refer to 'Light Mitigation' in **Appendix H-2.**	Project Manager Construction Manager Civil Engineer Mining Engineer

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			latissima, sericea; shrub *Buddleja salvifolia*). Incorporation of indigenous trees into the landscaping to break up the long north facing wall facade.	17	Ensure all structures and infrastructure are painted in green and earthy tones, unless required otherwise for safety warning.	Project Manager Construction Manager
				18	Plant shading trees into parking design (as per list above). All trees must be indigenous.	Project Manager Construction Manager Environmental Coordinator
				19	Plant indigenous trees into the landscaping to break up the long north facing wall facade.	Project Manager Construction Manager Environmental Coordinator
				20	Plant row of screening trees along north, east and western toe of co-disposal discard dump. Refer to **Appendix H-3.**	Project Manager Construction Manager Environmental Coordinator
2.5	Topography	Construction Operation	Earth berm of 1.5 m height to be created on northern, eastern and western raised fill areas to screen off vehicles and base views from proximate rural receptors located below the site.	21	Ensure engineering design details location of berms. Berms are to be managed in accordance with this engineering design.	Project Manager Construction Manager Civil Engineer Mining Engineer
2.6	Topography	Construction Operation	Revegetation of support berms to veld grasses.	22	Draw up a rehabilitation plan for berms located at the topsoil stockpiles, earthen berms, berms on the sides of the co-disposal discard dump and for the berms on the side of the adit entrance and adit platform. All berms are to be re-vegetated using indigenous grass species hydroseeding mixes.	Project Manager Construction Manager Civil Engineer Mining Engineer

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
2.7	Topography	Construction Operation	Monitoring methods (i.e. visual inspections) will be implemented from the start of construction to monitor the surface stability (baseline) prior to the commencement of underground mining activities.	23	Visual inspections of the surface topography and reporting of any areas of concern to be implemented.	Environmental Coordinator
Land Management Plan						
Refer to Ref. 2.2; 2.4; 4.9; 4.11; 4.12; 4.15; 4.17; 4.19; 4.20; 4.21; 4.23; 4.24; 4.25; 4.26; 4.31; 4.39; 5.1; 5.2; 5.3; 5.4; 5.6; 5.7; 5.8; 5.9; 5.10; 5.13; 5.14; 5.15; 5.16; 5.17; 5.17; 5.18; 5.19; 5.24; 5.24; 5.25; 6.19; 6.24; 7.1; 7.2; 7.3; 7.4; 7.5; 7.6; 7.7; 7.8; 8.1; 8.5; 8.9; 8.12; 10.1; 10.2; 10.3; 10.11; 10.13; 11.1; 11.2; 12.1; 12.2; 12.8; 12.12; 12.17						
3.1	Soils, Land Use and Land Capability	Construction Operation	Amend design of dump to allow for benching on north, east and western dump slopes to facilitate operation phase vehicle access for the application of topsoil for rehabilitation of dump faces. Incorporate management plan which would allow for a phased expansion of the discard dump where topsoil from the expansion area is utilised directly on the rehabilitation of the previous dump face. This would allow for topsoil not to be sterilised by stockpiling.	Refer to Action Reference No. 13, 14 and 15		
3.2	Soils, Land Use and Land Capability	Construction	Prior to the commencement of construction activities, the project site will be clearly demarcated with fencing. Temporary barriers should be erected to protect surrounding habitats from construction activities and dumping of rubble and waste.	Refer to Action Reference No. 13, 14 and 15		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
3.3	Soils, Land Use and Land Capability	Construction	Contractors operating onsite are to provide a method statement before site clearance commences. The method statement will clearly indicate all material storage areas, offices and other site infrastructure, waste disposal/ storage areas etc., designed to minimise removal of vegetation and damage to surrounding areas.	24	Receipt of method statements per contractor. This is to be in line with the engineering drawing and site layout.	Project Manager Construction Manager
3.4	Soils, Land Use and Land Capability	Construction Operation	Material extracted as a result of the development of the adit (high-wall, decline shafts and ventilation shaft) and other approved mining activity materials will be utilised instead of borrow-pit material where possible. Existing or commercial sources, or existing borrow pits will only be used if this material is not suitable. No borrow pits will be excavated onsite. Borrow pits will need to be authorised according to the relevant South African legislation prior to being excavated.	25	Draw up a plan clearly defining the quantities and characteristics of borrow material that will be required for the construction phase and indicate where this can be obtained on the construction site (i.e. high-wall overburden, decline shaft material, etc.).	Project Manager Construction Manager
				26	Brief contractors as to the various sources and quantities to be used and enforce the implementation thereof.	Project Manager Construction Manager
3.5	Soils, Land Use and Land Capability	Construction Operation	At least 300 mm of soils or until hard rock (if the soil cover is less than 300 mm deep) is reached will be removed from the area over which infrastructure, including co-disposal discard dump facility) will be placed. The topsoil (first 300 mm) is expected to have a higher fertility than the subsoil horizons and holds the vegetation seed bank.	27	Draw up a topsoil stockpile procedure, indicating the preferred stockpile areas as well as reflecting the method of stripping, stockpiling and stockpile management. The procedure should also address the identification of high-risk erosion areas, the rehabilitation of areas (should erosion occur), and the monitoring of erosion throughout the life of the project. The procedure must also incorporate the use of indigenous vegetation suitable to the area for	Project Manager Construction Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					rehabilitation purposes.	
				28	Brief contractors on the topsoil stockpile procedure and areas and enforce the implementation thereof.	Project Manager Construction Manager
3.6	Soils, Land Use and Land Capability	Construction	Large areas of soil excavation should be phased to limit the erosion potential during rainfall events (more common between September and February). Construction activities outside of the designated development areas should be limited.	29	Draw up a construction phase plan, limiting vegetation removal and soil excavation during the wet summer season.	Project Manager Construction Manager
3.7	Soils, Land Use and Land Capability	Construction Operation	The topsoil will be stockpiled in designated areas and will be vegetated where required or possible to minimise erosion in accordance with the relevant procedures for use in ongoing rehabilitation purposes. Topsoil should be kept separate from sub-soils during stockpiling. The stockpile shall be located away from seepage zones, floodlines, water courses and other ecological sensitive areas. Stockpiles will not exceed 2 m in height.	Refer to Action Reference No. 27 and 28		
3.8	Soils, Land Use and Land Capability	Construction Operation Closure	Sustainable erosion control measures (for wind and water erosion) will be implemented and maintained where necessary in areas disturbed by the construction (and operation) activities. Erosion control measures include, but are not limited to swales, sandbags, planting of vegetation, hydroseeding of topsoil and subsoil stockpiles and retention of vegetation.	Refer to Action Reference No. 27 and 28		
				30	Construct the required erosion protection measures.	Construction Manager
				31	Ensure the required erosion protection measures are maintained.	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
3.9	Soils, Land Use and Land Capability	Construction Operation Closure	Vegetation removal should be kept to a minimum and limited to the area of development. Where an impact to the vegetation outside of the development footprint occurs, rehabilitation measures need to be undertaken to maintain the baseline vegetation population and health. Weed and invader species growth needs to be appropriately managed within the mine area to maintain the baseline vegetation health.	Refer to Action Reference No. 13, 14 and 15		
				32	Draw up a plan in consultation with the Environmental Coordinator to indicate where vegetation should be removed.	Project Manager Environmental Coordinator
				33	Brief all contractors to remain within the planned area for construction and to only remove vegetation as indicated in a vegetation removal plan.	Construction Manager
3.10	Soils, Land Use and Land Capability	Construction Operation Closure	Due to the potential for soil compaction resulting from vehicles, traffic should be limited to existing or proposed roadways as far as possible. The construction of roads should be limited in width and length as far as is practical to limit impacts. Where possible already disturbed areas will be utilised.	Refer to Action Reference No. 13, 14, 15, 27, 28, 32 and 33.		
3.11	Soils, Land Use and Land Capability	Construction Operation Closure	All disturbed areas should be rehabilitated as soon as possible during the life of mine in accordance with design specifications to reduce soil erosion.	Refer to Action Reference No. 27 – 33		
3.12	Soils, Land Use and Land Capability	Construction Operation Closure	Dirty and clean water will be separated by implementing clean and dirty water systems/ structures prior to construction to prevent pollution of clean water runoff or the existing dirty and clean water systems will be maintained.	34	Implement the Stormwater Management Plan developed by WSP as part of this project.	Project Manager Construction Manager Environmental Coordinator
				35	Design all structures to ensure clean: dirty water separation as stipulated in GNR.704 of the National Water Act (No. 59 of 1998).	Project Manager Construction Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
						Civil Engineer
				36	Maintain and monitor the implementation of clean: dirty water separation.	Construction Manager Environmental Coordinator
3.13	Soils, Land Use and Land Capability	Construction Operation Closure	The clean and dirty water systems and structures will be properly designed (according to GNR.704 of the National Water Act (No. 59 of 1998)) to prevent contamination of clean water sources and the erosion and scouring of the infrastructure.	Refer to Action Reference No. 34 – 36		
3.14	Soils, Land Use and Land Capability	Construction Operation Closure	All waste generated onsite will be adequately stored, and collected and disposed of by a reputable waste management contractor. No waste is to be burned or disposed of onsite.	37	Draw up a Waste Management Plan that will ensure that the principles stated in the 'waste hierarchy' are included and that all other waste is correctly classified and disposed of at the appropriate registered waste disposal site. The plan is to include procedures for each waste stream generated onsite. Furthermore, all waste management and waste disposal activities are to be undertaken in accordance with the National Environmental Management Waste Act (No. 59 of 2008).	Environmental Coordinator
				38	Draw up and enforce site rules for employees and contractors to ensure good housekeeping practices with respect to general waste. Brief employees and contractors as to the waste management plan and ensure it is enforced.	Environmental Coordinator Mine Manager
				39	All waste streams generated should be classified (as general, hazardous or recyclable wastes) and separated at source.	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
				40	A waste management contractor is to be identified, a contract agreed and the waste management contractor is to collect all waste generated from the site and remove it to a permitted waste disposal facility.	Project Manager Environmental Coordinator Waste Contractor
				41	The following colour-coding system is recommended: ▪ General waste – Green ▪ Hazardous liquid waste – Red ▪ Hazardous solid waste – Orange ▪ Scrap steel – Grey ▪ Industrial recyclable – Blue ▪ Scrap paper and Cardboard – Yellow ▪ Old batteries – Black It is recommended that designated bays/ areas be painted in the specific colour rather than painting the waste receptacles. Furthermore, all receptacles are to be signposted.	Environmental Coordinator Waste contractor
				42	An adequate number of waste receptacles should be located across the Yzermyn Underground Coal Mine activity area.	Environmental Coordinator Waste contractor
				43	Waste receptacles are to be located in waste storage areas constructed in line with GNR.436 of 2011 and SANS 11014.	Environmental Coordinator Civil Engineer
				44	All waste collection storage areas will be managed effectively to avoid any potential surface and groundwater contamination.	Environmental Coordinator Waste Contractor

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
3.15	Soils, Land Use and Land Capability	Construction Operation Closure	A central salvage yard should be established where waste streams will be taken to prior to removal offsite.	Refer to Action Reference No. 37 – 44		
3.16	Soils, Land Use and Land Capability	Construction Operation Closure	Atha is to ensure that all access routes are adequately maintained (potholes, erosion damage, corrugations, etc.).	45	Draw up a road maintenance procedure and ensure the procedure is implemented.	Project Manager Construction Manager
3.17	Soils, Land Use and Land Capability	Construction Operation Closure	The use of herbicides and pesticides and other related horticultural chemicals should be carefully controlled and only applied by personnel adequately certified to apply pesticides and herbicides.	46	Draw up a procedure for the storage, management and application of herbicides and pesticides. Herbicides and pesticides should not be applied on very windy days and at all times their application should be directed away from surrounding land, to prevent damage to organisms in the surroundings.	Project Manager Environmental Coordinator
				47	Ensure herbicides and pesticides are only directed to areas required and only applied by a certified person.	Project Manager Plant Manager
3.18	Soils, Land Use and Land Capability	Construction Operation Closure	Fertilisers should not be used excessively and slow release fertilisers and organic products should be used in preference to highly soluble and inorganic fertilisers. Only natural fertilisers should be utilised.	48	Draw up a procedure for the appropriate use of natural fertilisers. The procedure is to comply with the requirements of the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No. 46 of 1947).	Project Manager Environmental Coordinator
3.19	Soils, Land Use and Land Capability	Construction Operation Closure	The use of herbicides and pesticides will be applied in compliance with the Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act (No. 46 of 1947).	Refer to Action Reference No. 47		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
3.20	Soils, Land Use and Land Capability	Construction Operation Closure	Fires will only be allowed in facilities specially designed and constructed for this purpose within the project site. No open fires or uncontrolled fires will be permitted as outlined in The National Veld and Forest Fire Act (No. 101 of 1998).	49	Draw up a fire management strategy, that will included all items such as prevention, firebreak burning, veld fires, maintenance of equipment, emergency numbers, evacuation procedures etc. It is mandatory to burn firebreaks (of a width sufficient to stop the spread into a neighbour's land of a fire originating from within the works) around the works, and to cooperate with the neighbouring landowner/s in doing so.	Project Manager Environmental Coordinator
				50	A veld fire action policy is to be included in the fire management strategy to prevent unnecessary loss of fauna and habitat in the event of a veld fire.	Project Manager Environmental Coordinator
				51	Brief employees and contractors on the fire management strategy and enforce the implementation thereof.	Project Manager Environmental Coordinator
				52	Designate an area that can be safely used to make fires.	Construction Manager
3.21	Soils, Land Use and Land Capability	Construction Operation Closure	Fire fighting measures, such as fire extinguishers, will be located in strategic locations onsite and the workforce will be made aware of fire prevention and fire fighting measures.	Refer to Action Reference No. 49		
3.22	Soils, Land Use and Land Capability	Construction	A demarcated area will be designated for cement batching and mixing of concrete in order to minimise soil contamination. The batching area is to be bunded/ surrounded by diversion drains to contain any runoff.	Refer to Action Reference No. 13, 14 and 15		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
3.23	Soils, Land Use and Land Capability	Construction	All excess cement and concrete mixes are to be contained on the construction site prior to disposal at a licensed landfill offsite.	53	Contain all concrete residues within the site boundary and remove for disposal by a waste management contractor.	Construction Manager Environmental Coordinator
3.24	Soils, Land Use and Land Capability	Construction	Cementaceous wash water is to be captured and removed from site. Cementaceous waste water is not to be released into the environment.	Refer to Action Reference No. 53		
3.25	Soils, Land Use and Land Capability	Construction Operation Closure	Soil and water contamination from diesel spills, particularly at the storage tanks, will be prevented by ensuring these areas are adequately constructed on barrier foundations with the statutory bund walls.	54	Draw up a comprehensive Material Safety Data Sheet (MSDS) obtained from the suppliers for all dangerous good and chemicals stored and/ or utilised onsite. All MSDS's must be displayed where dangerous goods and/ or chemicals are stored and utilised. MSDS's will take cognisance of the storage, handling, transportation and disposal of chemicals and hazardous materials. MSDSs are to be updated on a regular basis.	Materials Manager
				55	Brief all employees and contractors on the location of the MSDS and how they should be utilised.	Construction Manager
				56	Compile an Emergency Preparedness and Response Plan (RPRP) and ensure it is up to date.	Environmental Coordinator
				57	Brief employees and contractors on the EPRP and enforce the implementation thereof.	Environmental Coordinator Construction Manager
				58	All spillages and leakages must be reported as indicated on the EPRP.	Environmental Coordinator Construction Manager
				59	All chemicals and other hazardous materials are	Construction Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					to be stored in designated and bunded areas, where the bunded area is impermeable and is impervious to the stored substance. The bunded area will contain 110% volume of the largest container stored.	Environmental Coordinator Plant Manager
				60	All bunds should be designed with valves that should be locked when not in use, and that will be protected from vandalism and unauthorised use.	Construction Manager Environmental Coordinator Plant Manager
				61	All bunded areas are to be adequately signposted identifying the material, volume and appropriate SANS code. Furthermore, safety signs indicating "No Smoking" and "Danger" are to be placed in and around flammable storage areas.	Construction Manager Environmental Coordinator
				62	Monthly inspections of the integrity of all designated and bunded areas will be undertaken.	Construction Manager Environmental Coordinator
				63	Monthly inspections of the integrity of all designated and bunded areas will be undertaken.	Construction Manager Environmental Coordinator
				64	Any water that collects in bunds will not be allowed to stand. Should the water be contaminated, it is to be removed from site as hazardous waste. Clean stormwater contain within the bunds may be reused in the wash plant as process water.	Construction Manager Environmental Coordinator
				65	Used fuels, oils, paints, solvents and greases	Construction Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					should be stored in drums or other suitable containers in a bunded area. These should be labelled, sealed and disposed of at an appropriate disposal or recycling facility. Under no circumstances are the substances to be disposed of on-site or into the surrounding environment.	Environmental Coordinator
				66	All waste fuel, oily and chemically impregnated rags will be stored in leak-proof containers including a lid and will be disposed of at an appropriate disposal facility.	Construction Manager Environmental Coordinator
3.26	Soils, Land Use and Land Capability	Construction Operation Closure	A procedure for the storage, handling and transportation of the different dangerous goods, chemicals and hazardous materials has been drawn up for the mine and must be strictly enforced.	Refer to Action Reference No. 54 – 66		
3.27	Soils, Land Use and Land Capability	Construction Operation Closure	Material Safety Data Sheets will be updated regularly and be available onsite.	Refer to Action Reference No. 54 – 66		
3.28	Soils, Land Use and Land Capability	Construction Operation Closure	Oils, greases, diesel and other chemicals will be stored in the prescribed manner and within bunded areas.	Refer to Action Reference No. 54 – 66		
3.29	Soils, Land Use and Land Capability	Construction Operation Closure	If a major spillage or leakage occurs the contractor will be called out to clean the contaminated area and rehabilitate the soils, as appropriate.	Refer to Action Reference No. 54 – 66		
3.30	Soils, Land Use and Land	Construction	If any other minor spillage or leakage occurs the spillage will be cleaned	Refer to Action Reference No. 54 – 66		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
	Capability	Operation Closure	immediately and the contaminated area will be rehabilitated, as appropriate.			
3.31	Soils, Land Use and Land Capability	Construction Operation Closure	All spillages and leakages must be reported as indicated on the EPRP.	Refer to Action Reference No. 54 – 66		
3.32	Soils, Land Use and Land Capability	Construction Operation Closure	Contracts will include specifications that make employees and contractors aware of the necessity to prevent spillages by the implementation of good housekeeping practices.	Refer to Action Reference No. 54 – 66		
3.33	Soils, Land Use and Land Capability	Construction Operation Closure	A rapid response team should be available on 24-hour notice to deal with hazardous spillages.	67	Draw up a procedure to ensure all hazardous spills will be dealt with within 24 hours of occurrence.	Environmental Coordinator Project Manager
				68	Brief employees and contractors on the procedure for dealing with hazardous spillages and ensure their understanding and implementation thereof.	Environmental Coordinator Construction Manager
3.34	Soils, Land Use and Land Capability	Construction Operation Closure	A procedure for the storage, handling and transportation of the different hazardous materials has been drawn up for the mine and must be strictly enforced.	69	Draw up a procedure for the management of dangerous goods, hazardous materials and chemicals. The plan is to comply with the requirements of SANS 10234, 10228 and 10229.	Environmental Coordinator Project Manager Materials Manager
				70	Brief employees and contractors on the fire management strategy and enforce the implementation thereof.	Project Manager Environmental Coordinator
3.35	Soils, Land Use and Land Capability	Construction Operation Closure	An Environmental Awareness Programme will be instituted.	71	Compile an Environmental Awareness Plan and ensure it is up to date.	Project Manager Environmental Coordinator
				72	Brief contractors on the Environmental Awareness Plan and enforce the	Environmental Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					implementation thereof.	Construction Manager
3.36	Soils, Land Use and Land Capability	Construction Closure	The maintenance of the chemical toilets will be the responsibility of an external contractor.	73	Instruct contractors to supply and maintain the temporary toilets in a fit and proper manner.	Project Manager Contractor
				74	Ablution facilities shall be within 100 m from places of work, but further than 100 m from any watercourse or borehole.	Contractor Environmental Manager
				77	Remove the sewage from the temporary toilets and dispose thereof in a controlled manner. Records of all sewage removed from site and safely disposed of/ treated are to be provided to the Environmental Coordinator and maintained onsite.	Environmental Manager
3.37	Soils, Land Use and Land Capability	Construction Operation Closure	The sewage treatment plant to be constructed is to be located on an impervious surface, bunded and a leak detection system is to be installed.	Refer to Action Reference No. 13, 14 and 15		
3.38	Soils, Land Use and Land Capability	Construction Operation Closure	Sewage contained within the septic tank is to be removed by an external contractor on a weekly basis.	78	External contractor to develop a sewage collection procedure. The procedure is to include spill response plan, relevant training required and a schedule of collection.	Project Manager Contractor
				Refer to Action Reference No. 77		
Biodiversity Management Plan						
Refer to Ref. 2.2; 2.4; 4.9; 4.11; 4.12; 4.15; 4.19; 4.17; 4.20; 4.21; 4.23; 4.26; 4.31; 4.29; 4.39; 5.1; 5.2; 5.3; 5.4; 5.6; 5.7; 5.8; 5.9; 5.10; 5.13; 5.14; 5.15; 5.16; 5.17' 5.18; 5.19; 5.24; 5.25; 6.19; 6.20; 6.21; 6.22; 6.23; 6.24; 7.1; 7.2; 7.3; 7.4; 7.5; 7.6; 7.7; 7.8; 8.1; 8.5; 8.9; 8.12; 10.1; 10.11; 10.2; 10.3; 10.4; 10.11; 10.13; 11.1; 11.3; 11.2; 12.1; 12.2; 12.3; 12.8;						

