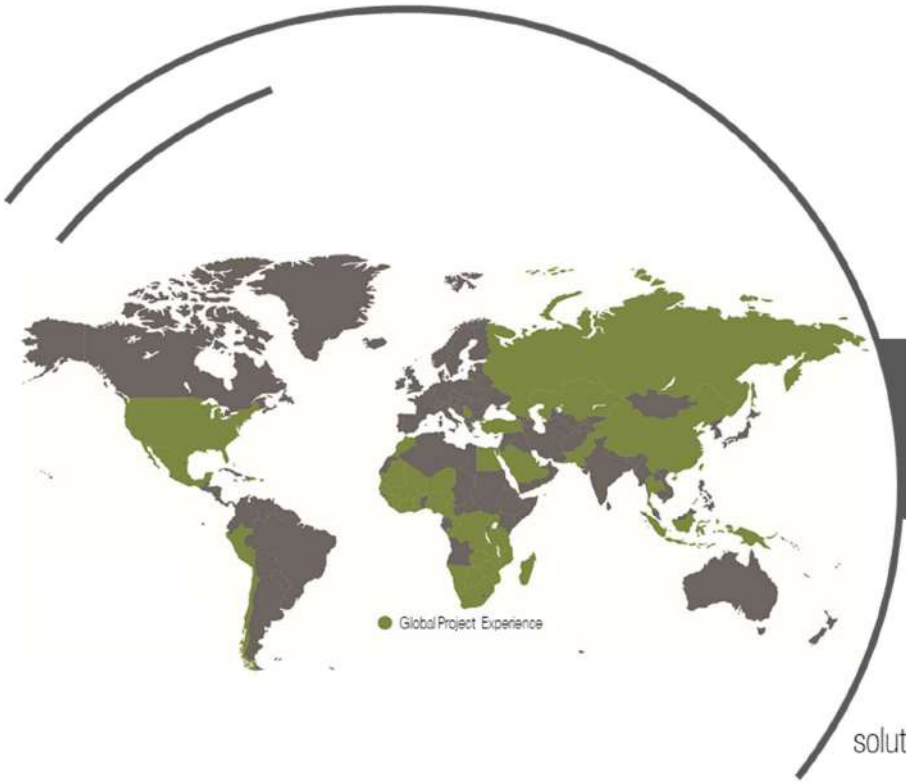


DIGBY WELLS
ENVIRONMENTAL

Your Preferred Environmental and Social Solutions Partner

Providing innovative and sustainable solutions throughout the resources sector

Proposed Arnot South Coal Mining Project, Situated near Hendrina, Mpumalanga Province

Draft Scoping Report

Prepared for:
Exxaro Coal Mpumalanga (Proprietary) Limited

Project Number:
UCD6802

January 2021

Digby Wells and Associates (South Africa) (Pty) Ltd
Company Registration: 2010/008577/07

Turnberry Office Park,
Digby Wells House.
48 Grosvenor Road,
Bryanston,2191

Phone: +27 (0) 11 789 9495
Fax: +27 (0) 11 789 9495
E-mail: info@digbywells.com
Website: www.digbywells.com

This document has been prepared by Digby Wells Environmental.

Report Type:	Draft Scoping Report
Project Name:	Proposed Arnot South Coal Mining Project, Situated near Hendrina, Mpumalanga Province
Project Code:	UCD6802

Name	Responsibility	Signature	Date
Modiegi Monaledi	Report Compiler		November 2020
Xan Taylor	1st Reviewer		November 2020
Barbara Wessels	2nd Reviewer		November 2020

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner (EAP) must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE SCOPING PROCESS

The objective of the scoping process is, through a consultative process, to: -

- identify the relevant policies and legislation relevant to the activity;
- motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking process;
- identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;
- identify the key issues to be addressed in the assessment phase;
- agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and
- identify suitable measures to avoid, manage, or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Introduction

Exxaro Coal Mpumalanga (Pty) Ltd (hereafter Exxaro or the Applicant) is applying for environmental authorisations required for the proposed Arnot South Underground Coal Mining Project (hereafter Arnot South Project). Exxaro held a Prospecting Right [Reference No. MP 30/5/1/1/2/360 PR] to mine coal on various farms covering approximately 16,000 hectares (ha) in extent.

The Prospecting Right was renewed in September 2017 and lapsed on 10 September 2020. However, a Mining Right Application (MRA) and Mine Works programme (MWP) for underground mining were submitted to the Department of Mineral Resources and Energy (DMRE) on 8 September 2020. The Applicant was issued reference number MP 30/5/1/2/2/10292 MR.

The Mining Right boundary includes the following farms:

- Groblersrecht 175 IS
- Mooiplaats 165 IS
- Tweefontein 203 IS
- Vaalwater 173 IS
- Weltevreden 174 IS
- Nooitgedacht 493 JS
- Leeuwpan 494 JS
- Schoonoord 164 IS
- Vlakfontein 166 IS
- Vryplaats 163 LQ
- Helpmakaar 168 IS
- Op Goeden Hoop 205 IS
- Klipfontein 495 JS

The target area for mining and mining-related infrastructure lies mainly on the farms Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS. The farms are located within the jurisdictions of Steve Tshwete Local Municipality (STLM) and Chief Albert Luthuli Local Municipality (CALLM), situated in the Nkangala District Municipality (NDM) and Gert Sibanda District Municipality (GSDM), respectively, in the Mpumalanga Province.

The proposed development triggers Listed Activities in terms of the Environmental Impact Assessment (EIA) Regulations, 2014 (GN R 982 of 4 December 2014 as amended by GN R326 of 7 April 2017) (EIA Regulations, 2014), as amended, promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). Digby Wells Environmental (hereafter Digby Wells) is the appointed Environmental Assessment Practitioner (EAP) to undertake the environmental applications in support of the proposed Project.

Exxaro is applying for the following authorisations and licences, which are required prior to the commencement of mining operations:

- An Environmental Authorisation (EA) in terms of the NEMA;
- A Waste Management Licence (WML) in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA); and
- An Integrated Water Use Licence (IWUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA).

Project Applicant

The details of the Project Applicant are included in the table below.

Company name:	Exxaro Coal Mpumalanga (Proprietary) Limited
Contact person:	Mr Tsheko Ratsheko
Physical address:	The Connexxion, 263B, West Avenue, Die Hoewes, Centurion
Telephone:	012 307 3000
Email:	Tsheko.Ratsheko@exxaro.com

Project Overview

The proposed Arnot South Project is located within the Witbank Coalfield of Mpumalanga Province. The Project area lies on the eastern margin of the Witbank Coalfield and comprises sediments of the coal-bearing Ecca Group of the Karoo Basin. The Witbank Coalfield falls within the Vryheid Formation of the Ecca Group. Exxaro proposes to extract coal through underground mining methods with a confirmed Life of Mine (LoM) of 17 years. The mineral reserve consists of one economically mineable underground block (No. 2 coal seam), producing approximately 2.4 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal for approximately 17 years. Further drilling will be required to confirm a resource to the south of the Mining Right area. The potential future resource of the remaining ROM coal is approximately 32,912,300 tonnes, allowing an additional mining period of approximately 13 years.

The proposed infrastructure required includes the following:

- Adit/ Boxcut;
- Medical facility;
- Temporary guardhouse;
- Workshop;
- Vehicle wash bay;
- Laundry facility;

- Site access (perimeter fencing & gates);
- Possible laydown area;
- Substation;
- Weighbridges;
- ROM stockpiles;
- Vent shaft;
- Discard facility;
- Topsoil stockpiles;
- Overburden stockpiles;
- Fuel dispensary/storage;
- Conveyors;
- Offices;
- Stores;
- Brake-test ramp;
- Stormwater management infrastructure;
- Pollution Control Dam (PCD);
- Washing plant;
- Potable water tank;
- Water storage tank and booster;
- Ventilation shafts (including fans);
- Sewage Treatment Plant;
- Change-house;
- Salvage yard;
- Coal Handling and Processing Plant (CHPP);
- Powerline/s;
- Pipelines;
- Parking area;
- Water Treatment Plant (WTP);
- New 3.0 km access road; and
- Road infrastructure (district road 15 km upgrade).

Purpose of this Report

A Scoping Report forms part of the EIA process and aims to identify those biophysical and socio-economic issues or concerns that require investigation as well as determine feasible alternatives. This information is then used to determine the scope of work for the EIA Phase of the S&EIA process. During the Scoping Phase, people interested or affected by the Project are informed of the proposed development as well as provided the opportunity to raise issues and concerns. Therefore, the purpose of this Draft Scoping Report is:

- To provide a description of the proposed Project and its activities;
- To provide a high-level description of the baseline environment;
- To predict potential impacts as a result of the Project and its activities;

- To provide a detailed plan of study for the EIA Phase; and
- To share Project information with Interested and Affected Parties (I&APs) and to record comments and issues raised.

Environmental Consultants

Digby Wells is the appointed independent EAP to undertake the EIA Process, IWULA process, associated specialist studies and the required public participation process for the proposed Arnot South Project. The details of the EAP are contained in the table below.

Company name:	Digby Wells and Associates (South Africa) (Pty) Ltd
Contact person:	Xan Taylor
Physical address:	Digby Wells House, 48 Grosvenor Road, Bryanston, Johannesburg, 2191
Telephone:	011 789 9495
Email:	Xan.Taylor@digbywells.com

Approach and Methodology for the Public Participation Process

A public participation process as per the EIA Regulations, 2014 (as amended), has been initiated. The public participation process is central to the investigation of environmental and social impacts, as any stakeholder who is affected by the Project is given an opportunity to comment, raise concerns and contribute to ensure that local knowledge, needs and values are understood and taken into consideration throughout the process.

This Draft Scoping Report is available for public comment for a period of 30 days and all comments or concerns raised will be recorded and responded to in the Comments and Responses Report (CRR). The 30-day comment period will commence from **22 January 2021 to 24 February 2021**.

The following activities were undertaken to announce the Project and initiate the Scoping Phase:

- A Background Information Document (BID) was distributed via email on **22 January 2021**;
- Newspaper advertisement was placed in the Middelburg Observer and Witbank News;
- An announcement letter and including a registration form was distributed to identified I&APs via email on **22 January 2021**;
- Site notices were placed around the site on **21 January 2021**; and
- An electronic copy can be accessed and downloaded from the Digby Wells website www.digbywells.com (Public Documents), and our data-free service portal. ***Due to COVID-19 Regulations, no hard copies were made available.***

Project Alternatives

The alternatives considered in this report include location, mining method, technology and the "No-Go" alternative (the option of not proceeding with the Project).

Environmental Baseline

The Project area is characterised by warm, rainy summers and dry winters with sharp frost. The geology falls within the Karoo Basin and are overlain by the Karoo Super Group. The dominant soil forms include Avalon, Cartref, Clovelly, Glencoe, Glenrosa, Hutton, Katspruit, Kroonstad, Longlands, Mispah, Rensburg and Wasbank.