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
12.12; 12.17						
4.1	Biodiversity	Construction Operation Closure	Develop a Biodiversity Action Plan	79	Contractor/ company is to be appointed to develop and compile a Biodiversity Action Plan. The plan should be monitored and updated on an annual basis. The Biodiversity Action Plan is to be developed prior to commencement of the construction phase.	Contractor Environmental Coordinator
4.2	Biodiversity	Construction Operation	Animals should be given sufficient time to relocate from the project area prior to the initiation of construction activities.	80	Design the construction plan to ensure that construction activities are initiated in a specific area and from there expand to the remaining areas.	Project Manager
				81	Brief the employees and contractors on the construction plan and timeframes and enforce it.	Construction Manager Environmental Coordinator
4.3	Biodiversity	Construction Operation	Protected floral and faunal species will require permits for destruction/ translocation.	82	The footprint area should be re-investigated by a qualified botanist and zoologist with appropriate field experience so that the locations of all CI and transplantable plant species (e.g. *Eucomis autumnalis*) can be recorded and visually marked. The designated mine Environmental Coordinator should be included in the search. Transplanted specimens should be monitored to assess their success of establishment during the operational phase.	Environmental Coordinator Professional botanist and zoologist
				83	Appoint company/ contractor to identify, geo-reference and record all fauna and flora species that are	Environmental Coordinator Professional botanist and zoologist

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					protected in South Africa.	
				84	Company/ contractor will compile all relevant permits and discuss the permit process with the relevant authorities.	Environmental Coordinator Professional botanist and zoologist
				85	Company/ contractor to dig up/ capture fauna and flora species and relocate them to a pre-identified area within the prospecting right area.	Environmental Coordinator Professional botanist and zoologist
				86	Records of all species will need to be maintained and photographic evidence of relocation and health of species will be taken.	Environmental Coordinator Professional botanist and zoologist
				87	Individuals from the MTPA, WWF-SA, etc. should be present during relocation programme.	Environmental Coordinator
				88	Any incidents should be recorded and closed out in the incidents report.	Environmental Coordinator
4.4	Biodiversity	Construction Operation	Locate, translocate and monitor Conservation Important (CI) flora.	Refer to Action Reference No. 82 – 88		
4.5	Biodiversity	Construction Operation	Translocate CI fauna.	Refer to Action Reference No. 82 – 88		
4.6	Biodiversity	Construction Operation		89	A qualified zoologist with appropriate expertise should assess the success of translocating resident CI faunal species.	Environmental Coordinator Professional botanist and zoologist
4.7	Biodiversity	Construction Operation	Include biodiversity conservation in staff and contractor training and inductions. Toolbox Talks are to	90	Draw up an induction, training and Toolbox Talk programme detailing importance of biodiversity in the area and management measures to	Project Manager Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Closure	include aspects of biodiversity.		minimise impacts thereof. Education through photographic references of species can be supplied.	
4.8	Biodiversity	Construction Operation		91	Brief the employees and contractors on the programme and enforce.	Environmental Coordinator
4.9	Biodiversity	Construction Operation	Prohibit the disturbance of biodiversity beyond the construction and operation footprints.	Refer to Action Reference No. 27 – 29 and 82 – 88		
4.10	Biodiversity	Construction Operation	Prohibit driving off the main access route.	92	Define access route to all employees and contractors.	Project Manager
				93	Develop, notify and implement a fining system for non-compliance.	Project Manager Environmental Coordinator
4.11	Biodiversity	Construction Operation	Avoid all Very High and High sensitive areas as illustrated in **Appendix G-1**.	Refer to Action Reference No. 13, 14 and 15		
				94	Amend site layout to take cognisance of Very High and High sensitive areas and relocate surface infrastructure and adit.	Project Manager Mine Engineer Environmental Coordinator
4.12	Biodiversity	Construction Operation	Shift the infrastructure layout to impact only one catchment.	95	The current surface infrastructure layout impacts on the catchments of both System 1 and 2 as defined in the wetland assessment. The layout of the surface infrastructure should be re-aligned to impact on only one of these systems.	Project Manager Mine Engineer Environmental Coordinator
4.13	Biodiversity	Construction Operation	Rehabilitate existing alien-invaded wetlands within the area as an offset	96	For the wetland systems lost by the surface infrastructure footprint, a Hectare Equivalent approach taking	Project Manager Mine Engineer

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Closure	option.		into consideration wetland integrity/ functionality of the wetland lost should be conducted. Based on the outcome of what hectare equivalents are required, wetland areas identified for rehabilitation should therefore be secured in the same catchment. Due to the Natural to Largely Natural status of the wetlands in the region, these rehabilitation options will be limited, and will mainly include the removal of alien and invasive bushclumps (specifically within System 2).	Environmental Coordinator
				97	Develop a rehabilitation procedure for the existing alien-invaded wetlands.	Project Manager Mine Engineer Environmental Coordinator
				98	Discuss potential of offsets with MTPA, WWF-SA, etc.	Environmental Coordinator
4.14	Biodiversity	Construction Operation	Water collected in the cut-off trench should remain clean, and be returned to the receiving environment. The release of water into the receiving environment should be dissipated to prevent erosion.	Refer to Action Reference No. 34 – 36		
4.15	Biodiversity	Construction Operation	If roads pass along steep gradients (≥ 1 in 10), erosion control measures should be implemented, as deemed	99	Appoint Civil Engineer to redesign access roads per commitment 2.2 and 2.4.	Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			appropriate by registered civil engineers. Effective storm water management measures should be implemented and maintained along these roads.	Refer to Action Reference No. 13, 14 and 15		
4.16	Biodiversity	Construction Operation Closure	Annual monitoring of the Present Ecological State (PES) of the water resources onsite and within all systems impacted on by the drawdown cone.	100	Develop monitoring programme to evaluate PES.	Project Manager Environmental Coordinator
4.17	Biodiversity	Construction Operation	Seal off water bearing geological structures like faults and dykes as they are intersected in the underground workings to minimise groundwater seepage to the workings and to limit the impact of mine dewatering	101	Identify water bearing geological structures (dykes and faults)	Mine Engineer
				102	Develop a procedure to effectively seal areas where the geological structures are intersected during mining activities.	Project Manager
4.18	Biodiversity	Construction Operation	Riparian integrity of the Assegaai River and associated tributaries should be monitored by a vegetation ecologist to assess the health of the riparian vegetation and the survival of threatened and protected CI species	103	Develop a procedure to evaluate the riparian integrity of the Assegaai River and tributaries. The procedure is to contain a monitoring programme.	Environmental Coordinator
				104	Appoint a Vegetation Ecologist to undertake monitoring.	Environmental Coordinator
4.19	Biodiversity	Construction Operation Closure	All vehicles and equipment will be serviced regularly and will be kept in good working order within designated areas.	105	All contractors to supply a pre-planned maintenance plan for vehicles and equipment.	Project Manager
				106	Regular audits or checks to be undertaken on vehicles and equipment.	Construction Manager Health and Safety Manager
4.20	Biodiversity	Construction Operation	An Alien and Invasive Management Plan should be developed for the proposed mining project. A detailed	107	Develop an alien and invasive management programme. Programme is to include training and	Environmental Coordinator Community Liaison

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			"on-the-ground" assessment of alien species within the greater study area, their density and distributions should form the baseline. Furthermore, stakeholder engagement strategies should be included into the planning phase of the programme. By ensuring that effective consultation takes place with local communities and all affected parties, any potential misunderstandings (if communities are utilising species such as *Acacia mearnsii* for firewood etc.) and disagreements can be resolved or accommodated in advance.		awareness of types of alien and invasive flora.	
				108	Undertake public consultation detailing the purpose of the programme and timeframes associated with the programme.	Environmental Coordinator Community Liaison
				109	Appoint a team to implement the alien and invasive management programme.	Environmental Coordinator Community Liaison
				Refer to Action Reference No. 110 – 115		
4.21	Biodiversity	Construction Operation Closure	A monitoring programme will be implemented that will ensure that all weeds and alien species will be eradicated in and around the project area. Measures will also be implemented to prevent the spreading of these species throughout the life of mine.	110	Identify any current invader species in the area by means of a survey	Environmental Coordinator
				111	Draw up an eradication, spread prevention as well as monitoring plan for invader species.	Environmental Coordinator
				112	Ensure materials to be utilised for rehabilitation purposes are sourced from reliable suppliers that can certify the absence of weed species in the materials.	Environmental Coordinator
				113	Staff and contractors should be made aware of existing and potentially occurring alien species onsite. If any alien species are seen emerging, the Environmental Coordinator onsite must be able to identify and remove these.	Environmental Coordinator Project Manager
				114	The intentional introduction of an alien plant species should not be considered for any screening effects, landscaping etc. Indigenous alternatives should be considered suitable for the purposes for which the introduction is	Environmental Coordinator Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					required.	
				115	No alien plant species or domestic animals such as dogs and cats should be allowed into the construction camp.	Environmental Coordinator Project Manager Mine Manager
4.22	Biodiversity	Construction Operation	Refer to Ref. 3.5	Refer to Action Reference No. 27 – 29		
4.23	Biodiversity	Construction Operation	No mining or construction may occur within 1 km radius of existing FEPA wetlands. If this cannot be avoided, permission for exemption from the guideline will have to be applied for prior to construction, from the relevant authority (MTPA, MDEDECT, DEA and DWA).	116	Refer to **Appendix H-4** and ensure no construction occurs within the area	Environmental Coordinator Project Manager
4.24	Biodiversity	Construction Operation	No disturbance should occur within an 'Irreplaceable' Critical Biodiversity Area.	117	Refer to **Appendix H-4** and ensure no construction occurs within the area.	Environmental Coordinator Project Manager
4.25	Biodiversity	Construction Operation	A 200 m buffer should be delineated around the Mkuzase and Mawandlane Rivers and associated channelled valley bottom wetlands (System 1 wetlands). No disturbance should occur within this buffer.	118	Refer to **Appendix H-4** and ensure no construction occurs within the area.	Environmental Coordinator Project Manager
4.26	Biodiversity	Construction Operation	A 100 m buffer should be delineated around the seep wetlands (System 2 wetlands). No disturbance should occur within this buffer.	119	Refer to **Appendix H-4** and ensure no construction occurs within the area.	Environmental Coordinator Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
4.27	Biodiversity	Construction Operation	A minimum 'no-go' 1 km aboveground and 500 m underground buffer must be maintained around the two large, old adits where at least four CI bat species are roosting.	120	Refer to **Appendix H-4** and ensure no construction occurs within the area.	Environmental Coordinator Project Manager
				121	The site could be screened using indigenous plants to create hedging. Alien and invasive plants must not be used.	Environmental Coordinator Project Manager
4.28	Biodiversity	Construction Operation Closure	Refer to Ref. 2.4	Refer to Action Reference No. 15 – 20		
4.29	Biodiversity	Construction Operation Closure	The movement of any animals intending to flee the impacted area will not be obstructed. Abuse and hunting/ chasing of animals by workers will not be allowed.	122	Ensure no animals are affected when naturally leaving the project area.	Environmental Coordinator Project Manager
4.30	Biodiversity	Construction Operation Closure	Stockpiles should be kept clear of weeds and alien vegetation	Refer to Action Reference No. 30 and 31		
4.31	Biodiversity	Construction Operation Closure	Collection of traditional medicinal plants will not be permitted. No area will be cleared of vegetation for camping purposes	123	Ensure no plants are collected for firewood or medicinal purposes.	Environmental Coordinator Project Manager
4.32	Biodiversity	Construction Operation Closure	Dangerous interactions between personnel and venomous fauna will be reduced through awareness courses, posters, and other forms of education.	124	Include information pertaining to dangerous animals in induction training material.	Environmental Coordinator Project Manager
4.33	Biodiversity	Construction Operation Closure	In the event that animals are present that may pose a risk to the safety of people on-site, a suitable animal handler will be requested to remove the animal in an environmentally responsible manner. This specifically	Refer to Action Reference No. 124		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			refers to snakes, scorpions and spiders.			
4.34	Biodiversity	Construction Operation Closure	Should a complaint be received relating to wildlife interaction, the Environmental Coordinator will respond to the complaint within 24 hours. All complaints will be reported in a complaints register.	Refer to Action Reference No. 261 – 269		
4.35	Biodiversity	Construction Operation Closure	Photographs of the project site before, during construction, operation, rehabilitation and after closure should be taken and maintained on record.	125	Ensure photographs at strategic locations are taken biannually and the records maintained.	Environmental Coordinator Project Manager Construction Manager
4.36	Biodiversity	Construction Operation Closure	No marking or disfiguring of natural rocks, trees and vegetation is permitted. Marking may be done by stakes and tags.	126	Ensure rocks, trees and vegetation is not destroyed in any manner.	Environmental Coordinator Project Manager
4.37	Biodiversity	Construction Operation Closure	Newly constructed features will have anti-collision devices in place and diverters.	127	Draw up a procedure for maintaining the security fence around the site.	Environmental Coordinator Project Manager
				128	Undertake regular audits to ensure structures and fences are free from animal and plants.	Environmental Coordinator
4.38	Biodiversity	Construction Operation Closure	If an electrical boundary fence is constructed, this will be inspected regularly for accidental mortalities such as tortoises.	Refer to Action Reference No. 127 and 128		
4.39	Biodiversity	Construction Operation Closure	An on-going rehabilitation programme will be drafted that will provide best management guidelines for the restoration and rehabilitation of the remnant portions of biodiversity.	129	Draw up an on-going rehabilitation programme to ensure that disturbed areas can be rehabilitated at the end of the specific construction activity, which will include ongoing monitoring of rehabilitated areas.	Environmental Coordinator Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
				130	Implement and monitor the rehabilitation and re-vegetation programme.	Environmental Coordinator
4.40	Biodiversity	Construction Operation Closure	The harvesting of natural vegetation for fuel wood or any other purposes will be strictly prohibited	Refer to Action Reference No. 123 and 124		
4.41	Biodiversity	Construction Operation Closure	The poaching and hunting of animals will be strictly prohibited.	Refer to Action Reference No. 122		
4.42	Biodiversity	Construction Operation Closure	Clear signs will be erected to indicate the potential presence of wildlife	131	Signs will be erected at all road crossings and where relevant on the construction site.	Environmental Coordinator
4.43	Biodiversity	Construction Operation Closure	Refer to Ref. 3.20	Refer to Action Reference No. 49 – 52		
Surface Water Management Plan						
Refer to Ref. 2.2; 2.4; 4.9; 3.2; 3.4; 3.5; 3.7; 3.8; 3.9; 3.10; 3.11; 3.12; 3.13; 3.14; 3.22; 3.23; 3.24; 3.25; 3.35; 4.9; 4.17; 4.20; 4.21; 4.23; 4.24; 4.25; 4.26; 4.39; 6.19; 6.20; 6.21; 6.22; 6.23; 6.24; 7.7; 7.8; 8.1; 8.5; 8.9; 8.12; 10.1; 10.2; 10.3; 10.4; 10.11; 10.13; 11.1; 11.2; 11.3; 12.1; 12.8						
5.1	Surface Water	Construction	All construction activities will remain outside the 1:100 year flood line of	132	Demarcate the 1:100 year flood line and 100 m buffer on a map. The map should be conveyed	Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Operation	the tributaries feeding the Mkuzase and Mawandlane Rivers and further than 100 m from watercourses identified onsite.		to staff and contractors. Proposed infrastructure within this 1:100 year flood line and buffer should be relocated.	Environmental Coordinator
5.2	Surface Water	Construction Operation	Clean and dirty water systems are to be installed and well maintained throughout the life of mine.	133	Refer to Action Reference No. 34 – 36	
5.3	Surface Water	Construction Operation	Where significant pollution potential is identified in terms of the clean and dirty water systems, these areas will be lined (i.e. PCDs, co-disposal discard dump, stormwater cut-off trench and clean: dirty water systems are to be lined).	134	Where the project will clearly result in pollution, key areas, i.e. systems, these areas will be lined (i.e. PCDs, co-disposal discard dump, stormwater cut-off trench and clean: dirty water systems are to be lined.	Project Manager Environmental Coordinator
5.4	Surface Water	Construction Operation Closure	All topsoil stockpiles will have storm water diversion berms for protection against erosion and contamination by dirty water.	135	Topsoil stockpiles are not to be placed across drainage pathways.	Project Manager Environmental Coordinator
				136	Ensure construction takes place as per designs.	Project Manager Environmental Coordinator
5.5	Surface Water	Construction Operation	Where significant pollution potential is identified in terms of the clean and dirty water systems, these areas will be lined.	137	Where the project results in an increase in pollution, key areas, i.e. pollution control dams etc. should be lined.	Project Manager Environmental Coordinator
5.6	Surface Water	Construction Operation	The co-disposal discard dump and coal stockpile area must be lined.	138	Ensure co-disposal discard dump and coal stockpiles are lined.	Mine Manager Project Manager
5.7	Surface Water	Construction Operation	Do not discharge waste of any nature, or any foreign material into any watercourse or associated buffer.	139	Ensure waste or foreign material is not discharged into watercourses and buffers.	Environmental Coordinator
5.8	Surface Water	Construction Operation	No untreated water should enter the receiving environment. Water released into the receiving	140	Ensure water that is to be discharged remains clean. No contaminated/ dirty water is permitted to be discharged. If required, water is to be	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			environment must comply with the Resource Quality Objectives or if these have not been set then the Target Water Quality Range for the protection of the receiving environment.		routed through a water treatment facility.	
5.9	Surface Water	Construction Operation Closure	A comprehensive surface and groundwater monitoring programme will be implemented.	141	Draw up a surface and groundwater monitoring programme.	Environmental Coordinator
				142	The surface and groundwater monitoring programme is to be monitored on a monthly basis.	Environmental Coordinator
				143	Results from the monitoring programme are to be recorded and an annual report compiled.	Environmental Coordinator
5.10	Surface Water	Construction Operation	Crossings of any water resources should include effective implementation of drainage control, such as the building of bridges, placement of culverts or drifts, as deemed appropriate by registered civil engineers.	144	Identify all watercourse crossings and develop scope of work for Civil Engineer to implement.	Project Manager Mine Engineer
5.11	Surface Water	Construction Operation	The flow within the Assegaai and associated tributaries should be monitored prior to construction and during the operational phase of the mine (until the mine voids have been filled). The minimum flow requirements, as per the reserve	145	Develop and implement monitoring procedure of the flow within the Assegaai River and associated tributaries.	Environmental Coordinator
				146	Calculate reserve determination and ensure compliance.	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			determination, must be met.			
5.12	Surface Water	Construction Operation	There is currently no information available on the flow rate of the fountains. It is recommended that the fountains be re-visited before mining commences to measure and record flow rates. This information is vital to determine the impact of mining on fountains in future.	147	Measure flow rates of all fountains/ springs within the area.	Environmental Coordinator
5.13	Surface Water	Construction Operation Closure	The mine must ensure that the necessary water licenses are in place for the dewatering activities, as well as for water discharge purposes. Where these licenses are not in place the mine will apply for the necessary water licenses to abstract and dispose of water. An integrated water management plan must be developed to manage all excess water.	148	All water uses should be identified and where required licenses must be applied for and obtained from DWA.	Environmental Coordinator
				149	Ensure that relevant reports (surface and groundwater monitoring programme) are made available to authorities (DMR, DEA, DWA, etc.) upon receipt.	Environmental Coordinator
5.14	Surface Water		Any activity impacting on a watercourse, or associated buffer, should only occur after authorisation by the relevant authorities.	Refer to Action Reference No. 148		
5.15	Surface Water	Construction Operation Closure	Dirty water and process water will be recycled. No contaminated water will be discharged directly into the environment. All contaminated water originating onsite will be stored within the PCDs which are designed to cater	150	No discharge of contaminated surface water will be permitted.	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			for the 1:100 year flood event.			
5.16	Surface Water	Construction Operation Closure	Spill response procedures are to include removal and disposal of potentially contaminated/ contaminated water and any used absorbent materials.	Refer to Action Reference No. 54 – 66		
5.17	Surface Water	Construction Operation Closure	Should vehicle, machinery or equipment spillages or leakages be observed on-site, drip trays are to be placed to ensure no soil contamination occur. Should a spill or leak occur, the resultant spillage will be cleaned immediately	Refer to Action Reference No. 54 – 66		
5.18	Surface Water	Construction Operation Closure	Adequate spill kits should be placed in strategic locations throughout the project site.	Refer to Action Reference No. 54 – 66		
5.19	Surface Water	Construction Operation Closure	Soils that may be contaminated by leakages and spillages associated with construction and operational activities are to be removed as soon as possible to prevent further contamination of the soils or underlying groundwater. Contaminated soil will be treated as hazardous waste and disposed of at an appropriate disposal facility off-site.	Refer to Action Reference No. 54 – 66		
5.20	Surface Water	Construction Operation Closure	Water pipelines on the site will be inspected for defects, cracks and leakages.	151	Draw up a pipeline monitoring programme and implement.	Project Manager Environmental Coordinator
5.21	Surface Water	Construction	Refer to Ref. 3.12 and 3.13.	Refer to Action Reference No. 34 – 39		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Operation Closure				
5.22	Surface Water	Closure	To limit the generation of dirty water during the decommissioning of the plant and administration area, it is recommended that the stormwater management infrastructure associated with these areas (channels and PCD) remain to capture dirty runoff.	152	Maintain and monitor the stormwater management infrastructure until post-closure.	Project Manager Environmental Coordinator
5.23	Surface Water	Closure	Once the site has been fully decommissioned, there should be limited water quality impacts, provided that the site is properly rehabilitated. To limit erosion, it should be ensured that the soils maintain their pre-development characteristics as far as is practicable to ensure infiltration and vegetation rooting. The vegetation health should be returned to the baseline health where practically feasible.	Refer to Action Reference No. 129 – 130		
5.24	Surface Water	Construction Operation Closure	Develop bio-monitoring programme and under take the bio-monitoring at least biannually, during all phases to ensure aquatic biota health is not adversely affected by mine development.	153	Develop a bio-monitoring programme as detailed in **Appendix H-6.** Programme should include monitoring points as illustrated in **Appendix H-6.**	Environmental Coordinator
				154	Water quality should be monitored monthly at the sampling sites. This ensures that water monitoring takes place downstream of any potential point of contamination. These water quality results should be compared against the	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					baseline data and TWQR, annually incorporated and interpreted in order to determine trends and identify possible sources of acute and chronic contamination.	
				155	The following water quality constituents should be included in the programme for monitoring: ▪ pH, EC, TDS, DO; ▪ salts (SO4, Mg, Na and Cl); ▪ As, Al, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb and Zn (coal mining associated constituents); and ▪ SS, turbidity, nutrients, organic enrichment, algal presence and eutrophication should be monitored	Environmental Coordinator
				156	If significant changes occur in water quality, the cause must be investigated and rectified appropriately.	Environmental Coordinator
				157	The bio-monitoring of the habitat, macro-invertebrate and fish communities should be determined bi-annually.	Environmental Coordinator
				158	Results should be recorded and an annual report detailing surface and groundwater quality developed.	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
5.25	Surface Water	Construction Operation Closure	Formulate and implement a comprehensive water quality monitoring plan.	159	The water quality results (contained within WSPs Surface Water Impact Assessment Report, **Appendix C**) can form part of a longer term water quality record that may be used as an indication of the baseline water quality in order to quantify the impacts of the proposed project. A formal monitoring programme will need to be developed for the mine and be implemented for the duration of the mining operations to quantify the potential impacts of the mining operations on surface water quality. As a result, the following is recommended:	Environmental Coordinator
				160	The WSP sampling locations and parameters should be maintained at a minimum, to determine any impacts arising from the mining activities. These should be expanded to additional watercourses and parameters should additional impacts be expected.	Environmental Coordinator
				161	It is recommended that monitoring is conducted on at least a quarterly basis for at least a year prior to the commencement of mining activities to determine baseline water quality. Thereafter, during mining activities monitoring should be conducted monthly in order to determine impacts to the water quality through the mining activities. Post closure of the mine, monitoring should continue in order to detect residual contamination sources.	Environmental Coordinator
				162	Draw up a surface and groundwater monitoring programme.	Environmental Coordinator
				163	Surface and groundwater quality upstream and downstream of the mine site are to be monitored monthly for the first year. Thereafter, depending on the results, monitoring periodicity	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					may change	
				164	Bio-monitoring (SASS5) of the main river draining the mine area is to be conducted twice per year, wet and dry season.	Environmental Coordinator
				165	Results from the monitoring programme are to be recorded and an annual report compiled.	Environmental Coordinator
5.26	Surface Water	Closure	The adit must be sealed during the closure phase using sound engineering principles to prevent decant.	166	Seal adit during the closure phase.	Project Manager Closure and Rehabilitation Manager
Groundwater Management Plan						
Refer to Ref. 2.2; 2.4; 4.9; 3.2; 3.4; 3.5; 3.7; 3.8; 3.9; 3.10; 3.11; 3.12; 3.13; 3.14; 3.22; 3.23; 3.24; 3.25; 3.35; 4.9; 4.17; 4.20; 4.21; 4.23; 4.24; 4.25; 4.26; 4.39; 5.1; 5.2; 5.3; 5.4; 5.6; 5.7; 5.8; 5.9; 5.10; 5.14; 5.24; 5.25; 7.7; 7.8; 8.1; 8.5; 8.9; 10.11; 11.1; 11.3; 11.2; 12.1; 12.8						
6.1	Groundwater	Construction Operation Closure	Groundwater abstraction is a critical issue in area, and water should be sourced from an alternative supply such as from rainwater harvesting.	168	Implement stormwater management plan as per Ref. 3.12 and 3.13.	Project Manager Environmental Coordinator
6.2	Groundwater	Construction Operation Closure	The comprehensive groundwater monitoring programme for water levels and the management thereof will be undertaken.	Refer to Action Reference No. 159 – 165		
6.3	Groundwater	Construction Operation Closure	Should any negative effects groundwater be identified, the surrounding neighbours as well as the relevant authorities (DWA, DEA, MDEDECT) will be notified.	Refer to Action Reference No. 156 and 158		
6.4	Groundwater	Construction Operation Closure	The boreholes onsite will be monitored for quality and quantity on a monthly basis and results supplied to DWA. These results will be communicated to relevant stakeholders biannually.	Refer to Action Reference No. 159 – 165		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
6.5	Groundwater	Construction Operation Closure	Should it be determined by geohydrological studies that the dewatering activities have an impact on the surrounding groundwater users the mine will put a plan in place to supply these users.	Refer to Ref. 5.25 Refer to Action Reference No. 159 – 165		
				Refer to Action Reference No. 148		
				169	Where a potential for pollution exist the design criteria should be revisited and best practices should be implemented.	Environmental Coordinator
				170	Sufficient, clean potable water is to be supplied to the water users impacted by dewatering activities.	Environmental Coordinator
6.6	Biodiversity	Construction Operation	No water should be abstracted from boreholes CBH2D, CBH3S and CBH7S, or any other boreholes, for supplementing the water requirements of the washing plant. Dirty water collected from the plant area or from the de-watering activities should be treated and used for the water requirements of the washing plant.	171	Ensure abstraction from boreholes does not occur.	Project Manager Environmental Coordinator
6.7	Biodiversity	Construction Operation	Water abstracted for de-watering should be returned to the receiving environment under the requirements of the Resource Quality Objectives or if these have not been set then the Target Water Quality Range for the protection of the receiving environment. The requirements of the Reserve Determination must also be taken into consideration in terms of volume and timing of releases. Should it not be possible to discharge the water to the receiving environment it must be re-used in the	172	Develop procedure in line with the Resource Quality Objectives for returning abstracted water to the environment.	Project Manager Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			underground workings			
6.8	Biodiversity	Construction Operation	The guidelines for FEPA[15]s state that FEPAs should be considered as priorities for reserve determination (Driver et al. 2011). It is recommended that a Rapid III Reserve Determination should be completed prior to new abstraction permits being considered for river FEPAs (Driver et al. 2011). A reserve determination is currently underway for the Mhlatuze River, which the Assegaai flows into. A reserve determination should therefore be undertaken for the main systems impacted on by the drawdown cone.	173	Undertake Rapid III Reserve Determination prior to obtaining WULA.	Project Manager Environmental Coordinator
6.9	Biodiversity	Construction Operation	It is uncertain whether the drawdown cone extends into the quaternary catchments V31A and W42A. Further investigations should be undertaken to determine the groundwater impacts within these catchments	174	Determine groundwater impacts on quaternary catchments V31A and W42A.	Environmental Coordinator
6.10	Groundwater	Construction Operation Closure	The mine will only dewater groundwater for safe mining conditions. This water will be utilised in the plant and will be recycled, as far as possible.	Refer to Action Reference No. 159 – 165, 169 and 170		
6.11	Groundwater	Construction Operation Closure	Water that is required for underground mining must be kept in a dedicated sump.	175	Ensure dedicated sump is constructed for the storage of water underground.	Project Manager Environmental Coordinator
				Refer to Action Reference No. 34 – 36, 54 – 66 and 140		