The Project area is situated within the Eastern Highveld Grassland. The biome is rich in flora and fauna diversity but is under threat due to agricultural activities, expansion of mining and industrial activities within the Province. The Eastern Highveld Grassland is classified as "endangered" on the National List of Threatened Terrestrial Ecosystems and is considered approximately 55% altered. The present land use within the Project area mainly includes cultivated land and grasslands (for grazing). The Project area consists of areas classified as Critically Biodiversity Areas (CBA) Irreplaceable to the north east and south of the Mining Right area. The area is drained by rivers from the Olifants River catchment and the Inkomati River Basin. Major rivers passing through the area include the Klein Olifants River and the Vaalriverspruit. Aquatic environments are negatively impacted by mining and agricultural activities in the vicinity of the Project area. The Project area comprises channelled valley bottom, seep, depression and flat National Freshwater Ecosystem Priority Areas (NFEPA) wetlands. Low-lying wetlands, where groundwater levels are close to the surface, can indicate interaction between groundwater and surface water and can also serve as conduits for potential contamination. Activities associated with the proposed Arnot South Project may have significant impacts on the receiving watercourses.

Potential impacts of the proposed Arnot South Project on the baseline environment have been identified and can be summarised as follows:

- Potential increase in ambient noise levels;
- Potential increase in ambient dust levels;
- Loss of agricultural land where the shaft position has been located;
- Soil erosion and compaction;
- Habitat loss and impact on biodiversity;
- Possible contamination of ground and surface water;
- Potential loss of wetland integrity and functionality;
- Potential visual disturbances; and
- Potential loss of heritage and cultural aspects.

Conclusions and Recommendations

The depth of the economically viable seam to mine (No. 2 coal seam) varies between 10 m to 100 m below the surface. Based on this, Digby Wells has determined high-risk areas (areas at high risk of subsidence), which correlate with the shallowest sections of the seam. The extent of the high-risk areas comes to approximately 5,202 ha. Subsidence may result in water levels rising due to flooding of the underground mine void, potentially contaminating shallower aquifers. In addition, subsidence may also promote surface decant in lower areas through induced fracturing. Further drilling and stability of the area is required to understand the risk of subsidence in the proposed mining areas.

Due to the extent of the Irreplaceable CBA, potential occurrence of certain Species of Conservation Concern (SCC) and numerous wetlands within the Mining Right area, the Project area will need to be assessed due to potential impacts such as habitat loss, habitat fragmentation, alien invasive plants proliferation and loss of faunal and floral SCC. Through the preliminary assessment of the baseline environment, groundwater and wetland aspects may be the most negatively impacted environments as a result of the Project.

Based on the findings of the Scoping Phase, no fatal flaws or highly significant impacts were identified that would necessitate substantial redesign or termination of the Arnot South Project. The significance of impacts identified during the preliminary assessment of the baseline environment can be greatly reduced with the implementation of mitigation and management measures. There are, however, several anticipated impacts that will require a more detailed investigation and assessment. Digby Wells will assess these impacts in more detail during the EIA Phase and present the findings in the EIA Report. Mitigation and management measures will also be identified during this Phase.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF PLANS

LIST OF ABBREVIATIONS

ABA	Acid-Base Accounting
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AIPs	Alien Invasive Plants
AMD	Acid Mine Drainage
ARWP	Ash Return Water Pond
BID	Background Information Document
CALLM	Chief Albert Luthuli Local Municipality
CBAs	Critical Biodiversity Areas
CHPP	Coal handling and processing Plant
CR	Critically Endangered
CRR	Comments and Response Report
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
Digby Wells	Digby Wells Environmental
DMRE	Department of Mineral Resources and Energy
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
ECA	Environmental Conservation Act, 1989 (Act No. 73 of 1989)

ECO	Environmental Control Officer
EFC	Early Farming communities
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Programme
EN	Endangered
ESA	Early Stone Age
ESAs	Ecological Support Areas
ET	Evapotranspiration
Exxaro	Exxaro Coal Mpumalanga (Pty) Ltd
FEPAs	Freshwater Ecological Priority Area
FRAI	Fish Response Assessment Index
FROC	Frequency of Occurrence
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GPS	Global Positioning System
GSDM	Gert Sibande District Municipality
ha	Hectares
HDPE	High-Density Polyethene-Lined
HGM	Hydro-geomorphic Unit
HIA	Heritage Impact Assessment
I&APs	Interested and Affected Parties
IBAs	Important Bird Areas
IHI	Index for Habitat integrity
IUCN	International Union for Nature Conservation
IWULA	Integrated Water Use Licence Application
IWWMP	Integrated Water and Waste Management Plan
Km	kilometres
km^2	Square kilometres
KV	Kilovolt
kWhr	Kilowatt-hour
LC	Least Concern

LFC	Late Farming Communities
LoM	Life of Mine
LSA	Later Stone Age
m	metres
m/s	Metres per second
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MBCP	Mpumalanga Biodiversity Conservation Plan
MBSP	Mpumalanga Biodiversity Sector Plan
MIPI	Midgley and Pitman
MIRAI	Macroinvertebrate Response Assessment Index
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Right Application
MTPA	Mpumalanga Tourism and Parks Agency Act, 2005 (Act No. 5 of 2005)
MSA	Middle Stone Age
MVA	Megavolt Amperes
MW	Mega Watt
MWP	Mine Works Programme
mya	million years ago
NAAQS	National Ambient Air Quality Standards
NAG	Net Acid Generation
NBA	National Biodiversity Assessment
NCR	Noise Control Regulations Act, 1989 (Act 73 of 1989)
NDM	Nkangala District Municipality
NE	Near Endangered
NEM: AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEM: BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEM: WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)

NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Fresh Water Priority Areas
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NID	Notification of Intent to Develop
NT	Near Threatened
NVP	net present value
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PCD	Pollution Control Dam
PES	Present Ecological Status
PFC	Power Factor Correction
PHRA-G	Provincial Heritage Resources Authority of Gauteng
PIA	Palaeontological Impact Assessment
POSA	Plants of South Africa
PRECIS	Pretoria Computerised Information System
QDSs	Quarter Degree Squares
ROM	Run of Mine
SABAP	South African Bird Atlas Project
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SAIAB	South African Institute of Aquatic Biodiversity
SANBI	South African National Biodiversity Index
SANParks	South African National Parks
SANS	South African National Standards
SASS5	South African Scoring System Version 5
SAWS	South African Weather Service
SCC	Species of Conservation Concern
SDF	Spatial Development Framework
SIA	Social Impact Assessment
SLP	Social and Labour Plan
STLM	Steve Tshwete Local Municipality
SWMP	Stormwater Management Plan
TC	Total Concentration

TCT	Total Concentration Threshold
TDS	Total Dissolved Solids
TPM	Tonnes Per Month
USEPA	United States Environmental Protection Agency
Vu	Vulnerable
WMA	Water Management Area
WML	Waste Management Licence
WRC	Water Research Commission
WWF	Worldwide Fund for Nature
XRD	X-Ray Diffraction
XRF	X-Ray Fluorescence

1 Introduction

Exxaro Coal Mpumalanga (Pty) Ltd (hereafter Exxaro or the Applicant) is applying for environmental authorisations required for the proposed Arnot South Underground Coal Mining Project (hereafter Arnot South Project). Exxaro held a Prospecting Right [Reference No. MP 30/5/1/1/2/360 PR] to mine coal on various farms covering approximately 16,000 (ha) in extent.

The Prospecting Right was renewed in September 2017 and lapsed on 10 September 2020. However, a Mining Right Application (MRA) and Mine Works programme (MWP) for underground mining were submitted to the Department of Mineral Resources and Energy (DMRE) prior to the lapsing date (on 8 September 2020). The Applicant was issued reference number MP 30/5/1/2/2/10292 MR.

The Mining Right boundary includes the following farms:

- Groblersrecht 175 IS
- Mooiplaats 165 IS
- Tweefontein 203 IS
- Vaalwater 173 IS
- Weltevreden 174 IS
- Nooitgedacht 493 JS
- Leeuwpan 494 JS
- Schoonoord 164 IS
- Vlakfontein 166 IS
- Vryplaats 163 LQ
- Helpmakaar 168 IS
- Op Goeden Hoop 205 IS
- Klipfontein 495 JS

The target area for mining and mining-related infrastructure lies mainly on the farms Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS. The farms are located within the jurisdictions of Steve Tshwete Local Municipality (STLM) and Chief Albert Luthuli Local Municipality (CALLM), situated in the Nkangala District Municipality (NDM) and Gert Sibanda District Municipality (GSDM), respectively, in the Mpumalanga Province.

The mineral reserve consists of one economically mineable underground block (No. 2 coal seam), producing approximately 2.4 Million tonnes per annum (Mtpa) of Run of Mine (ROM) coal for approximately 17 years. Further drilling will be required to confirm a resource to the south of the Mining Right area. The potential future resource of the remaining ROM coal is approximately 32,912,300 tonnes, allowing an additional mining period of approximately 13 years. This application considers the use of underground board-and-pillar mining with continuous miners due to the depth and thickness of the reserve.

The proposed development triggers Listed Activities in terms of the Environmental Impact Assessment (EIA) Regulations, 2014 (GN R 982 of 4 December 2014 as amended by GN

R326 of 7 April 2017) (EIA Regulations, 2014), as amended promulgated under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). Digby Wells Environmental (hereafter Digby Wells) is the appointed Environmental Assessment Practitioner (EAP) to undertake the environmental applications in support of the proposed Project.

Exxaro is applying for the following authorisations and licences, which are required prior to the commencement of mining operations:

- An Environmental Authorisation (EA) terms of the NEMA;
- A Waste Management Licence (WML) in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA); and
- An Integrated Water Use Licence (IWUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA).

This Scoping Report has been compiled in support of both the NEMA and NEM: WA applications and will also form basis for the EIA, and the Environmental Management Programme (EMPr).

2 Project Applicant

This section provides the details of the Project applicant as well as the EAP.

2.1 Details of the Applicant

Table 2-1 provides the contact details of the Applicant.

Table 2-1: Contact Details of the Applicant

Name of Applicant:	Exxaro Coal Mpumalanga (Proprietary) Limited
Registration number (if any):	1999/010289/07
Trading name (if any):	N/A
Responsible Person : ***(E.g. CEO, Director, etc.)***	Mr Tsheko Ratsheko
Contact person:	The Connexxion, 263B, West Avenue, Die Hoewes, Centurion
Physical address:	The Connexxion, 263B, West Avenue, Die Hoewes, Centurion
Postal address:	The Connexxion, 263B, West Avenue, Die Hoewes, Centurion
Postal code:	0163

Telephone:	012 307 3000	**Fax:**	-
Email:	Tsheko.Ratsheko@exxaro.com		

2.2 Item 2(a)(i): Details of EAP

Digby Wells has been appointed by Exxaro to undertake the environmental applications in support of the proposed Arnot South Project.

Table 2-2: Contact details of the EAP

Name of EAP:	Xan Taylor		
Contact person: *(if different from EAP)*	Xan Taylor		
Company:	Digby Wells and Associates (South Africa) (Pty) Ltd		
Physical address:	48 Grosvenor Road, Turnberry Office Park, Digby Wells House, Bryanston		
Postal address:	Private Bag X10046 Randburg		
Postal code:	2125	**Cellphone:**	-
Telephone:	011 789 9495	**Fax:**	011 069 6801
Email:	xan.taylor@digbywells.com		

2.2.1 Item 2(a)(ii): Expertise of the EAP

This section provides the qualifications and experience of the EAP for the proposed Project. The EAPs Curriculum Vitae and Degrees are attached in Appendix A.

2.2.1.1 *Qualifications of the EAP*

Ms Xan Taylor holds the following degrees/diplomas:

- BA Honours Environmental Management – University of South Africa (2013)
- BA English and Psychology – University of South Africa (2009)

2.2.1.2 *EAP Experience*

Xan Taylor started working as a Consultant in 2012 and joined Digby Wells in 2015. She has eight years' experience. The majority of Xan's experience pertains to the mining sector applying for applications governed by the NEMA for both the 2010 and 2014 Regulations thereunder, the MPRDA, the NWA, as well as international legislation; International Finance Corporation Performance Standards and World Bank Guidelines. Her experience comprises managing integrated mining applications: compiling application forms, Basic Assessment reports, Scoping reports, Environmental Impact Assessment reports, Environmental Management Programmes, international Environmental and Social Impact Assessments,

NEMA Regulation 29 and Regulation 31 Amendment reports, Section 102 Amendment reports, exemption applications, Appeal processes, and auditing.

3 Item 2(b): Description of the property

The Arnot South Project is situated approximately 10 km east of the town of Hendrina, 25 km west of Carolina, and 50 km southeast of Middelburg in the Mpumalanga Province of South Africa. The proposed Project is close to two of Eskom's operating power stations; Hendrina (25 km) and Arnot (5 km).

The N11 national road runs east of the proposed Project area in a north to south direction. The R38 provincial road runs across the southern part of the Project area in a west to east direction. The R33 provincial road runs to the east of the Project area in a north to south direction, and the N4 national road runs north of the Project in a west to east direction.

There are five farm homesteads situated within the planned underground mining area, and a small watercourse runs in a north-eastern direction across the northern half of the mining area. The land is currently mainly used for game farming. Table 3-1 provides a summary of the properties that are found within the Mining Right area (i.e. mining affected farms and those earmarked for future mining). The target area for mining and mining-related activities lie mainly on the farms Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS. All the necessary mine infrastructure for the Arnot South Project shall be placed on the farm Weltevreden 174 IS, which is on the southern part of the mining layout area.

Refer to Figure 3-1 for the Land Tenure Map (also attached in Appendix C as Plan 1).

Table 3-1: Property Description

<table>
<tr><td>Farm Name:</td><td>Mining affected farms:
<table>
<tr><th>Farm Name</th><th>Farm Portion</th></tr>
<tr><td>Weltevreden 174 IS</td><td>• Remainder of Portion 2;
• Portion 1;
• Portion 4; and
• Remainder.</td></tr>
<tr><td>Mooiplaats 165 IS</td><td>• Remainder of Portion 13;
• Remainder of Portion 14;
• Portion 11;
• Portion 12;
• Portion 13;
• Portion 15; and
• Portion 16.</td></tr>
<tr><td>Vlakfontein 166 IS</td><td>• Portion 2;
• Portion 5;
• Portion 8;
• Portion 9;</td></tr>
</table></td></tr>
</table>

	• Portion 10; • Portion 12; • Remainder of Portion 13; and • Remainder.
Schoonoord 164 IS	Portion 19

Farms earmarked for future mining:

Farm Name	Farm Portion
Groblersrecht 175 IS	• Remainder of Portion1; • Portion 2; • Portion 3; • Portion 4; • Portion 5; • Portion 6; • Portion 7; • Portion 8; and • Remainder.
Tweefontein 203 IS	• Portion 4; • Portion 7; • Portion 8; • Portion 13; • Portion 14; • Portion 18; • Portion 19; • Portion 20; • Portion 21; • Portion 22; • Portion 23; • Portion 24; • Portion 25; • Remainder of Portion 3; • Remainder of Portion 5; • Remainder of Portion 6; • Remainder of Portion 9; • Remainder of Portion 10; • Remainder of Portion 11; and • Remainder of Portion 12.

	Vaalwater 173 IS	• Portion12; • Portion 14; • Portion 21; • Remainder of Portion 2; • Remainder of Portion 10; and • Remainder of Portion 11.
	Nooitgedacht 493 JS	• Portion 4; and • Portion 9.
	Leeuwpan 494 JS	• Remainder; • Portion 7; • Portion 8; • Portion 9; and • Remainder of Portion 4.
	Helpmakaar 168 IS	• Remainder; • Portion5; • Portion 6; • Portion 7; • Portion 8; • Portion 9; • Portion 10; • Portion 11; • Portion 12; • Portion 13; • Remainder of Portion 1; • Remainder of Portion 2; • Remainder of Portion 3; and • Remainder of Portion 4.
	Op Goeden Hoop 205 IS	Remainder of Portion 2
	Klipfontein 495 JS	Portion of Remainder of Portion 6
Application Area (Ha):	Approximately 16,000 ha	
Magisterial District:	Nkangala District Municipality and Gert Sibanda District Municipality	
Distance and direction from nearest town:	50 km southeast of Middelburg	
21-digit Surveyor General Code for each farm portion:	Refer to Appendix B.	

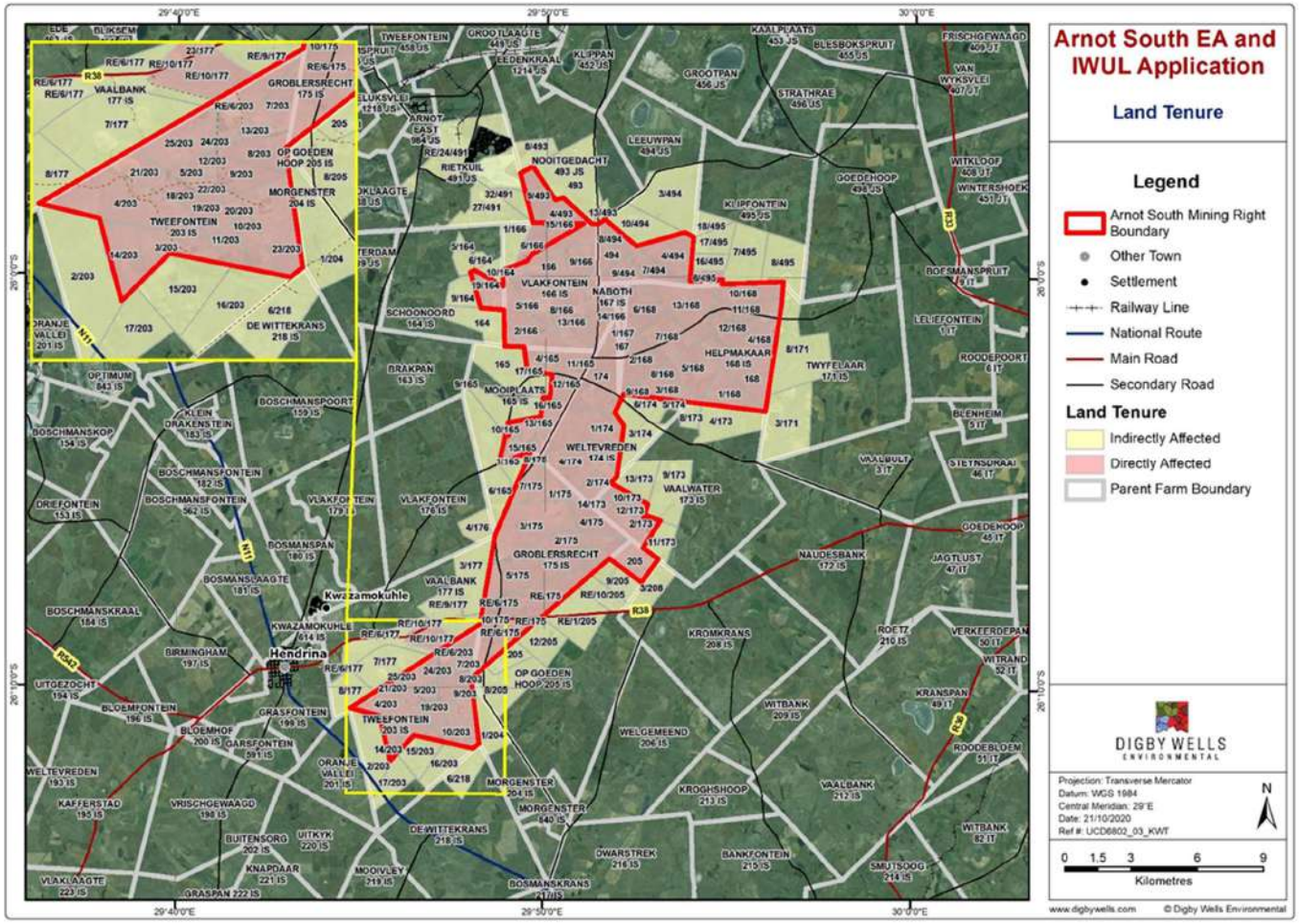


Figure 3-1: Land Tenure Map

4 Item 2(c): Locality map

Figure 4-1 illustrates the regional setting of the Arnot South Project area. The plan is also attached as Plan 2 in Appendix C.

The Project area is situated near the town of Middelburg within two District Municipalities, namely: NDM and GSDM. The area falls within the jurisdiction of STLM and CALLM, located in the Mpumalanga Province. The locality map is depicted in Figure 4-2 (also attached in Appendix C, Plan 3).