[15] Freshwater Ecosystem Priority Areas

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
6.12	Groundwater	Construction Operation Closure	Ensure that pollution control dams on surface are adequately sized to accommodate excess underground water. The pollution control dams must be lined to prevent seepage to the underlying aquifers.	Refer to Action Reference No. 34 – 36 and 140		
6.13	Groundwater	Closure	If the adit and underground workings need to be dewatered, an application for a water use license will be made to the Department of Water Affairs.	Refer to Action Reference No. 148		
6.14	Groundwater	Construction Operation Closure	Prevent dirty water runoff from leaving the general mining area.	Refer to Action Reference No. 34 – 36, 54 – 66 and 140		
6.15	Groundwater	Construction Operation Closure	The plant area must be paved to prevent contaminated seepage from coal washing areas infiltrating to the underlying aquifers. Coal stockpile areas should also, ideally, be paved, with dirty water collection sumps provided from which contaminated water can be pumped to the return water dam.	Refer to Action Reference No. 13, 14 and 15 and 140		
6.16	Groundwater	Construction Operation Closure	All dirty water from the plant area must be contained in the plant pollution control dams and reused in the mining process.	Refer to Action Reference No. 34 – 36, 54 – 66 and 140		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
6.17	Groundwater	Construction Operation Closure	Source clay (prior to relevant authorisation) lining that will be compacted at the base of the discard dump and line discard dump with an appropriate HDPE liner to minimise infiltration of poor quality water to the underlying aquifers. It is further important that efficient toe drains are installed to remove seepage before it becomes available for infiltration to the aquifers.	Refer to Action Reference No. 137 – 140		
6.18	Groundwater	Construction Operation Closure	The water balance of the operations must be carefully managed to ensure that spilling and over-topping of the dirty water management system does not take place.	176	Draw up a water balance monitoring procedure. The water balance as developed by WSP in the Hydrological Impact Assessment Report (**Appendix C**) should be utilised.	Environmental Coordinator
				177	Update water balance on an annual basis.	Environmental Coordinator
6.19	Groundwater	Closure	The objective at mine closure is to negotiate with, and get the groundwater closure objectives approved by Government during the closure phase of the project, based on the results of the monitoring information obtained during the construction and operational phases of the project	Refer to Action Reference No. 153 – 165		
				178	Negotiate with relevant government authorities to obtain groundwater closure objectives at least five years before closure.	Environmental Coordinator
				179	Closure and rehabilitation plan is to be updated with the outcome of the discussions detailed in Action Item No. 178 and submitted to the relevant authorities for consideration.	Environmental Coordinator
				180	Use the results of the monitoring programme to confirm/ validate the predicted impacts on groundwater availability and quality after closure	Environmental Coordinator
6.20	Groundwater	Closure	Continued groundwater quality and groundwater level monitoring for a period of two years after mining ceases is required to establish post-closure groundwater level and quality	181	Continue water monitoring programme for at least two years post closure as per Action Items 153 – 165.	Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			trends. The monitoring information will be used to update, verify and recalibrate the predictive tools used during the study to meet legal requirements.	182	Use the results of the monitoring programme to confirm/ validate the predicted impacts on groundwater availability and quality after closure.	Environmental Coordinator
				183	The water quality reports are to be utilised to update closure requirements in order to ensure legal compliance.	Environmental Coordinator
6.21	Groundwater	Closure	To minimise the rate at which groundwater quality will deteriorate in the long-term excess, seepage must be removed to a suitable facility on surface or in the underground workings during the operational phase to limit the reaction of pyrite with oxygen and water.	Refer to Action Reference No. 34 – 36, 54 – 66, 140 and 175		
6.22	Groundwater	Closure	During the closure phase, designated underground water storage areas must be identified. In these areas, the coal seam containing pyrite-bearing minerals will be flooded, thus reducing the risk of acidification and deterioration in underground water quality.	184	A registered civil engineer must be appointed during the closure phase to identify and design underground storage water areas. The design must be in line with relevant South African environmental legislation and international best practice.	Project Manager Mine Manager Environmental Coordinator Civil Engineer
6.23	Groundwater	Closure	Where the underground workings intersect water-bearing fractures and faults, these structures must be sealed off to prevent seepage into the underground workings, acidification and deterioration in underground quality.	Refer to Action Reference No. 101 and 102		
6.24	Groundwater	Closure	Present the results to Government on an annual basis to determine compliance with the closure objectives set during the closure	Refer to Action Reference No. 153 – 165 and 179 – 183		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
			phase.			
Air Quality Management Plan						
Refer to Ref. 2.2; 2.4; 4.9; 3.2; 3.4; 3.5; 3.7; 3.8; 3.9; 3.10; 3.11; 3.12; 3.13; 3.14; 3.22; 3.23; 3.24; 3.25; 3.35; 4.9; 4.17; 4.20; 4.21; 4.23; 4.24; 4.25; 4.26; 4.39; 5.1; 5.4; 5.10; 5.15; 5.16; 5.17; 5.18; 5.19; 8.1; 8.5; 8.9; 8.12; 10.11; 10.13; 11.1; 11.2; 11.3; 12.2; 12.1; 12.2; 12.8; 12.12						
7.1	Air Quality	Construction Operation Closure	All activities onsite will comply with the requirements of the National Environmental Management Air Quality Act (No. 39 of 2004).	185	Draw up a Dust Management Plan in line with the requirements of the National Environmental Management Air Quality Act (No. 39 of 2004).	Environmental Coordinator
7.2	Air Quality	Construction Operation	Dust suppression techniques (i.e. wet suppression) will be implemented on unpaved roads and the co-disposal discard dump to limit the dispersion of dust. It is recommended that a chemical binding agent be incorporated to make the dust suppression techniques more efficient.	186	Draw up a Dust Management Plan in consultation with the Project Manager and include dust suppression as part of the contractors' responsibility	Health and Safety Manager Environmental Manager
				187	Include the dust suppression techniques as part of the Dust Management Plan within the construction activities.	Health and Safety Manager Environmental Manager
				188	Monitor and ensure the dust suppression is well managed.	Health and Safety Manager Environmental Manager
				189	Application of dust-a-side or similar chemical suppressant to the mine access road.	Health and Safety Manager Environmental Manager
				190	Application of salts (calcium chloride, magnesium chloride, hydrated lime etc.) to increase the surface moisture content of the roads material.	Health and Safety Manager Environmental Manager
				191	Surface road with paving following three years of operation (within fourth year of operation)	Health and Safety Manager Environmental Manager
				192	Application of surfactants (soaps/ detergents) that decrease the surface tension of water allowing the available moisture to wet more particles per unit volume	Health and Safety Manager Environmental Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
7.3	Air Quality	Construction Operation	Limit the speed of vehicles on unpaved roads to 40 km per hour.	193	Signs will be erected indicating the road speed.	Project Manager Health and Safety Manager Contractor
				194	Haul truck driver training is to be conducted to include speed aspects. Drivers exceeding the speed limit will be fired.	Project Manager Health and Safety Manager Contractor
7.4	Air Quality	Construction Operation	Vehicles carrying any loose aggregates or materials (including saleable coal) should be covered with tarpaulins or sheets at all times.	195	Cover vehicles carrying coal and aggregate with tarpaulins.	Health and Safety Manager Environmental Manager
7.5	Air Quality	Construction Operation	Improve general maintenance, specifically the cleaning of machinery to remove deposited dust as well as the removal of deposited coal fines on the ground surrounding the wash plant and feedbins.	196	Tasking a team to be responsible for the removal of all deposited dust from machinery, enclosures and conveyors within the processing plant and tip area, resulting in less deposited dust available for wind entrainment.	Health and Safety Manager Environmental Manager Project Manager
				197	Deploy a dust sweeper to the processing plant and tip area, capable of collecting all deposited coal fines, reducing the amount of dust available for wind entrainment.	Health and Safety Manager Environmental Manager Project Manager
				198	Erect porous wind breaks at the base of crushers, screens and conveyor transfer points, approximately 1 m high, completely enclosing the base of the structure. This method will ensure deposited coal fines from the activity are not entrained by winds. These areas can then be routinely cleaned.	Health and Safety Manager Environmental Manager Project Manager
7.6	Air Quality	Construction Operation	Limit the generation of dust from stockpiles onsite during construction, operation and closure.	199	Enclose permanent stockpiles with concrete berms (around base of co-disposal discard dump, saleable coal stockpiles, etc.).	Health and Safety Manager Environmental Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
						Project Manager
				200	Enclose temporary stockpiles with a shade cloth windbreak.	Health and Safety Manager Environmental Manager Project Manager
				201	Cover small, temporary stockpiles with a porous sheet (preferably hessian).	Health and Safety Manager Environmental Manager Project Manager
7.7	Air Quality	Construction Operation	Windbreaks in the form of shade cloth screens may be erected at exposed areas.	202	Erect windbreaks at exposed areas within the project footprint.	Health and Safety Manager Environmental Manager Project Manager
7.8	Air Quality	Construction Operation	Enclose conveyors thereby reducing potential dust generation.	203	Enclose conveyor systems. Should this not be possible for low lying/ flat conveyors, it is suggested that these conveyors be fitted with side wind guards.	Health and Safety Manager Environmental Manager Project Manager
7.9	Air Quality	Construction Operation	Conveyor belts should be cleaned on a regular basis through the use of belt scrapers or washers.	204	Utilise belt scrapers or washers monthly to clean conveyor belts.	Health and Safety Manager Environmental Manager Project Manager
				205	Wetting of conveyor belts has also been found to greatly improve airborne dust concentrations around conveyors.	Health and Safety Manager Environmental Manager Project Manager
7.10	Air Quality	Construction	Where excessive dust exists watering down of blasts prior to blasting should be undertaken.	Include in Blasting Procedure.		
				Refer to Action Reference No. 1 – 4		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
7.11	Air Quality	Construction	Blasting will be carried out in accordance with relevant legislation and using only the required amount of explosives. Blasting should occur on calm days to reduce the possibility of dust travel.	Refer to Action Reference No. 1 – 4		
Noise Management Plan						
Refer to Ref. 2.2; 2.4; 4.9; 3.2; 3.4; 3.5; 3.7; 3.8; 3.9; 3.10; 3.26; 3.35; 4.9; 4.11; 4.12; 4.19; 4.23; 4.24; 4.25; 4.26; 7.1; 7.2; 8.1; 8.5; 8.9; 8.12; 10.1; 10.2; 10.3; 10.4; 10.11; 10.13; 11.2; 12.1; 12.2; 12.3; 12.8; 12.12; 12.17						
8.1	Noise	Construction	Construction activities should be limited to daylight hours in noise sensitive areas. Where construction activities are required after dark, notification is to be sent to affected landowners/ farm dwellers.	206	Draw up a noise monitoring procedure that details day and night-time threshold limits. Communication strategy should be included in the programme and reference to a grievance mechanism is to be included. The programme must comply with the requirements of the Occupational Health and Safety Act (No. 85 of 1993) and the Mine Health and Safety Act (No. 29 of 1996).	Health and Safety Manager Environmental Manager Project Manager
				207	Limit construction activities to daylight hours.	Project Manager
8.2	Noise	Construction	Blasting activities are to be controlled to minimise noise, air blast and timing of explosives.	Include in Blasting Procedure.		
8.3	Noise	Construction Operation	Construction and operation activities will comply with the standard requirements of the Occupational Health and Safety Act (No. 85 of 1993) and the Mine Health and Safety Act (No. 29 of 1996).	Refer to Action Reference No. 206		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
8.4	Noise	Construction Operation	All equipment, machinery and vehicles are to be kept in good working order and inspected regularly to ensure integrity and reliability and prevent excessive noise. Vehicles, machinery and equipment generating excessive noise should be fitted with appropriate noise abatement measures.	Refer to Action Reference No. 105 and 106		
8.5	Noise	Construction Operation Closure	Staff working in areas of excessive noise (above 75dBa) should be provided hearing protection equipment (personal protective equipment).	208	Draw up a safety and health document specifying the required safety and health related requirements during the construction, operation and closure phases.	Health and Safety Manager Environmental Manager
				209	Audit and ensure compliance with safety and health requirements.	Health and Safety Manager Environmental Manager
				210	Supply all employees with the necessary PPE.	Health and Safety Manager Environmental Manager
				211	A PPE register should be signed once PPE has been supplied to an employee and the record maintained.	Health and Safety Manager Environmental Manager
8.6	Noise	Operation	The fans of the ventilation shaft must be equipped with silencers.	212	Equip fans on the ventilation shaft with silences if required.	Health and Safety Manager Environmental Manager
8.7	Noise	Construction Operation Closure	Where noise becomes a nuisance management measures will be investigated and implemented to address these.	213	Continue sample monitoring during the mining operations to ensure that it is well within the acceptable levels, where levels are of concern the necessary management measures will be implemented.	Health and Safety Manager Environmental Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
8.8	Noise	Construction Operation	Comprehensive noise monitoring must be undertaken and mitigation measures implemented where required. This will be applied to night conditions.	214	Draw up a comprehensive noise management plan and monitor the aspects of the plan on a regular basis.	Health and Safety Manager Environmental Manager
8.9	Noise	Construction Operation Closure	Screens (i.e. screening methods, enclosed equipment etc.) should be implemented to reduce the noise in areas of concern. These measures must take into account noise generated during night time conditions	215	All screens will be initiated and/ or established prior to the construction activities and must be maintained throughout the life of mine.	Health and Safety Manager Environmental Manager
				216	Should the noise monitoring and stakeholders indicate any noise concern the screens strategy will be revised and updated.	Health and Safety Manager Environmental Manager
8.10	Noise	Construction Operation	Selecting construction equipment with lower sound power levels.	217	Request comparative list from supplier with regards to noise generation at full operation (i.e. vehicles, pumps, etc.).	Project Manager
8.11	Noise	Construction Operation	Reduce noise generation during the operational phase of the project.	218	Enclose conveyor systems	Health and Safety Manager Environmental Manager Project Manager
				219	Enclosing of continuous noise sources (i.e. pumps) within sound absorbing enclosures.	Health and Safety Manager Environmental Manager Project Manager
				220	Installation of acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m² in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective.	Health and Safety Manager Environmental Manager Project Manager
				221	Regular maintenance of equipment to reduce the generation of additional unwanted noise.	Health and Safety Manager Environmental Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
						Project Manager
8.12	Noise	Construction Operation Closure	Vehicles will be equipped with mufflers where practical to reduce the emission of noise.	Refer to Action Reference No. 105 and 106		
Archaeology, Cultural and Heritage Management Plan						
Refer to Ref. 2.2; 2.4; 4.9; 3.2; 3.4; 3.5; 3.7; 3.8; 3.9; 3.10; 3.11; 3.35; 4.39; 5.4; 5.10; 7.7; 10.11; 10.13; 11.1; 11.2; 11.3; 12.1; 12.2; 12.8; 12.17						
9.1	Archaeology, Cultural and Heritage	Construction Operation	Much heritage material, by its very nature, occurs below ground. The contractors should therefore keep in mind that heritage sites might be exposed during the construction work. If a grave, midden or archaeological artefact is uncovered on site, or discovered before the commencement of work, then all work in the immediate vicinity of the graves/ middens will be stopped and the Environmental Coordinator informed of the discovery. If anything is noticed once work has commenced, work in the area should be stopped immediately and the occurrence should immediately be reported to the South African Heritage Resources Agency (SAHRA), or a museum, preferably one at which an archaeologist is available. The archaeologist should then investigate and evaluate the finding.	222	Draw up a procedure on how to address the potential uncovering of a heritage site.	Environmental Manager Project Manager
				223	Contractors should be briefed about the potential of heritage sites in the area and should be provided with a procedure to be followed if such a site is uncovered.	Environmental Manager Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
9.2	Archaeology, Cultural and Heritage	Construction Operation	The removal of a Heritage site must be undertaken by means of controlled excavation of the site by qualified personnel, prior to construction. The necessary permits must be obtained from SAHRA. The removal of a site will be done by a qualified archaeologist and in consultation with the SAHRA.	Refer to Action Reference No. 222 and 223		
9.3	Archaeology, Cultural and Heritage	Construction Operation	The Environmental Coordinator is to be kept informed of all activities relating to heritage.	Refer to Action Reference No. 222 and 223		
9.4	Archaeology, Cultural and Heritage	Construction Operation	Work may only resume once clearance is given in writing by an archaeological consultant.	Refer to Action Reference No. 222 and 223		
9.5	Archaeology, Cultural and Heritage	Construction Operation	Where necessary, heritage sites will be fenced off in order to protect the sites during construction activities.	Refer to Action Reference No. 222 and 223		
9.6	Archaeology, Cultural and Heritage	Construction Operation	All construction activities will remain outside the 1:100 year flood line as these may be the areas where Heritage sites are present due to earlier settlements.	Refer to Action Reference No. 222 and 223		
9.7	Archaeology, Cultural and Heritage	Construction Operation	Any measures applied by an archaeologist, in the sense of excavation and documentation, should, if merited, be published in order to bring this information into the public domain.	Refer to Action Reference No. 222 and 223		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
9.8	Archaeology, Cultural and Heritage	Construction Operation Closure	Sites 1, 2, 3 and 11 (**Appendix H-7**) as detailed in the Heritage Impact Assessment were deemed to have medium cultural, historic or heritage importance and therefore are not to be damaged, defaced or disturbed in any way.	224	Draw up a heritage management plan, indicating the approximate location and importance of the sites identified in the Heritage Impact Assessment (**Appendix H-7**) for employees and contractors to ensure good housekeeping practices.	Environmental Manager Project Manager
				225	Brief employees and contractors as to the heritage management plan and ensure it is enforced.	Environmental Manager Project Manager
9.9	Archaeology, Cultural and Heritage	Construction Operation Closure	Sites 9, 16, 17 and 18 (**Appendix H-7**) as detailed in the Heritage Impact Assessment were deemed to have high cultural, historic or heritage importance and therefore are not to be damaged, defaced or disturbed in any way.	Refer to Action Reference No. 224 and 225		
				226	These sites should be fenced in order to ensure no unauthorised access. As old adit structures are utilised by bats, these are not to be sealed.	Environmental Manager Project Manager
				227	The bushman paintings identified should be documented and drawings of the painting procured.	Environmental Manager Project Manager
Traffic Management Plan						
Refer to Ref. 2.2; 2.4; 3.2; 3.3; 3.4; 3.11; 3.14; 3.25; 3.26; 3.35; 4.15; 4.19; 4.31; 5.4; 7.3; 7.4; 7.5; 7.6; 7.7; 7.8; 8.1; 8.5; 8.9; 8.12; 10.1; 10.2; 10.3; 10.4; 10.11; 12.1; 12.2; 12.8; 12.17						
10.1	Traffic	Construction Operation Closure	Atha will ensure that all contracted logistics companies have professional driver training programmes in place.	228	Generate a driver database ensuring drivers have undergone professional driver training.	Project Manager
				229	Record and maintain driver programmes in place.	Project Manager
				230	Atha will ensure that all contractors, sub-contractors etc. onsite implement driver training programmes.	Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
				231	Drivers are to undergo regular training to ensure they are compliant with all relevant South African legislation pertaining to roads, transportation and traffic.	Project Manager
10.2	Traffic	Construction Operation Closure	Traffic calming and speed control measures will be instigated in consultation with the municipality.	232	Liaise with the local and district municipality to agree on 'traffic calming and speed control' measures.	Health and Safety Manager Environmental Manager
10.3	Traffic	Construction Operation Closure	Ensure safety aspects are implemented to reduce traffic collisions and increase pedestrian safety.	233	Increase the visibility of heavy vehicles by utilising sufficient reflectors and active headlights	Project Manager Health and Safety Manager
				234	Construct speed humps at regular intervals along the unpaved/ paved road leading from the site to Dirkiesdorp.	Project Manager Health and Safety Manager Contractor
				235	Signs will be erected indicating the road speed.	Project Manager Health and Safety Manager Contractor
				236	Traffic notification signs will be erected along the road from the site to Dirkiesdorp. These signs will include speed, stop, high accident zones, water courses, etc.	Project Manager Health and Safety Manager Contractor
				237	Erect lighting at high-risk populated areas.	Project Manager Health and Safety Manager Contractor
				238	Minimise vehicle activity on the road from the site to Dirkiesdorp during peak hours.	Project Manager Health and Safety Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
10.4	Traffic	Construction Operation Closure	Mine management is to respond immediately to any incident involving a mine vehicle.	239	Identify and contract a road accident emergency service contractor.	Project Manager Health and Safety Manager
				240	Implement a road accident early warning system	Project Manager Health and Safety Manager
				241	Draw up a vehicle accident management procedure.	Project Manager Health and Safety Manager
				Refer to Action Reference No. 69 – 72		
10.5	Traffic	Construction Operation Closure	Vehicle speed will be managed and will not exceed 40 km per hour on unpaved, haul and mine roads.	Refer to Action Reference No. 193 and 194		
10.6	Traffic	Construction Operation Closure	Material delivery to site will be scheduled to avoid peak-hour traffic.	242	Ensure material delivery only occurs between 10h00 – 15h00.	Project Manager Mine Manager
10.7	Traffic	Construction Operation Closure	All construction and mine vehicles travelling on public roads will adhered to the relevant traffic laws and regulations.	243	Draw up a vehicle management procedure, including aspects such as traffic laws and regulations, road rules, provincial requirements, travel routes, etc.	Project Manager
10.8	Traffic	Construction Operation Closure	General road rules will be enforced and complied with at all times	Refer to Action Reference No. 243		
10.9	Traffic	Construction Operation	No deviation from approved access routes will be permitted.	Refer to Action Reference No. 13 and 14		
10.10	Traffic	Construction	During fuel/ chemical delivery, the	Refer to Action Reference No. 34 – 36, 54 – 66		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Operation Closure	tanker driver and associated qualified staff are to be present at all times during product off loading	244	An emergency stop will be installed should an accidental spillage occur	Environmental Coordinator Contractor
10.11	Traffic	Construction Operation	Replace the existing dirt road with a designed road pavement structure.	245	Identify sections of the dirt road which require upgrade via the Traffic Impact Assessment Report compiled as part of this project (**Appendix C: Traffic Impact Assessment**) and visual inspection.	Project Manager Health and Safety Manager Contractor (Civil Engineer)
				246	Commission a contractor to undertake the road upgrades (qualified contractor).	Project Manager Health and Safety Manager Contractor (Civil Engineer)
				247	Generate a road monitoring plan to ensure maintenance is undertaken along the route. This will prevent unnecessary large capital expenditure due to road surface degradation.	Project Manager Health and Safety Manager Contractor (Civil Engineer)
				248	Maintain records of upgrades and maintenance (all records).	Health and Safety Manager
10.12	Traffic	Construction Operation	Upgrade pavement capacity of the haul route.	249	Undertake a survey to determine the current state of the pavement capacity.	Project Manager Health and Safety Manager Contractor (Civil Engineer)
				250	Undertake the necessary upgrades via appropriate contractors.	Project Manager Health and Safety Manager Contractor (Civil Engineer)
				251	Monitor to determine maintenance requirements.	Project Manager Health and Safety Manager Contractor (Civil Engineer)
				252	Maintain records of upgrade.	Health and Safety Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
10.13	Traffic	Construction Operation Closure	All vehicles and equipment will be serviced regularly and will be kept in good working order within designated areas.	253	All contractors to supply a pre-planned maintenance plan for vehicles and equipment.	Project Manager
				254	Regular audits or checks to be undertaken on vehicles and equipment.	Construction Manager Health and Safety Manager
10.14	Traffic	Construction Operation Closure	Vehicles will be equipped with mufflers where practical to reduce the emission of noise.	255	Equip vehicles with mufflers where practical.	Contractor Project Manager
10.15	Traffic	Construction Operation Closure	Vehicles should not be overloaded with building material or coal.	Refer to Action Reference No. 71 and 72		
10.16	Traffic	Construction Operation Closure	Vehicles should not be overfilled at the fuelling depots. Re-fuelling must be supervised. Any spillage or accidental discharge of fuel onto the soil or vegetation must be reported to the mine's environmental coordinator and the necessary management measures should be in place for the cleaning of spillages.	Refer to Action Reference No. 54 – 66, 71 and 72		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
Visual Management Plan						
Refer to Ref. 2.2; 2.4; 3.2; 3.3; 3.4; 3.5; 3.6; 3.7; 3.8; 3.9; 3.10; 3.11; 3.12; 3.13; 3.20; 3.21; 3.22; 3.23; 3.24; 3.25; 3.26; 3.35; 4.9; 4.15; 4.19; 4.17; 4.20; 4.21; 4.23; 4.24; 4.25; 4.26; 4.31; 4.29; 4.39; 5.1; 5.2; 5.3; 5.4; 5.6; 5.7; 5.8; 6.19; 6.20; 6.21; 6.22; 6.23; 6.24; 7.1; 7.2; 7.3; 7.4; 7.5; 7.6; 7.7; 7.8; 10.11; 10.13; 11.1; 11.2; 12.1; 12.8; 12.17						
11.1	Visual	Construction Operation	The minimum amount of existing vegetation, borrow material and topsoil should be removed from construction areas. Wherever possible, utilize existing natural vegetation in site design and landscaping. Eradication of vegetation should be done in 'natural manner', avoiding harsh straight lines. An ecological approach to rehabilitation and vegetative screening measures, as opposed a horticultural approach to landscaping, should be adopted. An appropriately qualified person should be consulted for this purpose.	256	Trees or plant screens, where required will be planned as part of the design drawings.	Project Manager Environmental Coordinator
				257	All screens/ vegetation will be initiated and/ or established during the construction activities.	Project Manager Environmental Coordinator
11.2	Visual	Construction Operation Closure	Ensure litter is not generated onsite. Staff and contractors found littering will be punished by fines.	Refer to Action Reference No. 37 – 44		
11.3	Visual	Construction Operation	Relocate staff bus parking and turning area to lower ground that is not as steep in gradient as that initially proposed.	Refer to Action Reference No. 15		
11.4	Visual	Closure	Remove all structures and hard surface road materials in line with closure and rehabilitation plan.	258	Develop and finalise rehabilitation plan ten years prior to closure, with annual reviews thereafter. This process will include stakeholder consultations to establish post-closure land use objectives.	Project Manager Mine Manager Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
11.5	Visual	Closure	Rip compacted surfaces during closure.	Refer to Action Reference No. 17, 27, 28, 30 and 31		
11.6	Visual	Closure	Reshape footprint area to mimic natural topography as far as possible and to facilitate hydrological runoff.	259	Appoint engineer to assist with sloping and shaping of the dump area.	Environmental Coordinator Closure Manager
11.7	Visual	Closure	Rehabilitate transformed footprints area to veld grasses and other indigenous plants, restoring agricultural land uses.	260	Utilise an indigenous seed mix that will assist in rehabilitation of the unvegetated soils.	Environmental Coordinator Closure Manager
Socio-economic Management Plan						
Refer to Ref. 2.2; 2.4; 4.9; 3.25; 3.35; 4.31; 4.29; 4.39; 7.1; 7.2; 7.3; 7.4; 7.5; 7.6; 7.7; 8.1; 8.2; 8.3; 8.4; 8.5; 8.6; 8.7; 8.8; 8.9; 10.11; 10.13; 11.1; 11.3; 11.2						
12.1	Socio-economic	Construction Operation Closure	The mine must capture all public complaints in a grievance mechanism housed within an Environmental Management System.	261	Atha is to implement an EMS system in order to receive the relevant ISO accreditations.	Project Manager Environmental Coordinator Health and Safety Manager
				262	Grievance mechanisms should be appropriate to respond to community concerns around risks and potential adverse impacts of the proposed Yzermyn Underground Coal Mine.	Project Manager Environmental Coordinator Health and Safety Manager
				263	Establish a procedure for receiving, addressing, and recording/ documenting complaints. This procedure should clearly define who can raise complaints, and ensure that the confidentiality of the persons raising the complaint is protected. It should also be easily accessible and understandable to the members of the affected community and should be communicated to the affected community.	Project Manager Environmental Coordinator Health and Safety Manager
				264	A public complaints register is to be available at	Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					the security office at the entrance to the mine.	Environmental Coordinator Health and Safety Manager
				265	Contractor to forward all public complaints to Environmental Coordinator.	Contractor
				266	All issues/ complaints received by stakeholders, authorities, etc. will be documented, and the necessary corrective and preventive actions identified.	Environmental Coordinator Health and Safety Manager
				267	An open channel of communication will be maintained throughout the life of the project to ensure that all issues are raised and addressed.	Project Manager Environmental Coordinator Health and Safety Manager
				268	The Environmental Coordinator is to ensure that the actions have been implemented and that there is a systematic follow-up to ensure their effectiveness.	Environmental Coordinator
				269	Atha should update the management program from time to time, so that it can adequately address the change in the social or environmental risks arising from any change in the client's business or circumstances.	Project Manager Environmental Coordinator Health and Safety Manager
12.2	Socio-economic	Construction	Relocate households within 1 km radius of where the proposed surface infrastructure is to be developed.	Refer to Action Reference No. 261 – 269		
				270	Atha is to consider alternative project design to avoid or minimise physical and/ or economic displacement, while balancing environmental, social and financial costs and benefits.	Project Manager Environmental Coordinator Health and Safety Manager
				271	When displacement cannot be avoided, Atha will offer displaced communities and persons compensation for loss of assets at full replacement cost.	Project Manager Environmental Coordinator Health and Safety Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
				272	Where involuntary resettlement is unavoidable, either as a result of a negotiated settlement or expropriation, a census will be carried out to collect appropriate socio-economic baseline data to identify the persons who will be displaced by the project, determine who will be eligible for compensation and assistance, and discourage ineligible persons, such as opportunistic settlers, from claiming benefits.	Project Manager Environmental Coordinator Health and Safety Manager
				273	Develop a Resettlement Action Plan or Livelihood Restoration Plan.	Project Manager Environmental Coordinator Health and Safety Manager
				274	Establish procedures to monitor and evaluate the implementation of a Resettlement Action Plan or Livelihood Restoration Plan. The plan is to include as a minimum the following: compensation at full replacement cost for land and other assets lost. The plan will be designed to mitigate the negative impacts of displacement; identify development opportunities; develop a resettlement budget and schedule; and establish the entitlements of all categories of affected persons (including host communities). Particular attention will be paid to the needs of the poor and the vulnerable. Atha will document all transactions to acquire land rights, as well as compensation measures and relocation activities.	Project Manager Environmental Coordinator Health and Safety Manager
				275	Implementation of a Resettlement Action Plan or Livelihood Restoration Plan will be considered completed when the adverse impacts of resettlement have been addressed in a manner that is consistent with the relevant plan.	Project Manager Environmental Coordinator Health and Safety Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
				276	Atha will offer persons required to move to another location, displaced persons choices among feasible resettlement options, including adequate replacement housing or cash compensation where appropriate; and provide relocation assistance suited to the needs of each group of displaced persons. New resettlement sites built for displaced persons must offer improved living conditions.	Project Manager Environmental Coordinator Health and Safety Manager
				277	Atha will offer the choice of replacement property of equal or higher value, security of tenure, equivalent or better characteristics, and advantages of location or cash compensation where appropriate.	Project Manager Environmental Coordinator Health and Safety Manager
				278	Atha will offer affected persons a choice of options for adequate housing with security of tenure so that resettlement can occur legally without the risk of forced eviction. Where these displaced persons own and occupy structures, Atha will compensate them for the loss of assets other than land, such as dwellings and other improvements to the land, at full replacement cost.	Project Manager Environmental Coordinator Health and Safety Manager
12.3	Socio-economic	Construction Operation Closure	As far as possible, labour will be sourced from the local, nearby formal (not squatter) settlements, where appropriate skills exist.	279	Encourage contractors to utilise local employment, services and consumables.	Project Manager Environmental Coordinator Contractor
				280	Recruitment rules and requirements will be included in the contractors' contract.	Project Manager Environmental Coordinator Contractor