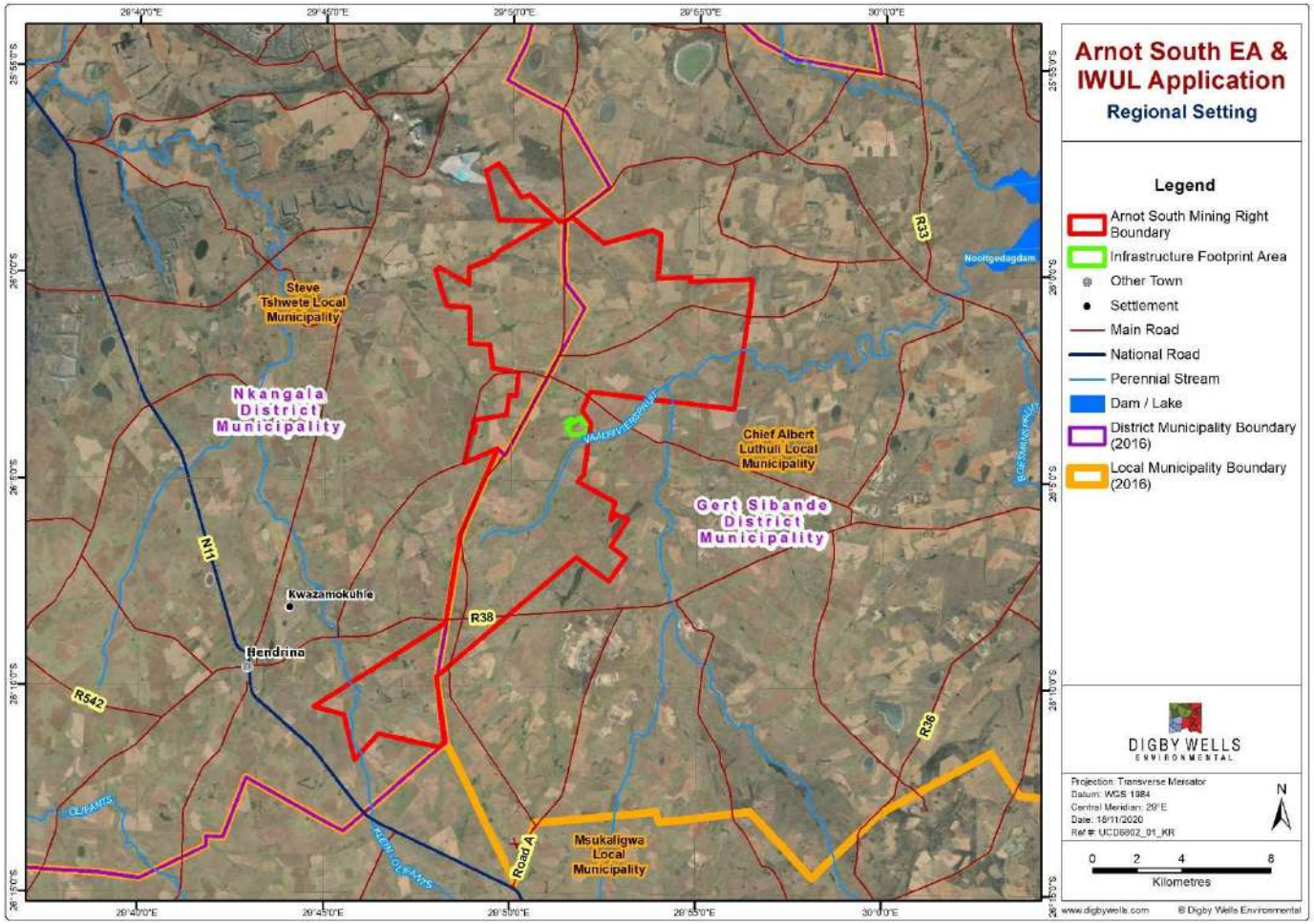


Figure 4-1: Regional setting

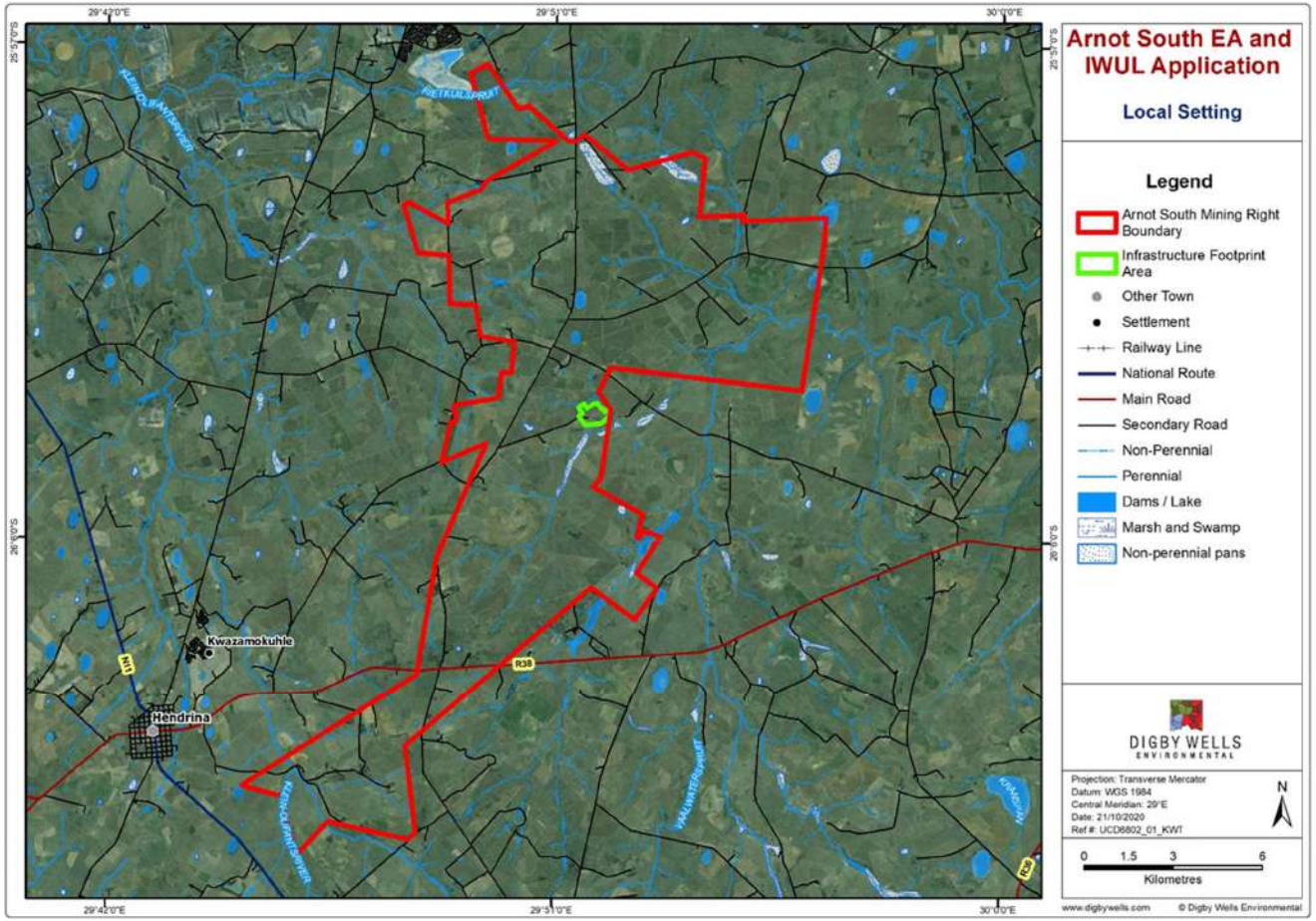


Figure 4-2: Locality map

5 Item 2(d): Description of the scope of the proposed overall activity

The proposed infrastructure layout plan, as shown in Figure 5-1 and Figure 5-2 below, are included in Appendix C as Plan 4 and Plan 5.

For the purpose of the report, the following terms apply:

- **Mining Right area** defines the farms included in the Mining Right boundary as indicated in section 3 above;
- **Project area** defines farm portions directly affected by mining and mining-related infrastructure (i.e. Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS); and
- **Study area** will be determined by each specialist and the zone of influence in terms of potential impact the Project area will have, relevant to the individual specialist fields.

5.1 Item 2(d)(i): Listed and specified activities

Together with the EIA Regulations, 2014 (as amended), the Minister published Regulations in terms of Sections 24 and 24D of the NEMA for Activities that require Environmental Authorisation prior to their commencement.

Activities identified in Listing Notice 1 (GN R 983) require that a Basic Assessment Process be followed when applying for an EA. Activities identified in Listing Notice 2 (GN R 984) require a Scoping and EIA Process to be undertaken.

As indicated in Table 5-1 below, Regulations GN R.983, GN R.984 and GN R.921 will be triggered, and therefore a Scoping and EIA process must be undertaken, and approval received prior to the activities being commended with.

Table 5-1: Listed and Specified Activities

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Establishment of infrastructure Ventilation fans, change houses, offices, ablutions, workshops, cable workshop, weighbridge, weighbridge control room and access control office	Infrastructure footprint - 13.2849 ha	*Not Listed*	-	-
Listing Notice 1				
Construction of access and haulage road *The development of a road-* *(i) for which an environmental* *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres;* *but excluding a road-* *(a) which is identified and included in activity 27 in Listing Notice 2 of 2014;* *(b) where the entire road falls within an urban area; or* *(c) which is 1 kilometre or shorter.*	19 113 m	X-24 *(ii)*	GN R983, under NEMA	-
Pollution control dam *The development of facilities or infrastructure for the off-stream storage of*	1.6078 ha	X- 13	GN R 983 under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
water, including dams and reservoirs, with a combined capacity of 50,000 cubic metres or more, unless such storage falls within the ambit of activity 16 in Listing Notice 2 of 2014.				
Raw water pipeline *The development of infrastructure exceeding 1000 metres in length for the bulk transportation of water or storm water-* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or* *(b) where such development will occur within an urban area.*	TBC during the EIA phase	X-9 (i) and /or (ii)	GN R983 under NEMA	-
Process water *The development and related operation of infrastructure exceeding 1 000 metres*	Pipeline Bowser 44 m Pipeline Bulk Water 44 m	X-10 (i) and or (ii)	GN R 983 under NEMA	-

Name of Activity	Areal extent of the activity		Listed Activity	Applicable Listing Notice	Waste Management Authorisation
in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes- *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or* *(b) where such development will occur within an urban area.*	Pipeline Drainage Pipeline Fire Water Pipeline New Pipeline Potable Water Pipeline Process Water Pipeline Return Water Pipeline Sewer	2 m 1 894 m 5 m 1618 m 878 m 890 m 855m			

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Operating sewage treatment plant *The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes-* *(i) with an internal diameter of 0,36 metres or more; or* *(ii) with a peak throughput of 120 litres per second or more;* *excluding where-* *(a) such infrastructure is for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or* *(b) where such development will occur within an urban area.*	18.3168 m (combination of two delineations)	X-10	GN R 983	GN R 921 under NEM: WA Category B 4 (10)
Power line construction *The development of facilities or infrastructure for the transmission and distribution of electricity-*	22kV line, 2.3 km long	X- 11	GN R983, under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or *(ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more*				
Listing Notice 2				
Site/vegetation clearance *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan*	52.281385 ha	X-15	GN 984, under NEMA	-
Mining of coal by underground mining *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including-* *(a) associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource; or*	5 050.83 ha	X- 17	GN R 984 under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing.				
Infrastructure construction *Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including-* *(a) associated infrastructure, structures and earthworks directly related to the extraction of a mineral resource; or* *(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing;* *but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.*	51 501 m (linear infrastructure)	X- 17	GN R 984, under NEMA	-

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
Diesel storage and explosive magazine *The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.*	TBC during the EIA phase	X- 4	GN R 984 under NEMA	
Water Use Licence *The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent*	Inclusive of all water management infrastructure on site.	X- 6	GN R 984 under NEMA	GN R 921 under NEM: WA Category B 4 (11)
Sewage treatment plant *The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15 000 cubic metres or more.*	TBC during the EIA phase	X-25	GN R 984 under NEMA	
Waste Activities				
Sewage treatment plant, pollution control dam	Sewage treatment plant - 0.0084 ha	Category B 4 (10)	GN R 921 under NEM: WA	Yes

Name of Activity	Areal extent of the activity	Listed Activity	Applicable Listing Notice	Waste Management Authorisation
The construction of a facility for a waste management activity listed in Category B of this Schedule	Pollution control dam 1.6078 ha			
Rock removal (blasting) and stockpiling (rock dumps, soils, ROM, and discard dump) *The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).*	Discard dump 2 946 ha Overburden stockpile 13 716 ha	Category B 4 (7), (10) & (11)	GN R 921 under NEM: WA	Yes