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
				281	The recruitment philosophy as part of the Social and Labour Plan will be provided to the contractors.	Project Manager Environmental Coordinator Contractor
				282	Atha will ensure that a "locals first" policy is implemented.	Project Manager Environmental Coordinator Contractor
12.4	Socio-economic	Construction Operation Closure	Non-core activities related to the construction phase of the project will be identified and out-sourced to local service providers, where the skills exist.	Refer to Action Reference No. 279 – 282		
12.5	Socio-economic	Construction Operation Closure	Contractors must make all efforts to obtain services and consumables from local entrepreneurs.	283	Atha will ensure that contractors have a “skills development" policy and that the policy is adequately implemented.	Project Manager Environmental Coordinator Mine Manager
				284	Atha will ensure that contractors having a local SMME policy and that the policy is adequately implemented.	Project Manager Environmental Coordinator Mine Manager
				285	Atha will ensure that contractors have a regional as well as local focus to obtain services, consumables and labourers.	Project Manager Environmental Coordinator Mine Manager
12.6	Socio-economic	Construction Operation Closure	No recruitment on site will be allowed.	286	Recruitment rules and requirements will be included in the contractors’ site rules.	Project Manager Environmental Coordinator Mine Manager Contractor
12.7	Socio-economic	Construction	The mine will comply with their Social	287	Audit and ensure compliance with the Social	Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Operation Closure	and Labour Plan.		and Labour Plan.	Environmental Coordinator
12.8	Socio-economic	Construction Operation Closure	Contractors must comply with the standards of the mine and Atha Group as a whole.	288	Include Atha's employment and community standards in the contract documentation.	Project Manager Environmental Coordinator Mine Manager Contractor
12.9	Socio-economic	Construction Operation Closure	No informal settlements will be allowed on mine property.	289	A joint strategy with the relevant landowners is to be developed to prevent squatting on properties adjacent to the surface operations of the mine.	Project Manager Environmental Coordinator Mine Manager Contractor
12.10	Socio-economic	Construction Operation Closure	No accommodation will be permitted onsite.	Refer to Action Reference No. 279 – 282		
12.11	Socio-economic	Construction Operation Closure	Atha will work with the Pixley ka Seme and Khondo local municipalities to fit into the spatial development framework and housing strategies of the area.	270	On-going consultation in terms of a housing strategy between the mine and the Pixley ka Seme and Khondo local municipalities will be undertaken. Atha will provide its employees with an adequate housing allowance to enable them to obtain lodgings in nearby urban areas. Alternatively, include requirements for the provision of acceptable formal housing in nearby settlements, in the contract specifications.	Project Manager Environmental Coordinator Mine Manager Contractor
				271	Local government will be consulted with regards	Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					to their resource allocation to ensure that local residents are not adversely impacted by the influx of residents and contractors.	Environmental Coordinator Mine Manager Contractor
12.12	Socio-economic	Construction Operation Closure	PPE must be made available to all employees and contractors, during construction, operation and closure.	Refer to Action Reference No. 208 – 211		
12.13	Socio-economic	Construction Operation Closure	Condoms will be made available to all staff and workers.	272	Draw up a safety and health plan specifying the required safety related requirements during the construction phase.	Project Manager Environmental Coordinator Mine Manager Contractor
				273	Audit and ensure compliance with safety requirements.	Project Manager Environmental Coordinator Mine Manager Contractor
12.14	Socio-economic	Construction Operation Closure	Strict penalties will be built into tenders to deal with issues such as petty crime, stock theft, fence cutting, trespassing, the closing of farm gates etc.	274	Brief the employees and contractors on the rules and responsibilities as part of their appointment.	Project Manager Environmental Coordinator Mine Manager Contractor
				275	Trespassing on neighbouring properties will be forbidden and measures to incorporate transgression into a disciplinary code will be	Project Manager Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					taken and explained to the workforce.	Mine Manager Contractor
				Refer to Action Reference No. 71 and 72		
12.15	Socio-economic	Construction Operation Closure	The mine will routinely inspect the boundary fences around the mine.	Refer to Action Reference No. 127 – 130		
12.16	Socio-economic	Construction Operation Closure	The mine will ensure that an HIV/ AIDS strategy is in place and effectively implemented at the mine.	276	Draw-up an HIV/ AIDS strategy.	Project Manager Environmental Coordinator Health and Safety Manager
				277	Brief employees and contractors on the HIV/ AIDS strategy.	Project Manager Environmental Coordinator Health and Safety Manager
				278	Atha will provide free condoms to all workers. Condoms should be located in the bathrooms on the construction site.	Project Manager Environmental Coordinator Health and Safety Manager
				279	The numbers of condoms made available will be calculated using the numbers of employees as a basis.	Project Manager Environmental Coordinator Health and Safety Manager
				280	A voluntary counselling and testing program will be introduced during the construction phase and continued during operations.	Project Manager Environmental Coordinator Health and Safety Manager
				281	Atha will undertake a HIV/ AIDS prevalence survey amongst all workers on a regular basis.	Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					It will involve a voluntary test available to 100% of the workforce. The results of the survey will help to determine the HIV/ AIDS strategy. When and if statistically representative results are obtained then the results of the survey will be made available to management and workers at the same time. Results will be presented as statistical returns that ensure confidentiality.	Environmental Coordinator Health and Safety Manager
12.17	Socio-economic	Construction Operation Closure	The mine will ensure that a transportation system is implemented from the potential housing areas to the mine to reduce the potential impact on the roads.	282	Construction Manager will be responsible for managing transportation of contractors to and from the mine during the construction phase	Project Manager Environmental Coordinator Health and Safety Manager
12.18	Socio-economic	Construction Operation Closure	A grievance mechanism will be put in place and all employees and project-affected parties will be made aware of its existence and the procedures contained therein.	283	Atha will establish a grievance mechanism that will specify procedures for lodging and registering complaints – by external parties, employees and contractors – and for responses to them including time limits for responding and addressing the complaint, and recording of same. The grievance mechanism will be applicable to all project phases and any areas of operation or impact	Project Manager Environmental Coordinator Health and Safety Manager
				284	The Uys, Greyling and Malan families will be visited prior to construction, introduced to the key role players such as Contractor and Client Representative, and given information about disruptive activities (such as the application of animal warning sirens, blasting sirens) and the grievance mechanism.	Project Manager Environmental Coordinator Mine Manager
				285	Homesteads within a 5 km radius of the mine will be visited prior to construction, introduced to the key role players such as Contractor and Client Representative, and given information	Project Manager Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					about disruptive activities (such as the application of animal warning sirens, blasting sirens) and the grievance mechanism.	Mine Manager
12.19	Socio-economic	Construction Operation Closure	Public awareness programmes will be developed by the mine with the community to identify areas of particular risk and approaches to reduce risk. This will include awareness programmes at schools along roads leading to the site to advise children of the dangers of traffic as well as other frequent users.	286	Draw up a public awareness programme that identifies areas of risk from a community health and safety perspective.	Project Manager Environmental Coordinator Mine Manager
12.20	Socio-economic	Construction Operation Closure	Principles of equality, BBEEE, gender equality and non-discrimination will be implemented.	Refer to Action Reference No. 279 – 282		
12.21	Socio-economic	Construction Operation Closure	The contractor is to ensure that all staff onsite will be in possession of a South African identity document, or suitable valid work permit from the Department of Home Affairs.	Refer to Action Reference No. 279 – 282		
12.22	Socio-economic	Construction Operation Closure	All contact with external stakeholders shall be courteous at all times, and the rights of the stakeholders should be respected at all times.	Refer to Action Reference No. 261 – 269		
12.23	Socio-economic	Construction Operation Closure	All visitors to site, contractors and employees will be inducted in site health and safety procedures.	As per **Table 11-1.**		
12.24	Socio-economic	Construction Operation	Atha will provide for security staff and ensure that the contracted security company supports local community	287	Ensure security is provided for all staff and contractors and that the security company supports local policing forums.	Project Manager Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Closure	policing forums.			Mine Manager
12.25	Socio-economic	Construction Operation Closure	Access of all construction and material delivery vehicles will be controlled through one security entrance.	288	Ensure one access point is installed within the security fence around the site.	Project Manager Environmental Coordinator Mine Manager
12.26	Socio-economic	Construction Operation Closure	Areas for the storage of fuels and other flammable materials will comply with standard fire safety regulations and may require approval from the Municipal Fire Department.	Refer to Action Reference No. 54 – 66		
12.27	Socio-economic	Construction Closure	Adequate sanitary facilities and ablutions will be provided for construction staff, with a recommended maximum ratio of 15 workers to one ablution facility.	289	Atha will ensure that an adequate number of ablution facilities are available. The ablution facilities are to be cleaned on a daily basis.	Project Manager Environmental Coordinator Health and Safety Manager
12.28	Socio-economic	Construction Operation Closure	Sufficient drinking water will be made available to all contractors, sub-contractors and onsite staff. The drinking water container will be strategically located and will be signposted as potable water.	290	Supply adequate drinking water to employees and contractors and ensure the drinking areas are adequately signposted.	Project Manager Environmental Coordinator Health and Safety Manager
12.29	Socio-economic	Construction Operation Closure	Demarcated areas for food preparation should be designated and provided with adequate washing, seating and general refuse receptacles, Refuse bins should be removed from food preparation areas at least three times a week, or as directed by health regulations.	291	Demarcate designated areas for the preparation of food.	Project Manager Environmental Coordinator Health and Safety Manager
12.30	Socio-economic	Construction Operation	The site is to have 24 hour security.	Refer to Action Reference No. 284		