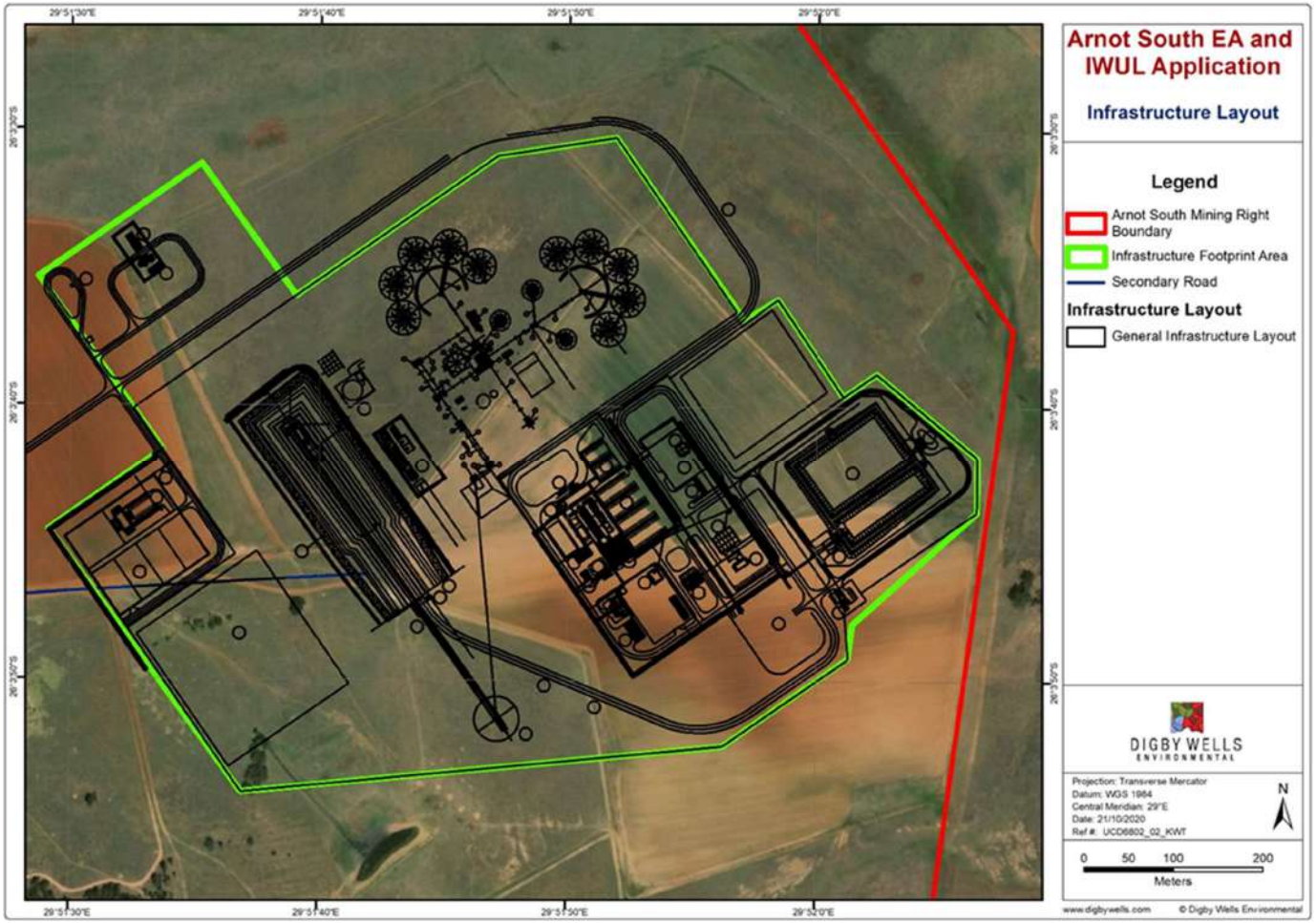


Figure 5-1: Preliminary Infrastructure Layout Plan

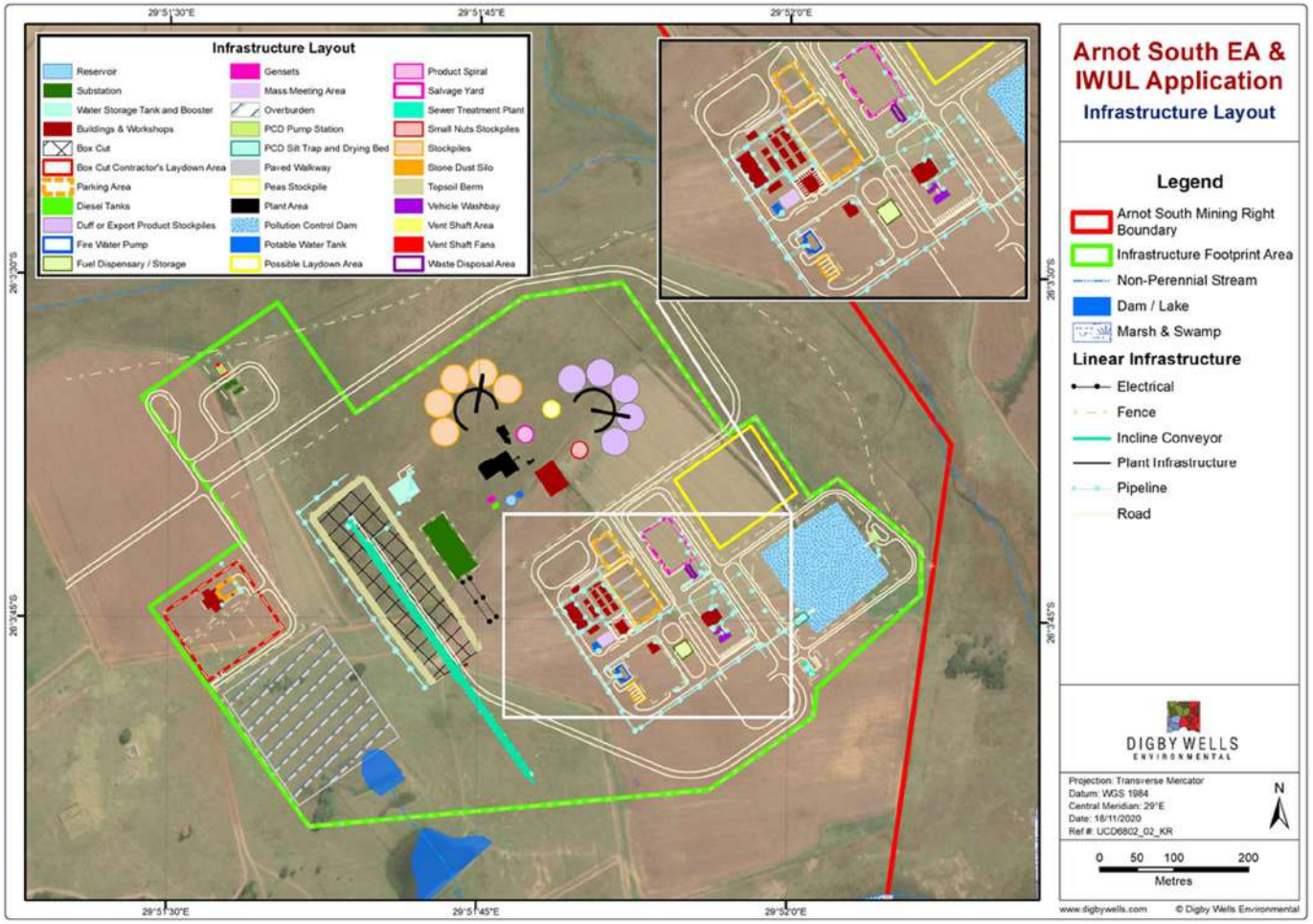


Figure 5-2: Detailed Mining-Related Infrastructure

5.2 Description of the activities to be undertaken

5.2.1 Mineral Deposit and Resource Reserve

The Arnot South Project is located on the eastern margin of the Witbank Coalfield, and is comprised of sediments of the coal bearing Ecca Group of the Karoo Basin (Arnot South MWP, 2020). The Witbank Coalfield falls within the Vryheid Formation of the Ecca Group and comprises of five coal seams that are referred to as No.1 to No. 5 coal seam from bottom to top and these are contained within a succession of some 70 m to 75 m in thickness. The No. 2 coal seam is the most economically exploitable coal seam of the Coalfield and contains hard, dull to lustrous coal with several bright coal bands and occasional stone partings. The basement floor and local surface topography determine the depth to the top of the No. 2 coal seam and reaches an average depth of around 45 m in the lease area. Minimum depth in the sub-outcrops is around 10 m to 20 m, and maximum depths are around 110 m to the south. Figure 5-3 below, extracted from Arnot South MWP (2020), shows the depth distribution. Based on this, Digby Wells has determined high-risk areas, which correlate with the shallowest sections of the seam. The extent of the high-risk areas comes to approximately 5,202 ha. The thickness of the No. 2 coal seam at Arnot South varies from 0.5 m to 5.0 m, averaging 1.65 m and is generally thickest in the central portion of the basement low/channel.

The quantity of coal to be extracted from the proposed underground mine is approximately 2.4 Mtpa of ROM coal product for 17 years. Further drilling will be required to confirm a resource to the south of the Mining Right area. The potential future resource of the remaining ROM coal is approximately 32,912,300 tonnes, allowing an additional mining period of approximately 13 years. The coal product will be sold to various markets (i.e. Eskom and Richards Bay Coal Terminal).

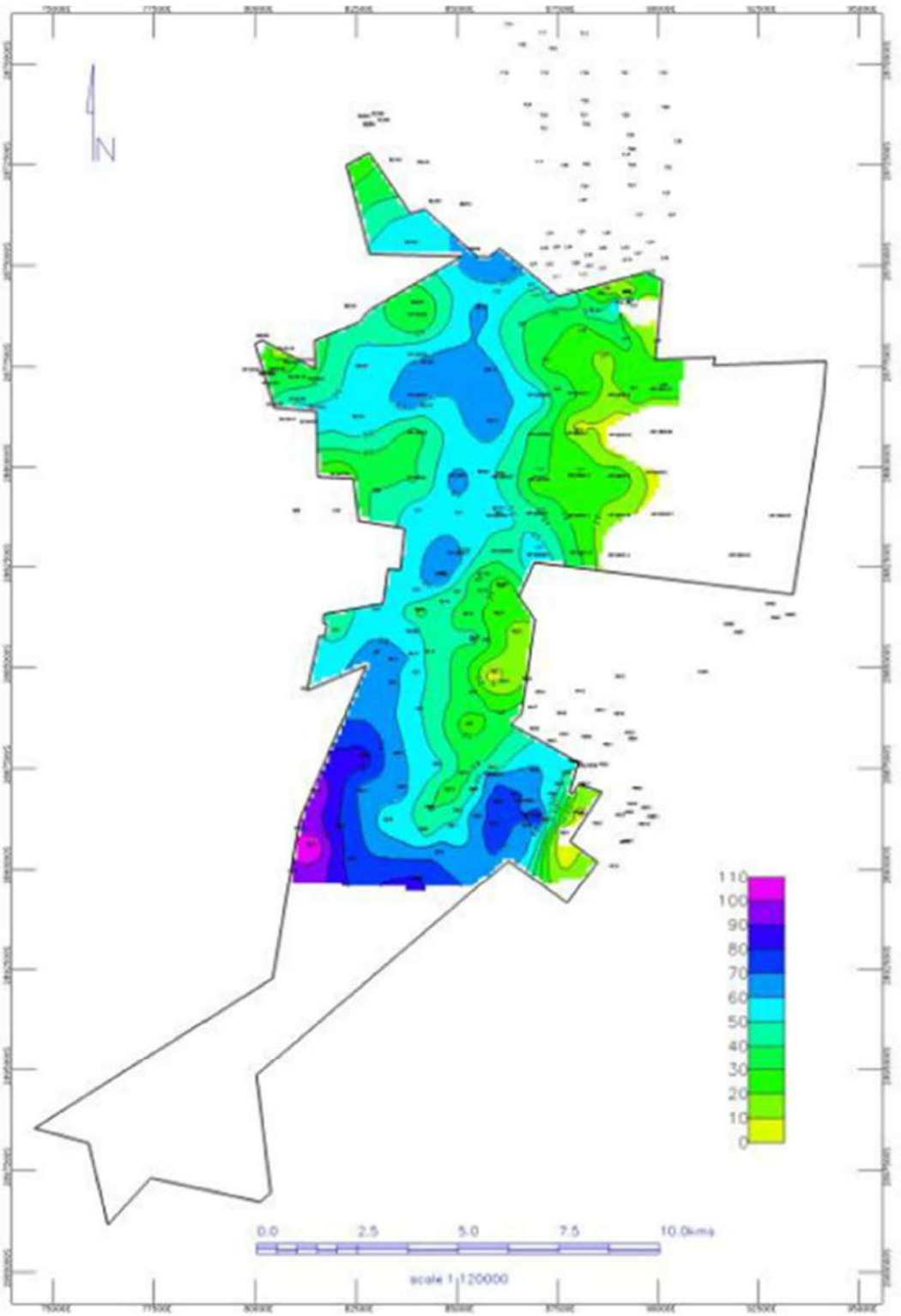


Figure 5-3: Seam Elevation (Source: Arnot South Mining Works Programme, 2020)

5.2.2 Mining Method

Due to the depth and thickness of the No. 2 coal seam, the Arnot South resource area shall be mined by underground mining methods. Underground bord and pillar mining utilising continuous miners and shuttle cars is considered as the optimal mining method for the mining of the initial reserve. The mining of the initial reserve on which the mining is planned consists of one economically mineable underground block (No. 2 coal seam). Mining shall commence on the south-eastern end of the block from where the underground mining shall develop northwest. The No. 2 coal seam shall be accessed via a boxcut located at the south-eastern end of the planned mining layout. An eight-degree ramp, 8.0 m wide, shall give access into the box cut and to the underground entrance portals. The inclination of the ramp shall allow rubber-wheeled equipment to travel up and down the ramp unassisted. The basis of the selected position of the boxcut is on the most practical underground mining layout with the least conveyor belt transfer points.

The main underground trunk conveyor belt shall run in a north-western direction to the north-western end of the mining layout. Continuous miners shall be deployed to cut and load the ROM coal into shuttle cars. Shuttle cars shall be utilised to deliver the ROM coal to a system of conveyor belts that shall deliver the coal to the surface by a shaft conveyor belt. The ROM coal will be fed into a primary and secondary crusher before being stacked on a coal product stockpile and then transported to the respective markets. The ROM coal shall be processed through a double-stage dense medium washing plant to produce export and Eskom products.

5.2.3 Production and Scheduling

The Arnot South Project shall deploy five continuous miner production sections. The main development panel shall develop in a north-western direction, and as it advances, secondary production panels shall start from the main panel to the left and right on both sides of the main panel.

The planned production rate of the main development production section is 45,000 tonnes per month (tpm). At that production rate, the main panel advance shall be 150 m per month. The production rate shall allow one secondary production panel to become available for mining on each side of the main panel after each month of main panel development. The planned production build-up includes introducing five continuous miner production sections in four months with steady-state production of 200,000 tpm reached in month seven. As indicated above, the initial underground mine has an estimated life of 17 years, producing 2.4 Mtpa of ROM coal. It is anticipated that production shall be consistent right up to end of the current 17-year mine planning.

During the 17 years of planned mining, the Applicant shall conduct additional drilling towards the south of the current underground mining layout. The results of this drilling shall be applied to plan the life extension of Arnot South that shall include additional underground mining of the No. 2 seam and opencast mining of the No. 4 lower and upper coal seam. The total estimated LoM is 30 years (including the assumed resource (No. 2 and No. 4 coal seams) earmarked for mining towards the south of the Mining Right).

5.2.4 Infrastructure associated with the mine

The main infrastructure (Refer to Figure 5-2 above) associated with the proposed Arnot South Project includes, but is not limited to:

- Adit/ Boxcut;
- Medical facility;
- Temporary guardhouse;
- Site access (perimeter fencing & gates);
- Possible laydown area;
- Substation;
- Weighbridges;
- ROM stockpiles;
- Vent shaft;
- Discard facility;
- Topsoil stockpiles;
- Overburden stockpiles;
- Fuel dispensary/storage;
- Conveyors;
- Offices;
- Stores;
- Brake-test ramp;
- Stormwater management infrastructure;
- Workshop;
- Vehicle wash bay;
- Laundry facility;
- Pollution Control Dam (PCD);
- Washing plant;
- Potable water tank;
- Water storage tank and booster;
- Ventilation shafts (including fans);
- Sewage Treatment Plant;
- Change-house;
- Salvage yard;
- Coal Handling and Processing Plant (CHPP);
- Powerline/s;
- Pipelines;
- Parking area;
- Water Treatment Plant (WTP);
- New 3.0 km access road; and
- Road infrastructure (district road 15 km upgrade).

5.2.4.1 *Access Roads*

Access to the Arnot South Project shall be by an existing gravel road that runs from the paved road that links the N4 highway to Hendrina town. The distance along the existing gravel road is 13 km with a short new 3.0 km road that shall be constructed from the existing gravel road.

5.2.4.2 *Contractors Camp and Laydown Areas*

Administrative buildings, workshops and contractor laydown areas will be constructed within the Mining Right boundary. The workshop areas will include bunded storage facilities for waste, fuel, lubricants and other hazardous substances. The bunded storage facilities will be constructed in accordance with the applicable South African National Standards (SANS) codes.

5.2.5 Power Supply

Based on the position of the resource, there is suitable Eskom infrastructure in the immediate vicinity to the site. A high-level review to establish where current 'large power' infrastructure lies, indicates that the Arnot Mine should be the closest point from where power can be sourced for Arnot South. The reticulation concept for the site would comprise the following:

- A continuous connected supply from the national grid, generated, and controlled by Eskom at a 'notified maximum demand' level, and
- Onsite automated standby' power supply generators that would be sufficient to maintain the operation of critical machines, emergency plant operations, and essential lighting and security requirements of the mine site.

Eskom supply distribution at Arnot South shall consist of a switching yard that shall be constructed at the site and comprise of the following:

- A 132/88-kilovolts (kV) supply line connected to the national network, terminated in a distribution yard constructed on the Exxaro property;
- One by 12 megavolt amperes (MVA) 132/88 kV to 11 kV transformer shall connect to the 132/88 kV yard distribution network at the site; and
- The 11 kV terminals from the transformer shall connect to an 11 kV distribution network via the site main intake substation that shall supply power to the site.

The Applicant shall construct an intake the substation adjacent to the Eskom yard that shall house the incoming supply and distribution switchgear supplying the various major plant sections. This substation shall also house the power supply maximum demand and kilowatt-hour (kWhr) metering, surge protection instrumentation, and Power Factor Correction (PFC) equipment.

An earlier power supply point for the early development operations shall be required. The Applicant shall require the erection of a containerised substation to satisfy the supply and

distribution requirement. The equipment installed would be repositioned into the main incomer substation when constructed.

5.2.6 Water Supply

5.2.6.1 *Staff Water Requirements*

The calculation for water requirements for use by the mine staff indicates 200 litres (ℓ) per person per day. The water supply capacity, therefore, must be 42.6 kilolitres (kℓ) per day. The Mine shall establish boreholes to supply water for staff requirements. A small WTP shall be built at the Mine to produce potable water from the borehole water.

5.2.6.2 *Industrial Water Requirements*

All underground water entering the workings from the roof or floor strata shall be pumped to underground dams constructed for this purpose. This water shall be used for dust control underground, and any excess shall be pumped to the PCD on the surface from where it shall be used as make-up water for the CHPP. An additional source of bulk water supply shall be from the now-closed Arnot Colliery underground workings. The washing plant water consumption, required as make-up water, has been estimated to be between 1,000 m^3 to 1,200 m^3 per day. The plant shall be equipped with a filter press and thickener to clarify the plant water for re-use. Effluent from the plant will be pumped to the process water tank for re-use.

5.2.6.3 *Surface Run-off Water*

Run-off water collected from disturbed areas will be routed to the PCD located near the CHPP, utilising a series of diversion berms. The collected water will be used for the mining and treatment processes. All water generated by the mining activities shall be stored in a high-density polyethene-lined (HDPE) PCD and re-used in the washing plant as well as for dust control purposes on the haul roads.

5.2.6.4 *Mine Closure*

The prediction is that the underground workings shall start decanting post-closure and allowance has been made in the capital expenditure and operating cost for a WTP. The WTP shall treat any water that decants from the underground mining areas before release into a natural watercourse. The location of the WTP has not been determined at this point, as current considerations indicate that water treatment shall only be required towards the end of the LoM.

5.2.7 Waste management

General and hazardous waste will be generated as a result of the Arnot South Project. The waste will be handled, separated, stored and disposed of accordingly. The following waste types are anticipated to be generated at the operation:

- General waste;

- Domestic Waste;
- Paper;
- Plastic;
- Cardboard;
- Tins; and
- Glass.

- Hazardous Waste:
  - Hydrocarbon waste such as oily rags as a result from the hydrocarbon stored onsite;
  - Chemical waste from the chemicals that may be utilised for cleaning purposes;
  - Light bulbs (i.e. containing mercury); and
  - Coal refuse and mine water;

It is anticipated that all general waste will either be recycled or disposed of at the local municipality landfill site. Hazardous waste will be removed offsite by a hazardous waste contractor. A safe disposal certificate for the removal of hazardous waste will be retained as proof of safe disposal.

5.2.8 Employment and Recruitment

The Arnot South Project shall be a contractor-operated mine. The planned workforce will consist of 168 permanent employees and contractor employees during the construction and operational phases.

5.2.9 Project Activities

Table 5-2 provides a summary of activities associated with the proposed Arnot South Project that will be further assessed as part of the EIA process.

Table 5-2: Proposed Project Activities

Phase	Activity
Construction	Removal of vegetation / topsoil for establishment of mining and linear infrastructure
	Establishing the box cut
	Diesel storage and explosives magazine
	Construction of infrastructure, and ventilation Shafts.
	Construction of access road and haul roads
	Stockpiling of soils, rock dump and discard dump establishment.
Operational	Ventilation fans and infrastructure area, including stockpile areas and the discard dump
	Underground blasting and operation of the underground workings
	Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.
	Removal of rock (blasting)
	Operating washing plant
	Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste;
	Operating sewage treatment plant;
	Stockpiling and dumping (rock dumps, soils, ROM, discard dump) establishment and operation
	Maintenance activities – throughout the operational phase, maintenance will need to be undertaken to ensure that all infrastructure in operating optimally and does not pose a threat to human or environmental health. Maintenance will include haul roads, pipelines, processing plant, machinery, water and stormwater management infrastructure, and stockpile areas.
	Continue with exploration activities
Decommissioning	Demolition and removal of infrastructure
	Post-closure monitoring and rehabilitation
	Closure of the underground mine

6 Item 2(e): Policy and legislative context

From an environmental and social perspective, the proposed Arnot South Project is required to comply with all the obligations in terms of the provisions of the NEMA and MPRDA. The additional legislative guidelines directing the Project are outlined in further detail in Table 6-1 below.