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Closure				
12.31	Socio-economic	Construction Operation Closure	Unauthorised social activities are to be prohibited, which include, but are not limited to, consumption of or illegal selling of alcohol, drug utilisation or selling, and onsite prostitution.	289	Draw up a social awareness plan indicating unauthorised social activities.	Project Manager Environmental Coordinator Health and Safety Manager
12.32	Socio-economic	Construction Operation Closure	Driving under the influence of alcohol is prohibited.	Refer to Action Reference No. 287		
12.33	Socio-economic	Construction Operation Closure	No firearms are to be permitted onsite.	290	A gun safe is to be installed at the main security office at the entrance.	Project Manager Environmental Coordinator Health and Safety Manager
12.34	Socio-economic	Construction Operation Closure	Activities undertaken onsite are to be in accordance with an Occupational Health and Safety Plan, Community Security Plan as well as the Emergency Preparedness and Response Plan.	Refer to Action Reference No. 206		
				291	Brief contractors and employees as to the relevant plans in place at the mine.	Project Manager Environmental Coordinator Health and Safety Manager Safety Officer
				292	Atha and the appointed contractor will implement safety measures, work procedures and first aid measures as depicted in the Occupational Health and Safety Plan.	Project Manager Environmental Coordinator Health and Safety Manager Safety Officer
12.35	Socio-economic	Construction	A Safety Officer will be appointed by Atha.	293	Appoint Safety Officer	Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Operation Closure				Environmental Coordinator Safety Officer
12.36	Socio-economic	Construction Operation Closure	Records of health and safety incidents, as well as mitigation measures will be maintained. Any health and safety incidents should be reported to the Safety Officer, Environmental Coordinator or Project Manager as soon as possible.	294	Draw up a health and safety incidents programme. The programme should make note of first aid facilities onsite.	Environmental Coordinator Health and Safety Manager Safety Officer
12.37	Socio-economic	Construction Operation Closure	First aid facilities will be available onsite.	Refer to Action Reference No. 294		
12.38	Socio-economic	Construction Operation Closure	SABS standards and specifications governing dangerous and high risk processes will be applied.	Refer to Action Reference No. 206		
12.39	Socio-economic	Construction Operation Closure	High risk areas, including but not limited to scaffolding, heights and open excavations will be demarcated and clearly marked and include, where relevant, adequate warning signs.	Refer to Action Reference No. 206		
12.40	Socio-economic	Construction Operation Closure	Emergency numbers for the police, fire department, clinic and relevant responsible staff will be made available in conspicuous locations.	295	Ensure relevant contact details are available at a number of conspicuous locations.	Project Manager Environmental Coordinator
12.41	Socio-economic	Construction Operation	All warning signs will be made available in English and applicable local languages.	296	Warning signs to be translated into Afrikaans and Zulu.	Project Manager Environmental Coordinator

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
		Closure				
12.42	Socio-economic	Construction Operation Closure	All neighbouring residents identified in the ESIA will be notified of high-risk activities (e.g. blasting).	Refer to Action Reference No. 261 – 269		
12.43	Socio-economic	Construction Operation Closure	A workplace HIV prevention and awareness programme will be developed and implemented.	297	Draw up contractor's workplace policy and management plans relating to HIV and Gender.	Health and Safety Manager Contractor
				298	Draw up operator's workplace policy and management plans relating to HIV and Gender.	Health and Safety Manager Mine Manager
				299	Promote VCT, and include public testing of senior personnel.	Health and Safety Manager
				300	Identify and train peer educators in the community. The focus needs to move beyond HIV awareness to more fundamental behaviour change outcomes, based on agreed targets and key performance indicators.	Health and Safety Manager
				301	Provide free antiretrovirals (ARVs) to staff	Health and Safety Manager Mine Manager
				302	Recruit locally wherever possible.	Health and Safety Manager Contractor
				303	The use of health services and products will be promoted.	Health and Safety Manager
				304	Employees will be given time off to attend HIV training and VCT programmes	Health and Safety Manager Mine Manager
				305	All necessary measures to ensure that job seekers do not flock to the project site or local villages looking for work will be undertaken. The	Health and Safety Manager Project Manager

Ref	Environment	Phase	Mitigation Measure	Action Ref. No.	Action Required	Responsible Person
					following strategies will be employed: ▪ No casual labourers will be hired 'at the gate'; ▪ Hiring will only take place through established employment agencies; ▪ All job interviews will be conducted at nearby towns, not on site; ▪ Advertising campaigns will be conducted to inform people about the employment policies and procedures; and ▪ Local government and police will be consulted to ensure that squatter camps do not start at the site gate or in nearby villages.	Contractor
12.44	Socio-economic	Construction Operation Closure	A transportation route HIV prevention and awareness programme will be developed and monitored.	306	The workplace programme for HIV will be extended include all contractors, suppliers, transportation companies and local communities.	Health and Safety Manager Contractor
				307	Suppliers who have in-house HIV programmes and policies in place will be selected.	Health and Safety Manager Contractor
				308	Tailored BCC materials, such as mirror hanger messages and bumper stickers, will be developed.	Health and Safety Manager
				309	Condoms will be include in the road safety kit.	Health and Safety Manager Contractor
				310	HIV awareness campaigns will target main transportation hubs (e.g. loading/ offloading points and transporter rest stops).	Health and Safety Manager Contractor

Table 11-3 represents the primary cost estimates required to implement the mitigation measures discussed above. Note: costing per mitigation item (line item) was noted to be broad and a number of mitigation measures will be included in the responsible person's job description or included into tender documentation for contractors which could not be costed. Furthermore, internal induction type training cannot be costed as this will be for Atha's capital and ongoing cost.

Table 11-3: Estimated Mitigation Cost Estimate

Particulars	Estimated Mitigation Costings (ZAR)*		
	Min.	Max.	Avg (approx)
A – One-time Expenses			
Design and compilation of surface layout design			100,000.00
Installation of light fittings that provide precisely directed illumination thereby reducing light spillage	650,000.00	1,000,000.00	825,000.00
Planting of row of screening trees along north, east and western toe of co-disposal discard dump	125,000.00	200,000.00	162,500.00
Ongoing rehabilitation of topsoil and areas prone to erosion (Assume surface area = 86 ha)			5,710,400.00
Waste management plan (including design of waste storage areas): Construction of waste storage areas	12,000,000.00	15,000,000.00	13,500,000.00
Rehabilitation of existing alien-invaded wetlands (assume 34 ha. Wetland within the surface infrastructure area of 86 ha.)	2,720,000.00	3,400,000.00	3,060,000.00
Groundwater impacts on quaternary catchments V31A and W42A	2,500,000.00	5,000,000.00	3,750,000.00
Design and construction of co-disposal discard dump			12,250,000.00
Installation of water treatment plant			5,341,000.00
Construction of PCD (Area per surface infrastructure plan= 2.82 ha=28,200 m2)			6,204,000.00
Erection of relevant signboards instructing employees of sensitivities associated with the site	10,000.00	15,000.00	12,500.00
Compilation of surface water and groundwater management	350,000.00	450,000.00	400,000.00
Construction of infrastructure associated with stormwater management			2,000,000.00
Develop biodiversity action plan (BAP)	85,000.00	150,000.00	117,500.00
Upgrade of unpaved road in fourth year to tarred surface			30,000,000.00
Total of One Time Expenses (Capital)			**83,547,900.00**

Particulars	Estimated Mitigation Costings (ZAR)*		
	Min.	Max.	Avg (approx)
B – Revenue Expense Per Year			
Monitor surface and groundwater management plan			100,000.00
Erosion control (construction of erosion control measures)	500,000.00	750,000.00	625,000.00
Erosion control measures (annual estimate)	400,000.00	480,000.00	440,000.00
Maintenance of stormwater management infrastructure			500,000.00
Expenses towards waste management through contractor (collection, transportation and disposal of waste)			2,400,000.00
Classification of waste according to draft norms and standards(R 2,000.00 per sample for 50 samples)			100,000.00
Appointment of contractor to collect, transport and dispose of sewage (R 5,500.00 per hour to collect and R 3,500.00 per tank to load)			200,000.00
Conduct annual monitoring of Present Ecological State (PES)	150,000.00	250,000.00	200,000.00
Monitoring riparian integrity of Assegaai River and associated tributaries	200,000.00	500,000.00	350,000.00
Dust control measures per year (For construction and 3 years operation period, the total expenses towards dust control is estimated to be R 550,000.00)	1,666,667.00	2,000,000.00	1,833,333.00
Annual noise monitoring	120,000.00	180,000.00	150,000.00
Total of (REVENUE) Expenses per year			**6,898,333.00**

*Please note: These are tentative costs that will be firmed up in due course. Furthermore, costs less than R 100,000.00 have not been detailed in this table

12 Environmental and Social Monitoring Management Programme

Atha will establish, implement and maintain a procedure(s) to monitor and measure, on a regular basis, the key characteristics of the operations that may have a significant environmental impact. The procedure(s) shall include the documenting of information to monitor performance, applicable operational controls and conformity with the operations environmental objectives and targets (ESMP).

Atha will ensure that all instruments and devices used for the measurement or monitoring are calibrated and appropriately operated and maintained. Calibration records must be kept on site or in close proximity to the equipment for ease of availability.

Atha will establish, implement and maintain a procedure(s) for periodically evaluating compliance with applicable legal requirements at the operation. Atha will also evaluate compliance with other requirements to which it subscribes. Records of findings, observations, etc. of the evaluation shall be maintained.

Atha will establish, implement and maintain a procedure(s) for dealing with actual and potential non-conformities identified and will develop a procedure(s) for taking corrective and preventive action. The procedure(s) shall define requirements for the following:

- Identifying and correcting non-conformities and taking actions to mitigate their environmental impact;
- Investigating non-conformities, determining their causes and taking actions in order to avoid their recurrence;
- Evaluating the need for actions to prevent non-conformities and implementing appropriate actions designed to avoid their occurrence;
- Recording the results of corrective actions and preventive actions undertaken; and
- Reviewing the effectiveness of corrective actions and preventive actions undertaken.

Atha will ensure that any necessary changes are made and adequately documented and recorded. Atha will establish and maintain records as necessary to demonstrate conformity to the requirements of the ESMP and relevant procedures.

Atha will also ensure that annual internal audits of the conditions within the ESMP are conducted at planned intervals. Audit procedures will be established, implemented and maintained that address the responsibilities and requirements for planning and conducting audits, reporting results and retaining associated reports. The procedure(s) will also address the determination of the audit criteria, scope, frequency and methods. Internal auditors will ensure objectivity of the audit process.

13 Environmental, Social and Heritage Goals and Objectives

Regulation 51 (a) of the MPRDA Regulations requires that the ESMP describe the goals and objectives specific for:

- The management of identified environmental impacts;
- The cultural and heritage aspects; and
- The socio-economic conditions as identified in the Social and Labour Plan (SLP).

13.1 Objectives and Goals relating to Environmental Impacts

13.1.1 Objectives

Atha intends to minimise the impacts of the proposed Yzermyn Underground Coal Mine on the environment as far as possible.

13.1.2 Goals

The environmental related goals are as follows:

- Implement the management and mitigation measures stated in the ESMP;
- Develop and implement monitoring programmes stated in the ESMP;
- Ensure compliance with all relevant environmental legislation;
- Obtain the relevant licences and permits; and
- Comply with relevant licence and permit conditions.

13.2 Objectives and Goals relating to Cultural and Heritage Aspects

13.2.1 Objectives

Atha intends to ensure that the integrity of the heritage and cultural resources associated with the site remain intact as far as practically possible.

13.2.2 Goals

The cultural and heritage related goals are as follows:

- Ensure that the management measures proposed in the ESMP, which relate to heritage resources, are implemented.
- Ensure compliance with the National Heritage Resources Act (No. 25 of 1999).

13.3 Objectives and Goals Relating to Socio-Economic Conditions

13.3.1 Objectives

The objectives relating to the socio-economic conditions are as per the draft SLP and are summarised below:

- Promote economic growth and mineral and petroleum resources development in the Republic;
- Promote employment and advance the social and economic welfare of all South Africans; and
- Ensure that the Yzermyn Underground Coal Mine contributes towards the socio-economic development of the area of operation as well as the areas from which the majority of the workforce is sourced.

13.3.2 Goals

The goals to accomplish the above objectives are:

- To provide skills training opportunities to mine workers during their employment in order to improve their income earning capacity after mine closure;
- To promote employment and skills development in the local communities and major labour sending areas;
- To ensure substantially higher levels of inclusiveness and advancement of historically disadvantaged South African's, including women, in the mining industry; and
- To contribute to the development of a pool of skilled South African workers in support of National Economic and Skills Development strategies.

14 Environmental and Social Awareness Plan

The MPRDA requires that, under regulation 55 (b)(vi), an environmental awareness plan is included as part of the EMPR submission. This Chapter details a framework outlining procedures essential for effective education of employees, contractors and their sub-contractors on social and environmental matters and associated responsibilities. The plan provides an outline to ensure that systems are in place to ensure that those working for the proposed Yzermyn Underground Coal Mine project are aware of their social and environmental commitments.

Atha will provide appropriate resources to facilitate social and environmental awareness training during the construction, operational and decommissioning and closure phases of the proposed Yzermyn Underground Coal Mine.

Atha will require that all managers associated with the proposed project adhere to the mitigation/ management measures detailed in the ESMP (**Section 11**) and identify, evaluate, and minimize risks to the social, physical and biophysical environments. This will be implemented by educating employees in social and environmental matters and responsibilities relating to performance of their assigned tasks. Furthermore, employees will be entrusted to maintain the necessary level of environmental performance for their activities. Contractors, and their associated sub-contractors, will also need to demonstrate compliance to mitigation/ management measures included in the ESMP.

The following methodology will be used to implement and ensure environmental and social awareness:

- Internal Communication;
- Standard Meetings;
- Environmental and Social Talk Topics;
- External Communication;
- Complaints; and
- Training.

14.1 Internal Communication

Internal communication of environmental and social issues to ensure environmental awareness will be achieved by the following means:

- Meetings;
- Memos;
- Notice boards;
- Briefs;
- Reports;
- Monthly themes;
- Daily operational bulletins;
- Newsletters;
- E-mail;
- Telephone; and
- Induction training.

14.2 Standard Meetings

The following standard meetings will be held at specific times to ensure that environmental and social awareness; potential problems, complaints etc. are heard and addressed proactively:

- Safety, Health and Environmental Meetings will be held monthly by the Senior Management;
- Safety, Health and Environmental Meetings will be held daily, weekly and monthly by the relevant operations personnel, environmental and social issues will form part of the agenda;
- Communication between all personnel and Senior Management will be facilitated through the appropriate reporting lines, or by using complaint and incident forms.

14.3 Environmental and Social Talk Topics

Monthly environmental and social talk topics will be compiled and distributed to relevant personnel and will be displayed on appropriate notice boards.

As a minimum, the following topics must be covered:

- Water Quality;
- Water Use and Consumption;
- Air Quality;
- Power Consumption and Energy Efficiency;
- Waste Management;
- Fauna and Flora;
- Emergency Procedures;
- Incidents Reporting;
- Systems;
- Noise;
- Heritage Impacts;
- Landowner Etiquette;
- Speed Limits;
- Health Risks (such as HIV/ Aids); and
- General Awareness (e.g. World Environment Day, National Arbour Day)

14.4 External Communication

An environmental and social forum will be developed and bi-annual meetings hosted to keep stakeholders informed of significant environmental and social aspects associated with the proposed Yzermyn Underground Coal Mine project. This forum will provide stakeholders with the opportunity to raise environmental and social issues and concerns. Records will be kept of all issues raised.

14.5 General Communications

Any environmental and social issues will be communicated to and from Head Office (in terms of Divisional and Group Communication) by means of the following:

- Fax or E-mail;
- News briefs from Head office;
- Formal meetings and workshops;
- Quarterly environmental reports; and
- Annual environmental reports.

Communication to the community, government, landowners, neighbouring farmers, environmental Groups, NGOs and other stakeholders will be communicated to ensure environmental and social awareness by means of the following:

- Fax or E-mail;
- Postal system;
- Telephone;
- Formal meetings; and
- Open days.

14.6 Complaints

All environmental and social related complaints and queries will be captured on a complaint form and directed to the Environmental Coordinator for attention. The Environmental Coordinator will record all complaints in the complaints register. The Environmental Coordinator will be responsible for capturing the complaints and developing appropriate action plans.

The Environmental Coordinator will ensure that the following information is recorded for all complaints:

- Nature of the complaint.
- Causes of the complaint.
- Party/ parties responsible for causing the complaint.
- Immediate actions undertaken to stop/ reduce/ contain the causes of the complaint.
- Additional corrective or remedial action taken and/ or to be taken to address and to prevent reoccurrence of the complaint.
- Timeframes and the parties responsible for the implementation of the corrective or remedial actions.
- Procedures to be undertaken and/ or penalties to be applied if corrective or remedial actions are not implemented.
- Copies of all correspondence received regarding the complaint.

14.7 Training

It is important to ensure that all personnel, contractors and their sub-contractors have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harm. As a minimum environmental training must include the following:

- Employees must have a basic understanding of the key environmental features of the site and the surrounding environment;

- Employees will be thoroughly familiar with the requirements of the ESMP and the environmental specifications as they apply to the Yzermyn Underground Coal Mine.
- Employees must undergo training for the operation and maintenance activities associated with Yzermyn Underground Coal Mine and have a basic knowledge of the potential environmental impacts that could occur and how they can be minimised and mitigated.
- Awareness of any other environmental matters, which are deemed to be necessary by the Environmental Coordinator.
- Training must include the environment, health and safety as well as basic HIV/ AIDS education.

The following facets to training form part of the Environmental and Social Awareness Plan:

14.7.1 Induction

Environmental and social awareness training will be given at induction when personnel join the company and/ or return from leave. Induction training will also be given to visitors entering the site.

14.7.2 Job Specific Training

Job specific training programs will be developed as and when required. The programs will be based on the significant environmental and social aspects/ impacts that are identified during regular audits and site inspections.

Supervisory staff will be equipped with the necessary knowledge and information to guide their employees on environmental and social aspects applicable to performing a specific task.

14.7.3 Competency Training

The Environmental Coordinator will be responsible for the environmental and social competency and awareness training of Middle Management and supervisors. This training will be performed both on a one-on-one basis and through workshops and presentations.

Competence and the effectiveness of training and development initiatives will be determined through the following methods:

- Trend analysis of incidents reported; and
- Analysis of work areas during visits and audits.

The process to declare competency of personnel is documented in the ISO9001:2000 procedure.

This plan will be amended periodically in light of operational changes, learning experienced during its implementation and other activities that can affect the risk profiles.

14.7.4 Training Records

Training can be done either in a written or verbal format but will be in an appropriate format for the receiving audience. Persons having received training must indicate in writing that they have indeed attended a training session and have been notified in detail of the contents and requirements of the ESMP. The attendance registers must be kept on file.

15 Environmental and Social Emergency Response Plan

This Chapter details a framework outlining procedures essential for effectively containing emergency situations for the proposed Yzermyn Underground Coal Mine project. The plan has been developed as per the requirements the MPRDA Regulations, Section 51(b) (iii), that require the mine to implement procedures for environmental related emergencies and remediation, and provides an outline to ensure that systems are in place to react and appropriately manage unwanted outcomes. Atha will use this framework for mitigating impacts that may be unforeseen or unidentified until construction or operation is underway, and will develop a detailed operational plan based on identified hazards.

Atha will provide appropriate resources to respond to process upset, accidental, and emergency situations for operations and activities during construction, operation and decommissioning and closure phases. The procedures will include plans for addressing training, resources, responsibilities, communication and all other aspects required to effectively respond to emergencies associated with their respective hazards.

All operations/ activities associated with the proposed Yzermyn Underground Coal Mine project will require site-specific emergency response plans to mitigate impacts, which meet or exceed all applicable regulations.