Table 6-1: Policy and Legislative Context

Applicable legislation and guidelines used to compile the report	Reference where applied
The Constitution of the Republic of South Africa, 1996 Under Section 24 of the Constitution of the Republic of South Africa, 1996 (the Constitution) it is clearly stated that: *Everyone has the right to* *(a) an environment that is not harmful to their health or well-being; and* *(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -* *(i) Prevent pollution and ecological degradation;* *(ii) Promote conservation; and* *(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*	Digby Wells is undertaking an EIA process to identify and determine the potential impacts associated with the Arnot South Project. Mitigation measures recommended will aim to ensure that the potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.
National Environmental Management Act, 1998 (Act No 107 of 1998) and EIA Regulations (as amended in 2017) The Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA), as amended was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be*	Activities associated with the proposed underground mine are identified as Listed Activities in the Listing Notices (as amended) and therefore require environmental authorisation prior to being undertaken. This Scoping Report and proceeding EIA Report will be informed by the requirements of the NEMA and Regulations thereunder.

Applicable legislation and guidelines used to compile the report	Reference where applied
considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity. The EIA Regulation, 2014 was published under GN R 982 on 4 December 2014 (EIA Regulations) and came into operation on 08 December 2014. Together with the EIA Regulations, the Minister also published GN R 983 (Listing Notice No. 1), GN 984 (Listing Notice No. 2) and GN R 985 (Listing Notice No. 3) in terms of Sections 24(2) and 24D of the NEMA, as amended. The EIA Regulations have been made applicable to prospecting and mining activities.	
Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002) The MPRDA sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts.	The Applicant has applied for a Mining Right to mine coal on the farms Weltevreden 174 IS, Mooiplaats 165 IS, Vlakfontein 166 IS, and Schoonoord 164 IS. Farm portions have been listed under Section 3. The EIA will be undertaken to meet the requirements of the MPRDA read with the EIA Regulations, 2014 (as amended). Financial Provisioning and Closure Costs will be included in the EIA/EMPr Report.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) On 29 November 2013, the list of waste management activities published under GN R718 of 3 July 2009 (GN R718) was repealed and replaced with a new list of waste management activities under GN R921 of 29 November 2013. Included in the new list are activities listed under Category A, B and C. These activities include inter alia the following: Category A describes waste management activities requiring a Basic Assessment process to be carried out in accordance with the EIA Regulations supporting an application for a waste management licence;	A WML has been applied for due to the nature of mining activities.

Applicable legislation and guidelines used to compile the report	Reference where applied
Category B describes waste management activities requiring an Environmental Impact Assessment process to be conducted in accordance with the EIA Regulations supporting a waste management licence application; and Category C describes waste management activities that do not require a WML but these activities will have to comply with the prescribed requirements and standards as prescribed by the Minister, which includes the Norms and Standards for Storage of Waste, 2013. These activities include the storage of general waste at a facility with a capacity to store in excess of 100 m^3 and storage of hazardous waste in excess of 80 m^3. The Waste Classification and Management Regulations published under GN R 634 of November 2013 require that all wastes be classified according to SANS10234 and managed according to its classification.	
National Water Act, 1998 (Act No. 36 of 1998) (NWA) The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA. GN R 704 was published in June 1999 and aims to regulate the use of water for mining and related activities for the protection of water resources and states the following: • Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution; • Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution; • Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, and	An IWULA and an associated Integrated Water and Waste Management Plan (IWWMP) are required in terms of Section 21 of the NWA for the Arnot South Project. The IWULA and IWWMP will be compiled and submitted to the DWS as the decision-making authority.

Applicable legislation and guidelines used to compile the report	Reference where applied
• Regulation 7 details the requirements necessary for the protection of water resources.	
DWS[1] Best Practice Guideline – G1: Storm Water Management Plan (SWMP) These are guidelines provided by the DWS for the development of a SWMP. The following will be undertaken to develop the conceptual SWMP: • Delineate the clean and dirty area contributing to runoff (based on the final layout plans) and site-specific hydrological assessments to determine volumes that require to be handled. The SWMP should ensure that temporary drainage installations should be designed, constructed, and maintained for recurrence periods of at least a 25-year, 24-hour event, while permanent drainage installations should be designed for a 50-year, 24-hour recurrence period; and • Site specific assessments to establish the appropriate mitigation measures and surface water monitoring programme.	All water management infrastructure will be designed for a 1:100 year, 24 hour rainfall event.
DWS Best Practice Guideline – G4: Impact Prediction The impacts of mine activities on the groundwater environment must be assessed as part of the MRA, as well as for the IWULA. The baseline conditions must be assessed to define the current aquifer systems, groundwater use and groundwater conditions before mine commencement and to determine the extent of possible future impacts on the groundwater resources.	An IWULA and an associated IWWMP are required in terms of Section 21 of the NWA. The IWULA and IWWMP will be compiled and submitted to the DWS as the decision-making authority. The EIA as part of the MRA will assess potential impacts on groundwater resources as a result of the Project.

[1] Previously the Department of Water Affairs (DWA)

Applicable legislation and guidelines used to compile the report	Reference where applied
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) The NEM:BA regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also takes into account the management of alien and invasive species. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: • Alien and Invasive Species Lists, 2014 published (GN R.599 in GG 37886 of 1 August 2014); • National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; and • National list of Ecosystems Threatened and in need of Protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GN R.1002, 9 December 2011).	A Fauna and Flora Impact Assessment will be conducted as part of the EIA Phase.
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) The prevailing legislation in the Republic of South Africa with regards to the Air Quality field is the National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA). According to the Act, the DEA, the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. A fundamental aspect of the new approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS). These standards provide the goals for air quality management plans and also provide the benchmark by which the effectiveness of these management plans is measured. The NEM: AQA provides for the identification of priority pollutants and the setting of ambient standards with respect to these pollutants.	An Air Quality Impact Assessment will be undertaken as part of the EIA Phase. The Project's activities will set out to abide by the NEM: AQA and standards set out in the NAAQS. The required mitigation will be included in the EMPr as part of the EIA Phase.

Applicable legislation and guidelines used to compile the report	Reference where applied
National Dust Control Regulation 2013 The Minister of Water and Environmental Affairs, released on the 01 November 2013 the National Dust Control Regulation, in terms of Section 53, read with Section 32 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA). In the published National Dust Control Regulations, terms like target, action and alert thresholds were omitted. Another notable observation was the reduction of the permissible frequency of exceedance from three to two incidences within a year. The standard actually adopted a more stringent approach than previously and would require dedicated mitigation plans now that it is in force.	An Air Quality Impact Assessment will be undertaken as part of the EIA Phase. The Project's activities will set out to abide by the NEM: AQA and standards set out in the NAAQS. The required mitigation will be included in the EMP as part of the EIA Phase.
National Noise Control Regulations, R.154 of 1992 (the Noise Regulations) promulgated in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989) The National Noise-Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCRs) form part of the Environmental Conservation Act and these Regulations apply to external noise. The NCRs differentiates between Disturbing Noise levels (which is objective and scientifically measurable which are generally compared to existing ambient noise level) and Noise Nuisance (which is a subjective measure and is defined as noise that "*disturbs or impairs or may disturb or impair the convenience or peace of any person*"). Local Authorities use Controlled Areas to identify areas with high noise levels. Restrictions have been set out for development that occurs in these Controlled Areas. These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication.	A Noise Impact Assessment, including modelling, impacts and proposed mitigation measures will be undertaken for the EIA Phase. Over and above the requirements set out in the NCR, a Blast Impact Assessment will also be undertaken.

Applicable legislation and guidelines used to compile the report	Reference where applied
As such, a Noise Impact Assessment in accordance with the NCRs must be undertaken for submission to determine the potential disturbing and nuisance noise levels associated with a particular development.	
The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Provincial Heritage Resources Authority of Gauteng (PHRA-G), be notified as early as possible of any developments that may exceed certain minimum thresholds. This act is enforced through the National Heritage Regulations GN R 548 (2000).	For the Scoping Phase, a Notice of Intent to Develop (NID) was submitted to SAHRA. A Heritage Impact Assessment will form part of the EIA Phase.
GN R 1147 (Financial Provisioning Regulations), 2015 The Financial Provisioning Regulations prescribe methods for determining the quantum of financial provision for rehabilitation and mechanisms for providing for it. Section 41 (1) of the MPRDA has been repealed and Section 24P of the NEMA, as amended, which provides that the holder of a mining right must make financial provision for rehabilitation of negative environmental impacts. The financial provision must guarantee the availability of sufficient funds.	The Financial Provisioning Regulations are applicable to rehabilitation and closure plans as they prescribe the minimum content of an annual rehabilitation plan and the minimum content of a final rehabilitation, decommissioning and mine closure plan. This will be finalised and included in the EIA Report.
GN R 527 (MPRDA Regulations), 2004 Regulation 527 (GN R. 527) specifies that the EMP must include environmental objectives and specific goals for mine closure. The applicant for a mining right must make prescribed financial provision for the rehabilitation or management of negative environmental impacts, which must be reviewed annually. R527 provides specific principles for mine closure including safety and health, residual and latent environmental impacts etc.	A preliminary EMP is provided in Section 12.9 of this report.

7 Item 2(f): Need and desirability of the proposed activities

Globally, coal plays a vital role in electricity generation. South Africa's energy is predominately coal fuelled. About 77% of the country's primary energy needs are provided by coal (Eskom, 2018). Renewable and alternative energy sources cannot yet meet the demands of the country's electricity needs. Coal mining is, therefore, crucial and until alternative energy generation options can be implemented on a sufficiently large scale, South Africa remains mainly dependent on coal mining.

Without a steady and secure supply of the mineral, it is unlikely that Eskom will be able to meet the energy demands of the country. As a result, coal mining is of paramount importance to South Africa for continued electricity generation in order to meet the energy demands of the country in the short, medium and long term. In addition to supplying the local economy, approximately 28% of South Africa's production is exported. The Witbank Coalfield is one of the most significant sources of South Africa's mined coal.

The Arnot South Project falls within the Witbank Coalfield. Based on preliminary studies there is potential for a 30-year LoM, delivering an average of 2.4 Mtpa ROM coal at steady state production. Based on the qualities of the products planned from the Arnot South Project, it is anticipated that the primary product (API4) shall be sold to Richards Bay Coal Terminal (RBCT) whereas the secondary product (thermal coal) shall be produced for the Eskom market. The mine will potentially contribute to the reduction of the domestic shortfall of coal, helping Eskom to ensure a sustainable supply of power which the South African economy depends on.

The positive aspects of the proposed Arnot South Project include the benefits of additional income generation in the area. The proposed Project will result in the development of the mine within the Project area and thus ensure that the mining activities create economic benefits to support the local and national economic and social needs. Thus, the proposed Project will result in employment opportunities (although not many).

7.1 Questions to be engaged with when considering need and desirability

The Guideline on the assessment of Need and Desirability (Department of Environmental Affairs (DEA), 2017) includes a number of questions, the answers to which should be considered in the EIA Process. Table 7-1 presents the needs and desirability analysis undertaken for the Arnot South Project.