The objectives of this plan are as follows:

- Protect the communities and the environment through the development of emergency response strategies and capabilities;
- Set out the framework for hazard identification in order to define procedures for response to the situations including the development of contingency measures;
- Structure a process for rapid and efficient response to and manage emergency situations during the construction, operational and decommissioning and closure phases of the proposed Yzermyn Underground Coal Mine project; and
- Assign responsibilities for responding to emergency situations.

15.1 Roles and Responsibilities

With respect to this plan, Atha has the responsibility to:

- Provide emergency response services and to structure and coordinate emergency response procedures for the proposed Yzermyn Underground Coal Mine project;
- Ensure that specific emergency responsibilities allocated to them are organised and undertaken; and
- Ensure that employees and contractor third parties are trained and aware of all required emergency procedures.

15.2 Emergency Communications and Coordination Plan

In an emergency situation where there is an immediate threat to communities, personnel or the environment, the Mine Manager will be notified immediately. The General Manager will dispatch the Emergency Response Coordinator who will determine the appropriate plan of action depending on the severity of the emergency, the people affected, and the need to evacuate. I

If there is a developing emergency or unusual situation, where an emergency is not imminent, but could occur if no action is taken, the Mine Manager (or if the Mine Manager is absent the Environmental Manager) is to be informed immediately. Once the emergency or unusual situation has been managed, the correct incident/ near miss must be reported to the General Manager.

If an emergency situation poses a direct threat to communities in the area, the Environmental Coordinator and/ or Community Liaison Officer will advise persons in the vicinity of the emergency to evacuate due to the potential risk. The appropriate government authorities will immediately be notified of such an emergency evacuation. The Emergency Response Coordinator will be tasked with responding to the potential risk. Should the emergency situation be such that it can be managed by Atha, equipment and personnel will be deployed to the maximum extent necessary, so as to prevent/ minimise potential risks.

15.3 Response to Incidents

An incident is any occurrence that has caused, or has the potential to cause, a negative impact on people, the environment or property (or a combination thereof). It also includes any significant departure from standard operating procedures. The reporting and investigation of all potential and actual incidents that could have a detrimental impact on human health, the natural environment or property is required so that remedial and preventive steps can be taken to reduce the potential or actual impacts because of all such incidents.

The actions resulting from any formal or informal investigations will be used to update the ESMP.

15.4 Budget for Emergency Response

Costs for emergency response and management will be included in the capital expenditure budget for the construction phase and operational budget for the operational and decommissioning phases of the proposed project.

15.5 Verification

An environmental emergency response system will be developed for the execution of emergency drills that will include the following, *inter alia*:

- Fire Drills;
- Bomb Threat Drills;
- Armed Riot Drills;
- Emergency Evacuation Drills; and
- Medical and Environmental Drills.

Reporting and monitoring requirements for the plan will include:

- Monthly inspections and audits;
- Quarterly reporting of accidents/ incidents;
- Reporting at the time of the incident and monthly spill reporting developed by the Environmental and Quality, Health and Safety departments;
- Bi-annual emergency response drills; and
- Annual reporting on training.

Emergency response drills and reporting will be maintained by the Mine Manager and will provide information regarding required revisions to training or the emergency response actions. Each incident reported will be reviewed and investigated upon occurring. Actions will be identified where possible to improve the site's overall response to emergencies.

Updates/ revisions that are necessary to protect worker or community health and safety will be implemented immediately after approval by the General Manager. On a bi-annual basis, Key Performance Indicators (KPIs) will be compared against past-performance and analysed for trends to determine if there are areas for improvement. Changes because of the trend analysis and identified areas for improvement will be implemented following the project's change management system as required.

This plan will be amended periodically in light of operational changes, learning experienced during its implementation and other activities that can affect the risk profiles.

16 Closure and Rehabilitation Plan

This closure and rehabilitation plan applies to the rehabilitation, decommissioning and closure of the mine workings, mine infrastructure and residue deposits. Recommendations and commitments relating to closure have been included based on the Project Plan based on information available at this time. It expected that the closure and rehabilitation plan will be updated to reflect the final project design and will be reviewed and revised as the mine develops and issues are identified and mitigated in the course of operations. This plan has been developed as per the requirements of Section 51 of the MPRDA Regulations (GNR.26275), and describes the manner in which environmental rehabilitation will be implemented during the various phases of the proposed project.

It is envisaged that mining activities will eventually cease when the finite coal resource is exhausted and the life of mine is estimated to be currently 15 years, depending on rates of production and future exploration drilling within the prospecting right area. However, activities may cease prematurely when costs associated with mining become unprofitable. Premature closure or temporary mothballing thus needs to be considered within the closure planning and flexibility needs to be provided for in the closure and rehabilitation plan.

16.1 Existing and Future Land Use

The existing status quo for the land use can be termed agricultural. Based on the Chamber of Mines Guidelines for Environmental Protection the site's pre-mining land capability included arable land, grazing, wilderness and wetland.

At present the farms are being used as pasture for livestock, mostly cattle. From the vegetation and soils patterns observed on the satellite photographs some of the farms show past evidence of cultivation, although this may date back twenty years or more.

The site has a series of natural wetlands in the form of valley bottom areas which are fed by hillslope seeps.

As the mine will be an underground mine, the disturbance to the land surface is limited to the mine adit, and the footprint of the mine infrastructure for conveying and washing the coal, water treatment and waste water treatment facilities, offices and change house and internal access roads. Construction activities would therefore involve stripping and stockpiling of soil and overburden, ground compaction and preparation for construction of permanent and temporary buildings and mine infrastructure. Operational activities, include dewatering and discharge of pit groundwater, removal and stockpiling of the coal, washing of coal and transport of coal to an offsite rail siding. The wet waste arising from the coal washing will be discharged to a residue impoundment constructed from mine discard waste (a co-disposal of rock wastes, coal discard and coal wash wastes). Decommissioning activities will involve backfilling the adit and ventilation shaft voids with demolition rubble or rock spoil, replacing the soil cover material to emulate the pre-existing site topography, re-vegetation to establish viable agricultural pasture and restoration of wetland systems to emulate the pre-existing conditions.

For the purpose of closure planning the following categories of future land use have been considered:

- Informal agriculture – grazing livestock; and
- Green belt – ecological reserves.

16.2 Water Resource Protection – Residual Impacts

The closure and rehabilitation plan is developed around key risks and residual environmental impacts that may affect the environment for many years post-closure. The most important impacts to manage during closure concern impacts to the surface and groundwater resources that may require intervention measures during the operational phase and into closure and involve an extended period of post-closure remediation and stewardship. The baseline water resource assessment is outlined below together with the likely impacts.

16.2.1 Surface Water Baseline

16.2.1.1 Surface Water Hydrology

The proposed Yzermyn Underground Coal Mine is located within quaternary catchment W51A, located on the upper reaches of the Assegaai River catchment. The Assegaai River passes through the northern extremity of the prospecting right associated with the mine. This river contributes to the Heyshope Dam located 15 km northeast of the project area. The Assegaai River confluences with the Ndlozane River 50 km east of the site, becoming the Mkhondvo River which confluences with the uSuthu River in Swaziland.

In the vicinity of the project area, various groundwater seep areas are evident which would be associated with baseflow contribution to the adjacent water courses. Based on the available mapping, a non-perennial watercourse located approximately 100 m to the west of the proposed mine extent and a perennial watercourse is located approximately 300 m to the east.

Based on the proposed development plan, and taking into account the stormwater management plan developed for the mine (Proposed Yzermyn Underground Coal Mine - Hydrological Assessment, Report 24514, dated August 2013) the following changes in catchment characteristics is expected as a result of the proposed mining activities:

- **Catchment 16**
  - This catchment includes the plant and stockpile area, as well as the western portion of the Co-Disposal Facility. Since these areas generate dirty water that is to be contained within the pollution con troll dams (PCDs) (PCD1 and PCD3), and will no longer report to the watercourse, the contributing catchment area was reduced by 0.34 k m^2 (~7%).
  - Due to the stormwater infrastructure proposed for the conveyance of clean water, the stormflow response fraction was increased from 0.95 to 0.98 within this catchment.
- **Catchment 17**
  - The eastern portion of the Co-Disposal Facility is located within this catchment. Since dirty water generated from this area is to be contained within the PCD2 and wont report to the watercourse, the contributing catchment area was reduced by 0.14 km^2 (~4%).
- **Catchment 19**
  - The eastern portion of the Co-Disposal Facility and plant area is located within this catchment, once the stormwater management infrastructure has been implemented, stormwater generated within this area will be contained in PCD1 and PCD2. As a result, this catchment area was reduced by 0.04 km^2 (~0.3%) in the post-development scenario.
  - Due to the improved clean stormwater infrastructure proposed within this catchment, the stormflow response fraction was increased from 0.85 to 0.87.
  - Because the parking areas, expected to be under asphalt, are to be located within this catchment, the disjunct impervious area was increased by 0.0004%.

Therefore, in order to reduce the identified impacts, it is recommended that alien vegetation is removed within the surface layout area, together with measures to reduce grazing pressure on the vegetation associated with the pans.

The objective of the rehabilitation plan is thus to restore the landform to emulate the previous topography and to re-establish the surface water runoff to the surrounding water courses and wetland systems.

During rehabilitation, it is proposed that the impervious areas are uplifted and the site is rehabilitated so that the soils and vegetation resemble baseline conditions. Due to the content of the Co-disposal Discard Facility and PCDs, it is expected that these will be appropriately managed to limit environmental impacts; however since these measures are unknown at this stage, it has been assumed that the areas will continue to be managed as dirty areas requiring impermeable capping and re-vegetation so as to generate clean stormwater runoff.

16.2.1.2 Water Quality Impacts

During the decommissioning and rehabilitation of the mine and associated infrastructure, there is expected to be a removal of impervious areas, and an increase in vegetation cover. As a result, the runoff from these areas is expected to return to the pre-mining conditions over time.

Due to the dirty nature of the Co-Disposal Facility and PCDs, it has been assumed that these will continue to be managed as dirty areas, with runoff not contributing to the watercourses. This will result in a continued reduction in Water Quality Impacts.

The decommissioning phase and rehabilitation phases have the potential to lead to similar water quality impacts as during the construction phase (i.e. increased turbidity through soil exposure and spills of hydrocarbons from heavy machinery used in the decommissioning).

Surface water quality associated with the wetland drainage courses is generally of very good quality and characteristic of clean rainfall dominated systems. Total dissolved solids (TDS) range from 83 to 137 mg/l during the dry winter months. An extended winter drought would tend to increase the TDS values and reduce dissolved oxygen, with improvements expected during the summer rainfall period. Nutrient levels appear to be controlled by the localised influence of livestock watering and are marked by nitrates, ammonium and chemical oxygen demand (COD) levels being above Target Water Requirements for Aquatic Ecosystems.

Surface water impacts during the operational phase of the mine are anticipated if management measures for PCDs, residue deposits and stockpiling and loading areas are poorly implemented resulting in poor quality runoff entering surface catchments. The most likely contaminants are considered to be coal derived salts including sulphate and chlorides, decreasing pH from acid producing coal and rock waste and increasing turbidity and total dissolved solids and heavy metals, particularly iron and manganese.

16.2.2 Groundwater Baseline – Predicted Groundwater Impacts

16.2.2.1 Construction Phase

The construction of the adit is not expected to have a significant impact on groundwater during the construction phase for two reasons. The first is that the construction phase will be of short-term duration and the second is that the adit will not be a large structure (7 m wide, 3 m high). When the groundwater level in the shallow aquifer is intersected, which is on average around 10 mbs, groundwater will seep into the excavation. Local dewatering of the aquifer will occur around the adit. The cone of depression is expected to be steep around the adit and will not extend more than 500 m away. The expected volume of groundwater that may seep into the adit during the construction phase is estimated to be around 35 – 80 m^3/d.

Adit construction is not expected to have a significant impact on groundwater quality other than the occasional spill or leak from machinery used during construction. The duration of the construction phase is probably too short to cause acid rock drainage. When the adit walls are sealed, contact with oxygen will be significantly reduced, which will limit or prevent acid rock drainage.

16.2.2.2 Operational Phase

The following operational mining activities may impact on groundwater:

- Dewatering of the aquifers as mining progresses.
- Dewatering of aquifers due to groundwater abstraction for water supply to the plant.
- Contamination of groundwater as a result of seepage from the discard dump.
- Dewatering and possible contamination of the wetlands identified.

The numerical model constructed for the project was used to assess the volume of groundwater that may flow into the underground workings as mining progresses. Groundwater seepage will occur when mining intersects water-bearing geological features like faults and dyke contact zones. The rate of groundwater seepage into the underground workings may vary between 330 and 1,280 m^3/d over the life of the operation.

16.2.2.3 Dewatering of the Aquifers – Mine Dewatering

The dewatering of the Yzermyn underground workings will result in a cone of depression forming around the mining area. The extent of the cone of depression depends on the depth of mining and the permeability of the rocks that are dewatered.

Based on available information, the extent of the cone of depression on both the shallow weathered and deeper fractured rock aquifers will probably have a significant impact in the immediate vicinity of the mining operations, mainly due to the depth of mining. Groundwater levels in the shallow aquifer may be lowered by up to 12 m in the south-western section of the underground workings where mining will be deepest.

It is expected that boreholes falling within the 30 m drawdown zone will be significantly impacted by mine dewatering and will probably dry up as a result of mine dewatering. It is however noted that the boreholes listed in this area are either mine exploration or monitoring boreholes and not private boreholes. Natural springs and seeps falling in this zone may also dry up.

16.2.3 Residual Impacts after Mine Closure – Groundwater

16.2.3.1 Activities that may Impact on Groundwater

The following activities will impact on groundwater post mine closure:

- Mining activities and mine dewatering will cease. All infrastructure will be removed;
- Flooding of the underground workings;
- Possible decant from the underground workings; and
- Contamination of the aquifers from surface and underground sources after mining ceases.

Rebound of Groundwater Levels

Under the assumptions made and the information available at present, it is estimated that groundwater levels will recover within 20 – 50 years after mining stops. It is assumed that no subsidence to surface will occur and that the rate of recharge to the underground workings will take place at natural rates. The likelihood of decant is determined by the volume of water that flows into the underground workings and the coal floor contours Exploration borehole information suggests that the coal floor dips away from the adit. If natural recharge rates occur post closure and groundwater inflow occurs at expected rates, it is unlikely that the adit will decant, if it is sealed after closure.

Long-term Impact on Groundwater Quality

Potentially contaminated groundwater originating from the discard dump may flow into the Mawandlane River and the tributary of the Assegaai River as baseflow. Hence the recommendation that the discard dump is fully lined. Normally the groundwater component of baseflow is comparatively low. During the dry season, the groundwater baseflow component may however become more pronounced when surface runoff is absent.

Available information suggests that sulphate concentrations in baseflow to the Mawandlane River may rise to above 2,000 mg/l in the long-term unless proper mitigatory design is implemented. First order groundwater baseflow calculations suggest a volume of approximately 27 m^3 per day in the affected area. This will result in an annual salt load of approximately 20 tons per annum to the river. Potentially contaminated baseflow may also enter the tributary of the Assegaai River to the north of the discard dump.

Simulations indicate that groundwater contamination will move in a northerly and north-easterly direction in the deeper fractured rock aquifer. In the vicinity of the underground workings, sulphate concentrations will exceed

2,500 mg/l, based on the information used. The plume may extend more than 2 km down gradient of the mining operations, depending on the permeability of any preferential flow paths.

16.3 Developing a Sustainable Rehabilitation Strategy

This closure and rehabilitation plan has been compiled following the Guidelines of the Department of Mineral Energy Affairs and the International Council on Mining & Metals 'Planning for Integrated Mine Closure: Toolkit' (2008).

In providing guidance on a rehabilitation strategy for the Yzermyn mine facilities, we have to consider the interrelated aspects of legal, financial and technical elements must be considered in order to inform the best practical environmental option which complies with Atha policy objectives.

16.3.1 Vision and Objectives for Mine Closure

The approach to mine rehabilitation master planning should be consistent with the vision, objectives and company philosophy, and should follow the same general concepts as applied in the site closure planning for other forms of company assets in the mining and industrial sector. Basic objectives for closure are:

- To develop landforms and land uses that are stable, sustainable and aesthetically acceptable on closure;
- To achieve agreed quality targets set by stakeholders as far as practical relative to impacts and reasonability to achieve; and
- A policy objective regarding mine closure is to leave self-sufficient communities after mine closure with appropriate infrastructure, skilled people and rehabilitated land.

16.3.2 Closure Objectives

The overall closure objective is within four years to return the area disturbed by mining operations, as closely as is practicable, to its pre-mining state. Also of critical importance is to stabilise the affected area by landscaping and re-vegetating the disturbed area to the pre-mining landscape and cover. The surface is planned to have a capability of grazing potential consistent with its present use. Management of surface and groundwater aims at ensuring that the mine does not have an unacceptably negative impact on the receiving environment or on the affected groundwater aquifer.

16.3.3 Closure Target Outcomes and Goals

The target outcomes and goals of closure and rehabilitation plan are as follows:

- **Target 1: Health and Safety**
  - Rehabilitation of adit area and ventilation shaft of the mine to produce a safe and stable landform; and.
  - Monitor underground void and stabilise areas that may give rise to ground subsidence in such a way that lives will not be endangered and environmental impacts are minimised.
- **Target 2: Impacts on Natural Environment**
  - Re-establish topography to emulate pre-existing condition, where possible;
  - Re-establish soil overburden to emulate pre-existing condition to favour development of natural drainage condition;
  - Create topsoil layer to favour re-vegetation with grasses suitable for grazing pasture;
  - Removal of alien species to enhance natural biodiversity and reduce possibility of infestation;

- Protect and maintain wetland systems;
- Restrict grazing areas to protect and enhance wetland systems; and
- Reduce and monitor impacts associated with acid mine drainage and other forms of contaminated seepage from residue deposits.

■ **Target 3: Social Impacts**

- Manage the retrenchment of employees and the cessation of procurement contracts in such a way so as to avoid or minimise potential negative impacts of closure; and.
- Minimise impacts on local community by re-establishing pre-mining condition of viable agricultural land use.

■ **Target 4: Reputational Risk**

- Achieve sustainable closure outcomes compatible with company policy on sustainable development and in compliance with all legal requirements.

■ **Target 5: Legal risk**

- Comply with all applicable legislation and the terms and conditions of all regulatory permits, licence's and environmental authorisations.

■ **Target 6: Financial Risk**

- Develop and maintain accurate financial provisions for implementation of closure and rehabilitation works and for short medium and long term maintenance and monitoring.

The above list represents the overarching targets Atha wishes to achieve following the completion of the twenty year mining activities at the proposed Yzermyn Underground Mine. These targets are supported by a set of Closure Goals which have been drawn out of the predicted impacts associated with the proposed mining activity. The Closure Goals represent Atha's commitment to the rehabilitation of the mining area and have been developed with a related management indicator to ensure the Goals are suitability met. **Table 16-1** below presents a summary of the site aspects which warrant protection, how this can be protected or enhanced, the related Closure Goal and the management indicator.

Table 16-1: Summary of Site Aspects which warrants Protection together with the related Closure Goals

Site Aspect	What must be protected	What can be enhanced	Closure Goals	Management Indicator
Land tenure	Property rights	Rehabilitation to agricultural pasture	Sale of property for agricultural use.	Successful property transfer on completion of rehabilitation.
Land use	Economic value of agricultural land	Rehabilitation to agricultural pasture	▪ Total area of site that remains after areas not designated for conservation around the wetlands have been defined. ▪ Support one large stock unit per ten hectares per annum.	Grazing production records.
Land Capability	Wetland systems to B class status	A land capability that can sustain a controlled grazing programme.	Rehabilitation to emulate pre-existing condition. Re-vegetation with indigenous grasses and re-establishment of surface drainage patterns to support wetlands.	▪ Adequate vegetative cover and production. ▪ Audits on wetland systems
Landform	To emulate pre-mining landform	Stability of landforms.	▪ The stability of the rehabilitated area will be monitored during the decommissioning phase. ▪ Criteria will include: localised settling, subsidence and erosion. ▪ The man-made catchments landscaped for a free-draining objective during the rehabilitation ▪ of the land surface after mining, will be given optimal slopes for surface water runoff and will be monitored for erosion. If erosion, subsidence or settling occur it will be repaired ▪ timeously. ▪ The disturbed area will be rehabilitated in order to minimise erosion and dust production. ▪ All areas will be landscaped before being top soiled.	Monitoring of physical stability

Site Aspect	What must be protected	What can be enhanced	Closure Goals	Management Indicator
Vegetation	Grassland vegetation to be re-instated	Indigenous grassland	A vegetation cover of a minimum of five species with a 50% "ground cover" rate with no visible erosion.	The grass will be monitored during the maintenance phase to determine: Soil fertility, grass cover, erosion and the need for modification of the rehabilitation programme to increase species mix and bio-diversity.
Mine Infrastructure		Opportunities for re-use of structures and materials.	▪ The infrastructure not required for post-mining land use will be removed from site. That ▪ remaining will be subject to a binding, contractual obligation to take over and maintain the commitments. ▪ Disused roads will be rehabilitated by ripping, topsoiling and re-vegetation. ▪ Un-required pollution control dams will be breached and rehabilitated when the water qualities are such that the water can be released, and where not, pumped into the underground workings. ▪ Other un-required structures, including berms, haul roads and stockpile areas will all be removed and rehabilitated. All the temporary facilities, including caravans, ablutions and workshops will be removed from the site.	
Transport network	Existing external arterial road links.		Maintenance and repair of any roads and bulk infrastructure impacted by mine operations.	Visual inspections of road surfaces

Site Aspect	What must be protected	What can be enhanced	Closure Goals	Management Indicator
Hydrology	■ Surface water inflows to support wetland systems ■ Prevention of surface water pollution from residual contamination from mining workings and spoil		■ Maintenance of wetland water volumes and quality. ■ Prevention and remediation of impacts of acid mine drainage on surface water quality. ■ Once rehabilitation has been completed and the topography has been landscaped to the ■ levels envisaged in the rehabilitation programme, the rainfall run-off would then flow along the drainage patterns landscaped to ensure free drainage from the site. ■ The re-vegetation of the area will minimise soil erosion and restore pre-mining infiltration rates	Surface water monitoring programme
Hydrogeology	■ Borehole yields, groundwater levels and water quality of existing domestic supply wells. ■ The mine will ensure that private water users, if affected by mine dewatering, have a reliable alternative source of water. ■ Groundwater baseflow volumes to wetland systems. ■ Groundwater baseflow quality influencing surface water quality		■ Monitor groundwater levels to observe predicted rebound of water table. ■ Re-establish groundwater flow paths. Monitor groundwater flows. ■ Monitor groundwater and surface water quality and intervene where necessary to prevent unacceptable impacts on surface water quality.	■ Groundwater quality. ■ Ground water rest levels.

Site Aspect	What must be protected	What can be enhanced	Closure Goals	Management Indicator
Culture and heritage	Grave sites	Improve condition, remove invasive vegetation, repair and maintain fences.	Maintain access and security of grave sites.	
Employment Rates and patterns	Mine will secure jobs and livelihoods of communities supported by the workforce of the mine.	Opportunities for training and temporary employment.	Implement Social and Labour plan. Short life of mine creates limited dependency of employees and contracted services and suppliers.	Social and Labour Plan – audits.
Biodiversity	Protection of wetland systems and associated buffer zones.	Development of long term wetland management and conservation plan	▪ Preservation and protection of diverse grassland/wetland habitat. ▪ No long term loss of biodiversity	Annual wet season audits by expert in wetland ecology

16.4 Rehabilitation Activities

16.4.1 General Approach to Rehabilitation

The general approach to rehabilitation is given in the EMPR document and is summarised below.

Pre-strip topsoil: the topsoil shall be regarded as the uppermost 500 mm of the soil profile from areas not designated as wetland or wetland buffer zones. The topsoil should be stripped to stockpile from pit areas and from areas where temporary stockpiles, dumps and mine infrastructure will be established.

Wet soil material should not be mixed with dry soil material, but should be selectively stockpiled if encountered. Soil material containing the existing seedbank of the site should be selectively stripped and used as the top dressing material for visual and pollution control temporary berms and then re-utilised as the topsoiling layer for final rehabilitation and re-vegetation.

Topsoil material will be utilised on the berms where needed, or will be stockpiled in a designated area. This material will be placed back on top of the back filled voids during rehabilitation. Specific actions: The sandy loams and sandy clay loams will be used to create the topsoil cover to the berm structures while the upper portion of the subsoil (100 cm), will be used to create the bulk of the berm structure. These soils must be stripped to a minimum depth of 100 cm. The berm structure must be founded on a stabilised base, the topsoil having been stripped prior to the berm construction. Topsoil stockpiles should be formed as to avoid excessive heights. Where topsoil piles exceed 1.5 m in height there is excessive densification of the lower layers which can lead to anaerobic conditions. Topsoil should be re-utilised as soon as possible after stripping to minimise propagule death.

The coal discard material consists of coal that is of inferior grade for sale as thermal coal and may contain fragments of sandstone and shale with the possibility of minor amounts of dolerite. The discard rock will be used to construct the sidewalls of a waste rock dump that can be fully lined to create an impoundment for storing water from the coal washing process. When mining operations have ceased and the residues will be landscaped and the upper layers compacted before placement of the clay capping layer.

The clay capping material will be placed above the mine residues in layers not exceeding 300 mm in thickness and compacted to a density of at least 90% Mod AASHTO and clay capping will be landscaped to create a topographic rise similar in gradient to the original land surface to ensure that a watershed is developed to enable surface water to drain to the south-west of the site to re-establish the natural drainage patterns of the area.

Topsoil will be lightly compacted to a field density sufficient to prevent erosion and the uppermost layer will be seeded with an appropriate mix of commercially available indigenous grass seeds to supplement the remaining seedbank and achieve an agriculturally viable pasture. Use of manually harvesting natural seed is to be encouraged and should commence on the onset of mining depending on the season. The choice of grasses will be influenced by seasonal influences depending on exact timing of re-seeding and the immediate and long term requirement of livestock farming and any specific biodiversity goals to be determined for the site.

While the ultimate goal should be to have indigenous, hardy, palatable, perennial grass species capable of growing under conditions of low soil fertility, such species are generally commercially unavailable and less easy to establish on disturbed sites. It is thus preferable to make use of commercial species to help the site to become stable. The objective is to establish a variety of species that will produce cover at a variety of growth forms and which would occur over as much of the growing season as possible.

Highveld grasslands are difficult to re-establish as species available for planting may be limited, this can lead to the development of monostrands and loss of biodiversity. Responsible storage and preservation of the topsoil is thus a key requirement for successful rehabilitation.

The surface water pollution control facilities will be maintained or decommissioned as required during the de-commissioning phase. All un-required pollution control facilities will be rehabilitated by the end of the maintenance phase. The un-required pollution control dam will be breached and rehabilitated when the water qualities are such that the water can be released, and where not, pumped into the underground workings.

Disused roads will be rehabilitated by the amelioration of physical properties (by ripping) and chemical properties with removal of surfacing and topsoiling with the addition of appropriate fertilisers and liming, and vegetation using appropriate indigenous seed mixes (to be defined five years prior to mine closure commencing).

Other un-required structures, including berms, haul roads and stockpile areas will all be removed and rehabilitated. All the temporary facilities, including caravans, ablutions and workshops will be removed from the site.

There will be no remaining disposal facilities as the industrial waste will not be disposed of on-site and oils and greases will be collected for recycling. Domestic waste will be disposed of on the nearest licensed municipal waste site. A septic tank for sewage disposal will be constructed according to sound engineering principles and based on percolation tests. The tank will be removed and the ground re-instated at closure.

Contaminated areas will be cleared of carbonaceous material and re-vegetated to reduce the contamination of water infiltrating the area.

16.4.2 Specific Revegetation Measures

The general methodology for landscaping and re-vegetation is summarised from the ESMP Closure Plan and has been summarised below.

It will be necessary for the topsoil and subsoil to be stripped and stockpiled separately, with the dry, friable soils being kept separate from the wet, clay-rich materials. It is recommended that the soils should be stripped during the winter months, and vegetated to prevent erosion.

The pollution prevention berms should, where possible be constructed using a bulldozer to push the topsoil from the box cut area towards the toe of the berm. These topsoils will be stockpiled and utilised to top dress the berm, while the black clay rich sub-soils will be used to form the bulk of the berm structure. Utilising the soil in this manner will maximise the beneficial properties of each material.

It is imperative that the topsoil that is used to cap the berm structure is well protected from erosion and compaction. These topsoils must be adequately vegetated as soon after construction as possible and maintained throughout the two year life of mining. It is recommended that the following actions be implemented:

- Strip and stockpile the topsoil from the box cut area;
- Construct the berm structure using the sub soils and overburden if required from the initial box cut. The berm should comprise a series of 1.5 m terraces if the height required is >1.5 m;
- The topsoils should then be spread evenly over the top and sides of the berm structure;
- Disc the area using a large disc harrow;
- Add the fertiliser and manure according to soil analysis and recommendation. The fertiliser and manure should be added using a standard industrial spreader;
- Harrow the area again to ensure adequate mixing has occurred; and
- The area can now be seeded with the recommended seed mix.

If the wet-based soils are stripped in their dry state it will not be necessary to cultivate the topsoil. However, if the soils are stripped when wet, then ripping and discing of the topsoil is recommended prior to seeding of the soils, in order to break up any clods that might have formed.

It is imperative, where possible, that the slopes of the berm are constructed to 1:6 or shallower gradient, as this will minimise the chances of erosion of the topsoil. However, prior to the establishment of vegetation, it is recommended that erosion control measures, such as the planting of *Vetiver* or other suitable species of grass, or the construction of benches and cut-off drains be included in the berm design. These methods of construction will limit the potential for uncontrolled run-off and the subsequent erosion of the unconsolidated soils, while the vegetation is establishing itself.

The application of fertilisers and the amelioration of the soil can be divided into two events. It is necessary to distinguish between the initial application of fertilisers or soil amendments and maintenance dressings. Initial applications of additives are required to correct disorders that might be present in the in-situ material to raise the fertility status of the soil to a suitable level prior to seeding.

The initial application of fertiliser and lime to the disturbed soils is necessary to establish a healthy plant cover as soon as possible. This will prevent erosion, while the maintenance dressings are applied for the purpose of keeping up nutrient levels, and maintaining the vegetative cover in a healthy condition.

In general, the uncultivated soils mapped are deficient in nitrogen (N), phosphorus (P) and potassium (K). It is recommended that a standard 3:2:1 ratio N:P:K fertiliser be added to the soil according to soil analysis and recommendation before the re-vegetation programme.

It is recommended that, prior to soil stripping, superphosphate fertiliser should be added to the sandy loams and sandy clay loams that make up the bulk of the dry friable soils, at a rate of about 200 kg/ ha if they have not previously been fertilised or cultivated. Double super phosphate should be used in preference to a single superphosphate, as they contain appreciably less sulphur and are, therefore, more suitable for use in a coalmining environment. The fertiliser should be added in a slow release, granular form.

It will be necessary to re-evaluate the nutrient status of the soils at regular intervals to determine the possibility of needing additional fertiliser applications.

The following control measures and maintenance will be required:

- The area must be fenced, and all domestic animals kept off the area until the vegetation is self-sustaining;
- Newly seeded/planted areas must be protected against compaction and erosion;
- Traffic over the rehabilitated ground should be limited were possible while the vegetation is establishing itself;
- Plants should be watered and weeded regularly;
- Check for pests and diseases at least once every two weeks and treat if necessary;
- Replace unhealthy or dead plant material;
- Fertilise, seeded and grassed areas with 200 kg/ ha LAN 4-6 weeks after germination; and
- Repair any damage caused by erosion.

The top dressed areas will then be rolled and seeded, preferably in February/March, or as soon as the soil moisture is sufficient (monitor with tensiometers) to guarantee that the seed has a chance of germinating. A suitable seed mix (to be determined from the vegetation survey) should be used to stabilise the replaced soils. Compaction of the sub-soils should be carried out to a 85% Mod AASHTO, and monitored, so as to achieve the required permeability rate for the underlying materials.

The planting will be undertaken with water, either, by making use of natural rainfall, or, by hydro-seeding the seed mix onto the ground, or having pre-wet the soils prior to planting, with a weekly watering program (15 to 20 mm/ha/week) for one month after planting, or until germination has occurred.

The areas to be planted will need to be landscaped and engineered to a slope not greater than 1:6. The soils will then be ripped to a depth of 20 mm to loosen the soil, and all weeds will be removed. A fertiliser mix, if required (of 3:2:1 at a rate of 200 kg/ha), will be applied at time of planting. In addition, and if available, chicken litter should be applied to add bulk (organic matter) to the heavy, clay rich soils.

For areas that are considered too steep, and where a gradient of 1:6 cannot be achieved, the use of *Vetiver* grass (*Vetiveriazizanodies*) or other suitable specie or an appropriately designed erosion control method is recommended, and in places will be essential to prevent erosion, and to stabilise the soils.

If Vetiver is used it must be planted according to the slope gradient, length of slope, and degree of erosion potential. A spacing of approximately one row every 5 m of vertical drop is recommended. This might alter as the slope becomes very steep, or very shallow. It is recommended that a specialist be used for the specific areas of concern.

A horticulturist will examine the grass stands one year after planting to ensure that the grass has established itself satisfactorily. A soil sample will be taken in the June following planting, and analysed to determine the required fertiliser applications.

16.4.3 Surface Water Management during Rehabilitation

Ideally, unpolluted surface water from around the rehabilitated area should be kept off the rehabilitated area in order to minimise infiltration into the backfilled pit area and to reduce the risk of surface erosion caused by excess surface water flow on and over this area. The present topography of the backfilled area is such that it forms a mound, which is mostly free-draining, although there are areas where water is ponding with the resultant increase in infiltration and possible AMD. The proposed reshaping will aim at ensuring that the area is free draining as far as is practical.

Water management will be such that all areas where vegetation is removed will be re-compacted. The disturbed area will be shaped to prevent water from ponding and will provide for positive drainage off the pit area. Where necessary, contour walls and drains will be constructed to limit the volume and velocity of surface runoff. Runoff will be controlled by reinstating the existing contour drains and ensuring that the outlets do not erode. Concentrated runoff, such as at the existing access road, will be avoided through the construction of water control structures. In addition, the area around the dump will be made free-draining to limit ponding of water and the resultant increase in leaching.

A proper surface storm water control management design must be done to address a one in 100 year storm event. This design will ensure that runoff is removed from the terrain as effectively as possible, i.e. contour drains and waterways will be shaped to ensure runoff away from all areas where tree clearing has taken place. As far as possible, the runoff will be diverted to the existing pollution dam structure, i.e. to the northwest of the site. Between the contour drains to be formed, extra care will be given to the proper design to ensure that slope lengths are short enough to minimise erosion risk; the slope angles will similarly be low enough to ensure sustainable re-vegetation and maintenance, while minimising erosion risk. As the rehabilitated area forms a mound, overland runoff will occur naturally in all directions. The combination of compaction of cleared areas, with proper water diversion to minimise infiltration and re-vegetation on properly ameliorated growth medium will ensure that minimal water will seep into the backfilled pit, which will minimise the AMD that can generate from the area.

16.5 Mine Closure Impact Assessment

The traditional form of semi-quantitative impact assessment methodology commonly applied in ESIAs is not fully applicable in the assessment of mine closure planning where the aim is to design mitigatory measures to ensure a successful outcome that it is consistent with a set of mine closure objectives that satisfy statutory points of compliance and various stakeholder goals. Furthermore, it is important that the mine closure objectives are practically achievable and can be used to derive a meaningful financial provision that is sufficient to ensure that all rehabilitation measures can be met.

It is important to note that as this is an underground mine the mine infrastructure footprint area is relatively small in terms of the norms for open cast coal mining and without the problems of dealing with large volumes of soil overburden and waste rock dumps. The size of the site places limitations on the mine closure plan as there are no forms of localised environmental offsets that can be applied on the site itself. Other than localised areas of alien vegetation and one overgrazed and eroded drainage channel the rest of the site is in a very good natural state. There will therefore be a number of inevitable environmental impacts during the operational phase of mining that cannot be addressed by rehabilitation measures. For example, the mining of the coal seam and rock will destroy the natural rock structure, porosity and permeability that presently influence groundwater storage and flow in the rock aquifer. The post mining condition of backfilled rock fill will produce a more homogeneous porous medium with a higher fluid-rock ratio which with increase the dissolved concentrations of metals and salts in the groundwater. The impact is inevitable and the change in the physical properties of the aquifer cannot be mitigated. The decision for closure is whether the changes in the chemical composition of the groundwater require intervention and remediation.

The impact assessment thus considers the environmental impacts that are residual and cumulative in a post mining scenario and assess the likely success and outcomes of the proposed rehabilitation measures. The assessment of a non-mitigated closure scenario serves no purpose as compliance with the closure plan submitted with the EMPR is mandatory and the option for no rehabilitation is thus ultra vires (**Table 16-2**).

It is important to consider the merits of progressive rehabilitation especially in view of the short life of mine envisaged for the Yzermyn Underground Coal Mine.

Table 16-2: Table of Residual Impacts Associated with Mine Closure and Rehabilitation

Site Aspect and Impact	Consequence			Likelihood	Significance
	Severity	**Duration**	**Extent**	**Frequency/ Probability**	
Safety and stability – ground subsidence	Minor to no stability issues associated with underground workings	Short term to long term extending many years after closure	Undermined area only	Unlikely	Short term and long term impact of low significance
Land use – rehabilitation to agricultural pasture	Minimal deterioration to probable improvement	4 years	Area within project boundary	Definite	Short term negative impact of moderate significance Long term positive impact of low significance.
Land use – rehabilitation and partial loss of wetlands	Measurable deterioration. Complete loss beneath discard facility	4 years: potentially harmful 10 years: measurable recovery. Permanent damage to certain wetlands	Area within project boundary	Definite	Negative impact of high significance
Landform- reinstate to emulate existing landform	Minor to moderate deterioration of landform	4 years: Permanent change in landform may be unavoidable	Surrounding area within and beyond property boundary	Probable but not definite	Negative impact of high significance
Vegetation – loss of wetland vegetation	Moderate deterioration Complete loss below discard facility	4 years: Some permanent loss of flora biodiversity may be unavoidable	Surrounding area within property boundary	Probable	Negative impact of moderate significance
Vegetation – loss of indigenous grassland	Minor deterioration	4 years: Minimal deterioration. Benefits of alien removal and fertiliser to improve soil fertility	Immediate area of mining activity	Unlikely	Negative impact of low significance. Long term positive impact also possible

Site Aspect and Impact	Consequence			Likelihood	Significance
	Severity	Duration	Extent	Frequency/ Probability	
Vegetation – Removal of invasive alien vegetation	Substantial improvement	4 years: Benefit to indigenous biodiversity and improved water runoff and infiltration	Surrounding area within project boundary	Definite	Positive impact of moderate significance
Hydrology – surface runoff Surface water inflows to support wetland systems	Moderate deterioration	4 years with possible permanent impacts	Surrounding area within project area	Highly likely	Negative impact of high significance
Hydrogeology- groundwater baseflow to support wetland systems	Minor deterioration	4 years, with possible impacts to 50 years	Surrounding area within project boundary	Highly likely	Negative impact of moderate significance
Mine decant affecting surface water quality – impacts associated with acid mine drainage	Insignificant deterioration. No decant predicted.	No anticipated permanent impacts	Surrounding area within project boundary	Definite	Negative impact of high significance
Mine decant affecting groundwater quality in regional aquifer – impacts associated with acid mine drainage	Significant deterioration of groundwater quality in and around the mine void	5 years with possible permanent impacts	Possibly beyond project boundary	Unlikely	Negative impact of low significance
Mine decant affecting water quality of perched water table and base flow to wetlands	Minor to significant deterioration of specific wetlands.	5 years with possible permanent impacts	Surrounding area within project boundary	Probable	Negative impact of moderate significance
Employment Rates and patterns	Significant to moderate improvement to employment opportunities	Long term (15 to 20 years) employment and skills training opportunities for unskilled workers Long term job security for trained and skilled staff	Beyond project boundary	Definite	Positive impact of moderate significance

16.6 Summary

The overall rehabilitation of the mining area to agricultural pasture is anticipated to take over four years post mine closure. This will result in a moderate negative impact for the short term, however, over time the site will be returned to agricultural pasture of potentially marginally lower quality thereby resulting in an overall positive impact of low significance. This is fundamentally dependent on the effort placed on the rehabilitation and the resources used, the quality of the rehabilitation plan will ultimately influence the overall potential of the land and its economic value. In addition, the proposed mining operation will change the pre-mining landform and affect some of existing wetlands on the site. As the mine workings are underground and have a low potential for ground subsidence the impact on the landform is considered to be minor.

These impacts are negative and are considered of high significance. However, the rehabilitation plan will seek to emulate the pre-mining condition as well as re-vegetate with indigenous grasses and re-establish the surface drainage patterns to support wetlands seeking to reduce the overall impact on the natural environment. Removal of alien vegetation will improve the biodiversity status of the site. Re-vegetation with indigenous grasses will re-establish pasture to a viable agricultural potential which will be equivalent or an improvement on the pre-mining state of land capability. Some minor loss of land capability is possible and is subject to the success of rehabilitation measures and timeframes applied to assessing the closure target.

There are activities associated with the operational phase of mining that will result in inevitable long term impacts on surface water and groundwater flows and water quality that will impact on the Yzermyn property that cannot be entirely mitigated by physical rehabilitation measures. As there is no predicted decant from the mining areas the impacts are localised in extent and are considered to be minor in the wider context of the regional catchment area and therefore do not warrant intervention measures such as water treatment.

The mining project creates locally significant opportunities for direct long term employment and ensures the livelihoods of the broader mining-skilled working community. Closure impacts on employment patterns are accordingly considered minor/ low.

17 Financial Provision

17.1 Introduction

According to the regulations set out in the Mineral and Petroleum Resource Development Act (ACT No 28 of 2002), it is necessary for Atha to compile a cost estimate for their proposed Yzermyn Mine and to update this on a regular specified basis. The financial provision for the environmental rehabilitation and closure of any mine and its associated operations and infrastructure form an integral part of the MPRDA and is addressed in Section 41 and 45 of the Act.

According to Regulation 56 (Principles for Mine Closure) of the MPRDA in the Government Gazette 466 No 26275, the holder of a prospecting right, mining right, retention permit or mining permit must ensure that prospecting or mining operations are closed efficiently and cost effectively. According to regulations published in terms of the Mineral Act (Act 50 of 1991) the holder of a mining authorisation has to:

- Compile Environmental Management Programmes that indicate adequate financial means in terms of both sufficient and acceptable pecuniary provision to the satisfaction of the DMR; and
- Annually, to the satisfaction of the DMR, and in consultation with an expert, determine the quantum of pecuniary provision.

The 'Guideline Document for the Evaluation for the Quantum of Closure Related to Financial Provision Provided by a Mine' (2004) was developed by the DMR in order to empower the personnel at regional DMR offices to review the quantum determination and closure of mining sites. This approach has been used to determine the financial provision for the closure cost of Yzermyn Mine together with information from the MWP (January, 2013) and project specific data compiled by Atha and Mindset.

The following closure components are suggested by the DMR for determining the quantum for financial provisions for mine closure:

- Dismantling of process plant and related structures;
- Demolition of steel structures;
- Demolition of reinforced concrete buildings and structures;
- Rehabilitation od access roads;
- Demolition of housing facilities;
- Opencast rehabilitation including final voids and ramps
- Sealing of vertical and incline shafts;
- Rehabilitation of overburden and spoil stockpiles;
- Rehabilitation of process waste deposits and evaporation ponds;
- Rehabilitation of subsided areas;
- General surface rehabilitation, including grassing of all denuded areas;
- River diversions;
- Fencing;
- Water management (separating clean and dirty water, management of polluted water, managing the impacts on groundwater); and
- Maintenance and aftercare.

A Master Rate for each component in the DMR Guidelines and weighting factor can be applied depending on the risk class of the activity and the sensitivity of the area. The financial rates were determined in 2005 so it therefore to calculate an escalation in the rates according to an appropriate CPIX.

Weighting Factor 1 is used in areas of difficult terrain with steep gradients, undulating and rugged ground.

Weighting Factor 2 is related to the proximity of the mine to urban centres as in remote areas the costs of transport, machinery, goods and personnel increases substantially.

17.2 Closure Methods

17.2.1 Generally Accepted Closure Method

The applicable project components are discussed below together with closure related comments and any items that influence applicable financial rates and Weighting Factors.

- **Component 1: Processing Plant**
  - Costs for dismantling of processing plant and related structures.
  - Plant includes tunnel feeders to vibrating screens to crushers.
  - Crushed coal is washed using cyclones and discard is fed to a silo.
  - Overland conveyors and power lines are included as part of the processing plant closure costs.
- **Component 2(A): Steel Buildings and Structures and Component 2 (B): Demolition of Reinforced Concrete Buildings and Structures**
  - Cost for demolition of steel buildings and structures are based on the assumption that all structures to be demolished include foundations to a depth of 1m below ground level.
  - The rubble is to be buried on-site.
  - Silos will be imploded and buried on-site.
  - Cleared areas will be shaped and topsoil with 300 mm of topsoil cover and re-vegetated or as stated in the relevant ESMP document.
  - Costs include allowance for monitoring and maintenance.
- **Component 3 Rehabilitation of Access Road**
  - Approximately 600 m^2 of internal access roads will be rehabilitated
- **Component 4 Rehabilitation of Railway Lines**
  - Not applicable. There will be no railway links for the mine
- **Component 5 Demolition of Housing and Administration Buildings**
  - It is proposed to use portable structures on concrete plinths for offices, workshops and change houses.
  - The building structures will be re-usable and demolition will be limited to the concrete foundation slab.
- **Component 6 Opencast Rehabilitation**
  - Rehabilitation of excavation works around the mine adit are estimated approximately 0.83 Ha
- **Component 7 Sealing of Shafts, Adits and Inclines**

- The sealing of vertical and incline shafts are primarily a safety consideration. Inert rubble arising from the demolition of surface infrastructure should be deposited into the shafts and a 1 m thick mass concrete cap be used to cap the rubble backfill. Allowance should be made for methane venting of the underground workings using strategically placed venting boreholes.
- An allowance has made for sealing shafts based on 42 m^2 of vertical shaft area.

- **Component 8 (A) Rehabilitation of overburden and spoils**
  - Relatively low volumes of overburden soil and rock will be generated from the adit excavation.
  - The excavated will be used as part of the bulk earth fill material for the construction of the pollution control dams and the dam for coal washing residues.
- **Component 8 (B) Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)**
  - See below.
- **Component 8 (C) Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste)**
  - Acidic metal enriched residue deposits are typical of coal mining activities. Accepted closure methods are aimed at the following: Limiting seepage of contaminants from the processing waste deposits, and preventing seepage from entering local surface water and groundwater resources. The standard master rates allows for slope modification, armouring and evaporative covers, lined pollution control dams and lined cut off trenches. Slope modification to achieve stabilisation of residue deposits is based on an outer slope gradient of 1:3 (18 °).
  - Benching at regular intervals should ensure that bench height does not exceed 35 m in order to curb stormwater flow velocities and reduce the risk of erosion to cover material. Benches should be at least 5 m wide, sloping inwards at a slope of 1:10. The lateral slope of benches should be based on the following stability criteria:
    - 1:2 year flow events should not result in bench flow velocities of less than 0.3 m/s. Flow velocities of less than 0.3 m/s tends cause sediment build-up on benches which can result in eventual overtopping and slope damage.
    - 1:50 year flow events should not result in bench flow velocities exceeding 1 m/s. Flow velocities in excess of 1 m/s could cause bench scouring and hence damage to stormwater chutes.
  - Generally accepted closure methods allow for a dedicated cover to be provided on the modified outer slopes of the residue deposit. The cover should provide stability to the slope and limit the ingress of air and water into the residue material reducing leaching and the potential to generate contaminated seepage from the footprint of the residue deposit. The cover material prevents contamination of the surface run-off from the deposit and allows for suitable re-vegetation to take place improving the aesthetics of the deposit.
  - Operational pollution control dams will be lined to prevent migration of contaminated water impounded in the dams to surface water and shallow groundwater. The life of mine is estimated to be 17 years and therefore it is unlikely that the liner systems will degrade over this time period and therefore residual impacts of seepage into surrounding water resources should be negligible. The Master Rate used in the cost provision assumes a liner design based on a 1.5 mm thick HDPE liner on a selected granular bedding layer of 250 mm with a geotextile separation layer. The Master rate allows for concrete stromwater chutes at 200 m spacing along the perimeter of the rehabilitated residue deposit with benching and energy dissipation measures upslope of bench crossings and discharge points
- **Component 9 Rehabilitation of subsided areas**
  - The geological review of the stability of the hanging wall rocks and rock overburden indicates that significant ground subsidence is considered unlikely that therefore the financial provision is not applicable for this component.

- **Component 10 General Surface Rehabilitation**
  - The final surface rehabilitation of areas disturbed by mining and related activities will be aligned to the selected final land use. General surface rehabilitation measures will ensure the following:
    - Surface topography will emulate the visual appearance of the surrounding areas and be aligned to the general character of the landscape.
    - Landscaping will facilitate surface run-off and result in free-drainage areas. Where possible natural drainage lines will be reinstated.
    - Special attention will be given to remove heaps of excess material and to remove unnecessary remnants of surface structures and infrastructure.
    - General shaping of the land surface will be made suitable for re-vegetation.
    - The Master Rate allows for shaping of the land surface to a depth of 500 mm.
- **Component 11 River Diversions**
  - There are no drainage courses within the area impacted by mining activities. This component is therefore considered to be non-applicable to the financial provision.
- **Component t 12 Fencing**
  - An allowance has been made for 16 000 running metres of fencing.
- **Component 13 Water Management**
  - The Master Rate developed by the DMR is considered to be over-conservative and too generic to be applied in the case of Yzermyn where the predictive modelling suggests that mine decant will not occur.
  - An allowance has been made of monitoring of surface water and groundwater for a period of three years, with management measures estimated at R 120 000. This cost estimate will need to readjusted during the Life of Mine as real data on groundwater level and water quality is obtained and the predictive decant modelling can be properly calibrated.
- **Component 14 Maintenance and Aftercare**
  - The Master Rate assumes a maintenance and aftercare period of 3 years after mine productive and includes the following:
    - Annual fertilising of rehabilitated re-vegetated areas
    - Monitoring of surface water and groundwater
    - Control of black wattle and other invasive alien plants
    - General landscaping maintenance, including rehabilitation of cracks and subsidence
  - The area requiring maintenance and aftercare is assumed to be 30 ha.
- **Component 15 Specialist Studies and Environmental Management Programme**
  - Specialist studies may be required to fully develop the Environmental Management Plan for closure. These studies could include additional monitoring boreholes for groundwater samples or various forms of field trials for re-vegetation and biodiversity initiatives. The requirements for further specialist studies should be evaluated during the Life of Mine and the Financial Provisions be updated to reflect any specific requirements as necessary.

17.3 Closure Cost Estimate

The closure cost estimate has been compiled from information supplied from Atha with quantities estimated by Mindset according to the DMR Guidelines. Master Rates are based on compound inflation adjusted rates for 2013. Weighting factor for terrain is not considered to be applicable and thus is taken by as x1. The mine location is part of a traditional coal mining area with nearest major town being Piet Retief. Location related costs are not considered applicable and therefore the Weighting Factor is taken as x1. Refer to **Table 17-1** for a closure cost estimate.

Table 17-1: Yzermyn Underground Coal Mine Closure Cost Estimate

Component	Description	Unit	Master Rate (2013) ZAR	Quantity	Weighting Factor	Value ZAR
1	Dismantling of processing plant and related structures (Including overland conveyors and power lines)	m^3	10.40	10,000	1	1,040,000
2(A)	Demolition of steel buildings and structures	m^2	144.86	250	1	36,215
2(B)	Demolition of reinforced concrete buildings and structures	m^2	213.48	80	1	17,078
3	Rehabilitation of access roads (excluding municipal road)	m^2	25.92	10,485	1	271,771
4(A)	Demolition and rehabilitation of electrified railway lines	m	251.60		1	
4(B)	Demolition and rehabilitation of non-electrified railway lines	m	137.23		1	
5	Demolition administration facilities	m^2	289.72	365	1	105,748
6	Opencast rehabilitation including final voids and ramps	ha	147,451.12	0.83	1	122,384
7	Sealing of shafts, adits and inclines	m^3	77.77	42	1	3,266
8(A)	Rehabilitation of overburden and spoils	ha	101,248.75	4	1	404,995
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	ha	126,103.49	1	1	126,103
8(C)	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste)	ha	366,264.31	1	1	366,264
9	Rehabilitation of subsided areas	ha	84,780.58		1	
10	General surface rehabilitation	ha	80,206.09	10	1	802,061
11	River diversions	ha	80,206.09		1	
12	Fencing	m	91.49	16,000	1	1,463,840
13	Water management	ha	30,496.61	10	1	304,966
14	2 to 3 years of maintenance and aftercare	ha	1,067.38	10	1	10,674
Sub-total (sum of items 1-15)						4,139,367
1	Preliminary and General	+12% of sub-total				496,724

Component	Description	Unit	Master Rate (2013) ZAR	Quantity	Weighting Factor	Value ZAR
2	Contingency	10%				413,937
Total						5,050,027
+VAT (14%)						707,004
Total (incl VAT)						5,757,031

The DMR requires 10 forecasts (one for each of the first 10 years of operation) and the progressive total in the tenth year (excluding concurrent rehabilitation). The Progressive total has been calculated in the MWP and is given as **R 957,822.00** (as at 2013).

All activities relating to the proposed project will occur on the area demarcated and as approved in the mine plan. On-going dust suppression measurers, best practice environmental management and monitoring will be conducted on site to ensure that the extent of the footprint area is not increased.

18 Assumptions and Limitations

The following assumptions and limitations have been identified during the ESIA process which requires additional studies in order to adequately quantify the extent of the risks associated with the proposed Yzermyn Underground Coal Mine.

Please note that the relevant assumptions and limitations for each specialist study is referenced in the applicable sections within the specialist study summary (**Section 8**).

- Information pertaining to the type of water treatment plant, diesel generators, and types of relevant machinery proposed for the project has not been specified to date. This will be identified during the bankable feasibility study which will be undertaken in the fourth quarter of 2013.
- The mining plan was supplied to WSP in August 2013, and as a result, a number of specialist studies modelled their impacts without this plan.
- The surface layout was submitted to WSP in August 2013. Cognisance needs to be taken for the assumptions made by each of the specialists pertaining to the surface layout.
- The cost estimates included in the ESMP are not to be taken as final. These costs were obtained from published information, assumptions and include a wide varying range. Atha is to obtain quantified costs from the relevant specialists, engineer and rehabilitation professionals. These costs were meant purely as an exercise following requests from stakeholders during the stakeholder engagement process. Under no context are these to be taken as final costs. Furthermore, these costs, were possible, were based on 2013 estimates and no provision has been included for inflation.
- The ESIA process undertaken by WSP is applicable to the target area and subsequent surface layout area, as well as the activities detailed in this document. Information pertaining to the proposed discard beneficiation (briquette) plant, although discussed as an aspect to reduce the volume and footprint of the co-disposal discard dump, will require separate authorisation from the relevant decision—making authorities.

19 Conclusion and Recommendations

19.1 Conclusion

Atha appointed WSP to undertake the necessary environmental authorisation process required for the construction of a new greenfields underground coal mine near Dirkiesdorp, within the Mpumalanga Province of South Africa. Atha obtained the prospecting right to an area of 8,360 hectares. Following detailed exploration, a feasible target area was identified which comprises approximately 2,500 hectares. Atha completed the detailed exploration drilling for the target area in 2012. .

Atha propose to produce thermal coal for the local and export market through means of underground bord and pillar mining. It is proposed that the Utrecht Coalfield will be mined, which comprises the Karoo Supergroup geological stratigraphic unit. The Alfred and Dundas coal seams, which form part of the Utrecht coal field, will be mined. The project involves the extraction, beneficiation/ washing and stockpiling of coal product and discard as well as the transportation of the saleable coal to the Piet Retief Siding for export through the Richards Bay Coal Terminal, or to Eskom power stations for the generation of electricity.

It is anticipated that the mine will have the potential to produce 2.25 million tons of coal per annum, with an estimated life of mine of approximately 15 years, with additional resources potentially available adjacent to the target area.

This report details the ESIA/ ESMP phase that was undertaken in accordance with the requirements of the NEMA EIA Regulations and the MPRDA. The report provides a detailed description of the proposed Yzermyn Underground Coal Mine project and follows to describe the methodology to undertake the ESIA process. All relevant and applicable South African legislation has been detailed, and the applicability thereof defined. A number of project alternatives were considered, including location alternatives of aspects associated with the proposed project as well as technical alternatives aimed to reduce risks (*viz.* beneficiation/ reuse of discard material to reduce discard dump footprint).

A detailed description on the existing environment (biophysical as well as socio-economic) is provided based on findings from the specialist surveys. A summary of the specialist studies that were undertaken in order to assess environmental and socio-economic aspects is included in this report, with the full specialist reports appended. The report provides a comprehensive description of the stakeholder engagement undertaken and the outcomes of the public and focus group meetings as well as the scoping report feedback. Environmental and socio-economic impacts (as well as heritage impacts) have been identified, evaluated and rated in order to identify significant risks associated with the proposed Yzermyn Underground Coal Mine. Where possible, mitigation measures were developed in order to minimise the impacts on the environment and maximise socio-economic aspects pertaining with anticipated job opportunities.

It has been noted that coal production, including the mining of coal, contributes to the provincial economy of Mpumalanga and the GDP of the region. In consultation with the local Pixley ka Seme and Khondo municipalities, it has been noted that economic development is needed within the greater area, which can be promoted through agriculture, manufacturing, mining and tourism. However, it is understood and noted by both municipalities, that these economic development initiatives must be undertaken in a systematic approach that balances the needs of the environment with the socio-economic needs of the region.

The proposed Yzermyn Underground Coal Mine is located within known sensitive habitats and environments as well as adjacent to an existing protected environment (KPE). Furthermore, the proposed area is located within a threatened ecosystem (Wakkerstroom/ Luneburg) which is considered endangered. The site itself comprises a number of farms that are proposed to be included in a separate protected environment (Mabola) and has been earmarked to be included in a 'no-go' mining area in terms of Section 49 of the MPRDA.

The target area is located within a FEPA river catchment and includes several wetland clusters within the preferred surface layout area. The target area comprises habitat that has been zoned by the National Mining and Biodiversity Guideline as having the Highest Importance for Biodiversity and thus Highest Risk for mining. In addition, the area falls within the Ekangala Grassland Project which focuses on protecting biodiversity and water in remote catchment areas of the Vaal, Pongola and Thugela rivers from threats. The Enkangala Grassland Project is recognised as an IBA, which is described as being one of the most important biodiversity areas in Africa, spanning 800 farms.

A number of CI, threatened, near threatened, etc. fauna and flora species are located within the target area, and have been identified within the surface layout area. The Mpumalanga Biodiversity Sector Plan has been developed to improve conservation of biodiversity in the province. Significant portions of the prospecting right area are recognised as Irreplaceable and Optimal Critical Biodiversity Areas (CBA) – most remaining habitat is ear-marked for Landscape Corridors, Local Corridors and Species Specific Ecological Support Areas. Irreplaceable CBAs are considered critical for meeting biodiversity targets and thresholds. It is however important to note that only 1% of the total prospecting area will be disturbed by surface infrastructure as the mine will be an underground mine.

It is likely that the nature of the area will be changed due to the proposed mining activities. Factors that are anticipated to contribute towards this include visual and aesthetic changes to the site, dust, noise and other physical environmental changes, as well as increased traffic, influx of employees and job-seekers, and development in these areas as a result of their proximity to the mine. In addition, cultural and political conflicts could result from the in-migration of labourers, which could affect settlements in close proximity to the mine. The possible transient nature of some of the mine labour and the associated social issues (such as alcohol abuse, influx of sex workers, and potential social unrest) could change the nature of the nearby settlements.

Conversely, the proposed Yzermyn Underground Coal Mine has been earmarked as a strategic project for Atha in order to obtain a foot in Africa, from which a number of other potential projects have been identified. The bi-lateral and Free Trade Agreements with India and South Africa have been noted as the reason for the investment (as part of the BRICS alliance). The South African and Indian government's objective for foreign direct investment agreements are linked to a socio-economic growth model based on equity and justice, addressing poverty and underdevelopment, especially in rural areas of South Africa.

The proposed Yzermyn Underground Coal Mine would significantly contribute to the local, regional and national economies in the form of direct and indirect employment, secondary activities and services to the mine, as well as tax revenue, and expenditure on business services in local and regional economies. There are a number of opportunities for the proposed mine to contribute towards the development of local services and business development through the prioritisation of local procurement for the provision of services to the mine (e.g. transport, provision of materials, catering, cleaning, etc.).

In support of the developmental needs of the Pixley ka Seme and Khondo municipalities and the Mpumalanga Province, as described in the respective IDPs, the proposed Yzermyn Underground Coal Mine will contribute to export earnings, will result in the creation of 576 direct jobs and the creation of an anticipated 100 opportunities during the construction phase (approximately six months in duration), and will result in a contribution to the local economy through the provision of local employment and its requirement for other services. It is also reported that for every single person receiving employment, an additional 27 persons stand to gain directly and indirectly from such employment (Mindset *per comms*, from article in Mining Weekly, 2013).

This will have a direct result in the increase in skills development within the two municipalities as well as the potential for SMME business development. Additional positive aspects associated with the proposed Yzermyn Underground Coal Mine comprises of a comprehensive skills development programme, including ABET training, core skill training, external learnerships, internal learnerships, portable skills, bursaries, internships, portable/ marketable skills, mining sector skills, basic education and further education and training. This will have a positive impact not only on the immediate communities, but in the larger community base, of which poverty is high and employment low.

In addition, and initial foreign Capex investment of approximately R900 million will be injected into the local economy. It has been noted that approximately 90% of the proposed revenue from the project over the life of mine will be invested back into South Africa.

In recognition of these sensitivities (positive and negative), this ESIA for the proposed Yzermyn Underground Coal Mine has attempted to identify all impacts, and propose rigorous mitigation measures to both enhance positive impacts, and reduce negative impacts. It is also recognised that some limitations to this ESIA study remain, as detailed in **Section 18**.

19.2 Recommendations

According to the preferred surface layout design and sensitivities pertaining to the layout, it is WSPs recommendation that this 'preferred' layout not be considered. However, taking cognisance of the sensitive habitats, environments and biomes assessed as part of this ESIA process, as well as the need for job employment and economic development within the area, WSP recommends reassessing the layout design in order to re-position the proposed infrastructure to accommodate both environmental and socio-economic aspects (as proposed in **Appendix I**).

Prior to providing an opinion in terms of an independent environmental impact statement, WSP has the following recommendations which Atha should consider:

- Relocating the surface infrastructure to the northeast in order to reduce the impact over two wetland catchment areas (i.e. locate the surface layout in order to potentially impact on one wetland area);
- Minimise the area in extent required to construct and install the surface infrastructure (approximately 25 ha);
- Relocate and reduce the size of the co-disposal discard dump, to the northeast and/ or northwest of the target area (within prospecting right boundary), which is approximately 1 km from the surface infrastructure area which requires an additional conveyor system as recommended by the technical consultant. It is anticipated that the potential for wetland occurrence is less (to be confirmed by relevant specialist);
- Design the co-disposal discard dump with a clay underliner as well as a HDPE liner to reduce potential leachate entering the environment;
- Reuse/ beneficiate the discard material in order to reduce the footprint size and produce additional product for Eskom use;
- Reassess the hydrogeology in close proximity to the proposed new surface layout area;
- Undertake a wetland delineation within the proposed new surface layout area;
- Develop a stormwater management plan that will illuminate runoff of contaminated water and retain rainwater harvesting for mine use (i.e. potable water, make-up wash water, etc.);
- Assessment of a shorter access road alternative;
- Undertake the following additional specialist studies in order to further identify the site sensitivities:
  - Biodiversity assessment (alternative location and route);
  - Air quality assessment (alternative location and route);
  - Noise assessment (alternative route);
  - Archaeological, cultural and heritage (alternative location);
  - Groundwater assessment (alternative location);
  - Stormwater management plan (alternative location and route); and
  - Traffic impact assessment (alternative route).

Refer to **Appendix I** for a copy of the recommended site layout as well as the recommended alternative route that will need to be assessed for impacts and resultant mitigation measures.

19.3 Summary

The Pixley ka Seme and Khondo municipalities recognise the importance of mining as a key economic sector within these two municipalities. However, both IDP's also recognise the significant challenges they face in balancing the needs of environmental protection with the economic and developmental needs of the Region. This proposed project is not immune to these challenges. This ESIA has therefore attempted to describe both the benefits of the proposed Yzermyn Underground Coal Mine as well as the associated environmental and social sensitivities. Where impacts are identified, detailed mitigation measures to reduce the significance of these impacts are described; in the case of positive impacts, measures to enhance such positive impacts are provided.

Atha recognise these sensitivities, and have provided a written undertaking to implement the measures prescribed in this ESIA (as provided the Letter of Undertaking) as a demonstration of their commitment in implementing all such mitigation measures. Alternatively, it is recommended that an additional site layout be identified prior to making a decision and assess whether the proposed mine can coexist within the area.

Furthermore, WSP recommends that the Mpumalanga Department of Minerals and Resources, the Department of Environmental Affairs, the Department of Water Affairs and the Mpumalanga Department of Economic Development, Environment and Tourism consider both the benefits and the impacts associated with the proposed Yzermyn Underground Coal Mine, preferably following the completion of the assessment of the recommended alternative site layout, in order to make an informed decision.

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Appendices

Appendix A: WSP Capability Statement

Appendix B: Project Team Curricular Vitae

Appendix C: Specialist Studies

Air Quality Impact Assessment

Noise Impact Assessment

Biodiversity Impact Assessment

Archaeological, Cultural and Heritage Assessment

Project number: 24514
Dated: 2013/10/17
d:

Surface Water Impact Assessment

Groundwater Impact Assessment

Socio-economic Impact Assessment

Soils, Land Use and Land Capability Assessment

Traffic Impact Assessment

Visual Impact Assessment

Appendix D: Relevant Application Forms

Appendix E: Blasting and Vibration Opinion

Appendix F: Piet Retief Siding Letter from Jindal

Appendix G: Stakeholder Engagement

G-1: Stakeholder Database

G-2: Issues Trail

G-3: Authority Meeting Minutes

G-4: Public/ Stakeholder Meeting Minutes

G-5: Newspaper Advertisements

G-6: Site Notice

G-7: Background Information Document and Letter of Invitation

G-8: Stakeholder Memo

Appendix H: Figures and Tables relevant to the ESMP

Appendix I: Altenative Site Layout Design

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