Table 7-1: Need and Desirability

Theme	No.	Question	Response
Securing ecological sustainable development and use of natural resources"	1	How will this development (and its separate elements/aspects) impact on the ecological integrity of the area?	The proposed Project is within an ecologically sensitive area. During the EIA Phase, the impacts to each environmental aspect will be assessed according to the Digby Wells impact assessment methodology.
	1.1	How were the following ecological integrity considerations taken into account?	
	1.1.1	Threatened Ecosystems	The Project is located within the endangered Eastern Highveld Grassland vegetation type, with vulnerable, near threatened and protected floral species potentially occurring on site. A total of 29 mammals and 31 avifaunal species potentially found in the Project area are listed in the International Union for Conservation of Nature Red List of Threatened Species. This includes Endangered, Near Threatened, and Vulnerable species. These have been listed in sections 10.8 and 10.9.
	1.1.2	Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, 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 desktop investigation identified that the landscape comprises of channelled valley bottom, seep, depression and flat wetlands (see section 10.10.1).
	1.1.3	Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)	Several Protected Areas are situated within close proximity to the Project area (Figure 10-23). ESA's have not been identified but this will be verified in the EIA Phase. The Project area consists of areas that are classified as CBA Irreplaceable in the northern and southern regions of the Mining Right area, which are the most important biodiversity areas in the

Theme	No.	Question	Response
			Province and cannot afford to suffer further loss of habitat or ecological functioning, as their remaining extent is already below biodiversity targets.
	1.1.4	Conservation targets	These will be considered during the EIA Phase and responded to accordingly.
	1.1.5	Ecological drivers of the ecosystem	
	1.1.6	Environmental Management Framework	
	1.1.7	Spatial Development Framework (SDF)	The NDM Integrated Development Plan (IDP), containing the SDF, was referenced for the compilation of this Scoping Report, and will be considered in the Impact Assessment Phase.
	1.1.8	Global and international responsibilities relating to the environment (e.g. RAMSAR sites, Climate Change, etc.)	A desktop survey of wetlands was carried out for the Scoping Phase which referenced National Freshwater Ecosystem Priority Areas (NFEPA) wetlands. No RAMSAR sites are present in the vicinity of the Project area.
	1.2	How will this development disturb or enhance ecosystems and/or result in the loss or protection of biological diversity? What measures were explored to firstly avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	The depth of the economically viable seam to mine (No. 2 coal seam) varies between 10 m to 100 m below the surface. Subsidence may result in water levels rising due to flooding of the underground mine void, potentially contaminating shallower aquifers. In addition, subsidence may also promote surface decant in lower areas through induced fracturing. Also, the Project area will need to be assessed due to potential impacts such as habitat

Theme	No.	Question	Response
	1.3	How will this development pollute and/or degrade the biophysical environment? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	loss, habitat fragmentation, alien invasive plants proliferation and loss of faunal and floral species of conservation concern. Digby Wells' impact assessment methodology will be utilised to identify, determine and assess the potential impacts during the EIA Phase (Section 11.1).
	1.4	What waste will be generated by this development? What measures were explored to firstly avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and/or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	General and hazardous waste will be generated as a result of the Arnot South Project. The waste will be handled, separated, stored and disposed of accordingly. It is anticipated that all general waste will either be recycled or disposed of at the local municipality landfill site. Hazardous waste will be removed offsite by a hazardous waste contractor. A safe disposal certificate for the removal of hazardous waste will be retained as proof of safe disposal.
	1.5	How will this development disturb or enhance landscapes and/or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	A desktop survey has been conducted for the Scoping Phase but the extent to which cultural heritage sites will/may be disturbed will be investigated in the EIA Phase.
	1.6	How will this development use and/or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be	Coal extraction for use in electricity generation is a non-renewable energy resource, however, South Africa is dependent on coal and until the energy supply and demand can feasibly be replaced with renewable energy, non-renewable energy sources will be required. The extent of any positive impacts associated with this Project will be investigated in the EIA Phase.

Theme	No.	Question	Response
		avoided altogether, what measures were explored to minimise and remedy (including offsetting) the impacts? What measures were explored to enhance positive impacts?	Preliminary impacts of the proposed project have been identified and mitigation measures aimed at avoiding, reducing and / or managing the negative impacts as well as enhancing the positive impacts have been recommended.
	1.7	How will this development use and/or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and/or impact on the ecosystem jeopardise the integrity of the resource and/or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	The Scoping Phase has confirmed the presence of wetlands and the potential for extensive water management on site for the proposed mine due to groundwater disturbance. The extent of these impacts and potential mitigation can only be determined in the EIA Phase. It must be noted that avoidance of this impact would result in the No-Go alternative being implemented, as the coal seam is too deep to motivate opencast mining.
	1.7.1	Does the proposed development exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)? (note sustainability requires that settlements reduce their ecological footprint by using less material and energy demands and reduce the amount of waste they generate, without compromising their quest to improve their quality of life)	Historically, Eskom has struggled to secure coal from South African mining operations due to international prices of coal yielding more profit for mines. South Africa will be a coal-dependent country for the foreseeable future. The socio-economic impacts as a result of coal mining proceeding will be assessed in the EIA Phase.
	1.7.2	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used (i.e. what are the opportunity	

Theme	No.	Question	Response
		costs of using these resources this the proposed development alternative?)	
	1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The EIA will provide mitigation measures to reduce the overall impact of the mine in terms of scarce resource usage.
	1.8	How were a risk-averse and cautious approach applied in terms of ecological impacts?	Sufficient information was gathered prior to the onset of this process to indicate that the potential mining of coal is feasible.
	1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Each specialist will investigate the impacts and present the gaps and / or limitations in knowledge in their respective reports. Gaps in knowledge are collated and expressly provided in the EIA Report, which is submitted to the Competent Authority for consideration.
	1.8.2	What is the level of risk associated with the limits of current knowledge?	
	1.8.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	
	1.9	How will the ecological impacts, resulting from this development impact on people's environmental right in terms following:	This will be investigated and quantified by each specialist and presented in the EIA Phase.
	1.9.1	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	
	1.9.2	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	

Theme	No.	Question	Response
	1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	
	1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives/targets/considerations of the area?	
	1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	Refer to Section 9.1 for details of the alternatives considered. This aspect will be further investigated during the EIA Phase.
	1.13	Describe the positive and negative cumulative ecological/biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Cumulative impacts will be investigated and presented during the EIA Phase.
Promoting justifiable economic and	2.1	What is the socio-economic context of the area, based on, amongst other considerations, the following considerations?	
	2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks of policies applicable to the area,	The socio-economic baseline took the NDM and GSDM IDPs for the period 2019-2020 into consideration. The IDPs present issues and requests raised by residents in each local municipal district of the Municipalities.

Theme	No.	Question	Response
	2.1.2	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	The spatial and economic development projects will be implemented through the Municipal IDP. The proposed Project will promote and support the sustainability of existing business, as well as assist in increasing local beneficiation and shared economic growth for the confirmed 17 years LoM.
	2.1.3	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	
	2.1.4	Municipal Economic Development Strategy ("LED Strategy").	
	2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	The proposed Project will result in limited job opportunities. The positive impact from the Project will be recognised through implementing the Community Development Projects.
	2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	The planned workforce will consist of 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries. The Applicant is committed towards contributing to the socio-economic activities of the immediate community and the region. Arnot South Coal Mine commits to the requirements of the Skills Development Act. In addition, the company will ensure that the contractors have fully developed skills plans and all colliery employees receive training and development in accordance with these plans.
	2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	The Company will implement the SLP Community Development projects and initiatives which are based on the requirements identified by surrounding communities through the SLP consultation process.

Theme	No.	Question	Response
	2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	Arnot South Coal Mine will offer portable skills to employees throughout the LoM, to ensure that they have skills other than those required by the mine, to lessen the negative impact and foster continued livelihood.
	2.5	In terms of location, describe how the placement of the proposed development will	
	2.5.1	result in the creation of residential and employment opportunities in close proximity to or integrated with each other,	The mine will be a contractor-run-operation. The planned workforce will consist of 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries.
	2.5.2	reduce the need for transport of people and goods	Coal product will be trucked to various markets. The Applicant will also provide employee transport to and from the mine thereby mitigating increased traffic for individual road users.
	2.5.3	result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport),	
	2.5.4	compliment other uses in the area,	A Traffic Impact Assessment will be undertaken in the EIA Phase, which will establish potential congestion on surrounding roads and provide mitigation measures to manage the impact.
	2.5.5	be in line with the planning for the area,	The current proposed LoM is 17 years and the Closure and Rehabilitation Report will consider end-land use in line with the LED Strategy.
	2.5.6	for urban related development, make use of underutilised land available with the urban edge,	Not applicable. The proposed Arnot South Project area is outside an urban area.
	2.5.7	optimise the use of existing resources and infrastructure,	No infrastructure is available on site which can be utilised as part of the mining operation; however, the proposed infrastructure on site

Theme	No.	Question	Response
			will all be removed during decommissioning and will therefore not create unwanted infrastructure either.
	2.5.8	opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement),	No bulk infrastructure will form part of this development.
	2.5.9	discourage "urban sprawl" and contribute to compaction/densification,	The project area and surrounds are fairly rural and cannot therefore influence urban sprawl.
	2.5.10	contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs,	The Community Development projects associated with the SLP will prioritise Historically Disadvantaged South Africans as beneficiaries.
	2.5.11	encourage environmentally sustainable land development practices and processes,	This can only be considered during the investigation for the end land use, post closure.
	2.5.12	take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.),	The location of the proposed Project is dependent on the location of the identified mineral resource (coal reserve).
	2.5.13	the investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential),	The proposed project will allow the mine to continue contributing to the local, regional and national Gross Domestic Product (GDPs), and also to the local communities through potential employment of workers and local contractors, as well as other influences and community upliftment programmes that are undertaken by the mine through their SLP.

Theme	No.	Question	Response
	2.5.14	impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area, and	In total, 948 heritage resources were identified within the regional, local and site-specific study areas. The predominant tangible heritage resources recorded in the area under consideration demonstrate affiliations with the historical period, including the historical built environment and burial grounds and graves. The impact to cultural heritage will be investigated during the EIA Phase.
	2.5.15	in terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	The Arnot South Project shall be a contractor-operated mine. The planned workforce will consist 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries. The proposed project will ensure employment, as well as programmes implemented from the mine's SLP.
	2.6	How were a risk-averse and cautious approach applied in terms of socio-economic impacts?	Socio-economic impacts will be investigated during the EIA Phase.
	2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	Gaps in knowledge, uncertainties and assumptions will be determined during the EIA Phase and presented in the EIA Report.
	2.6.2	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	
	2.6.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	

Theme	No.	Question	Response
	2.7	How will the socio-economic impacts, resulting from this development impact on people's environmental right in terms following:	
	2.7.1	Negative impacts: e.g. health (e.g. HIV- Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	A Social Impact Assessment will be conducted during the EIA Phase which will consider the extent and significance of the proposed impacts presented in this section.
	2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	
	2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socio-economic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	
	2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	
	2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)?Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	
	2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic	

Theme	No.	Question	Response
		human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	
	2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	
	2.13	What measures were taken to:	
	2.13.1	ensure the participation of all interested and affected parties,	During the pre-application and Scoping Phase, an I&AP database was developed to identify and verify the directly and indirectly affected landowners or land occupiers as well as the potentially affected surrounding communities. This database will be updated throughout the EIA Process to ensure adequate consultation.
	2.13.2	provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Digby Wells will maintain and update the I&AP database to ensure communication with all registered I&APs. Site notices have been erected in various locations around the site and in the nearest communities to announce the Project, SMS notifications will be utilised to provide progress reports to I&APs as well as Digby Wells contact information for further consultation. Due to COVID-19 Regulations, Focus Group meetings will be held in both the Scoping and EIA Phases to engage with any I&AP who wishes to attend, and the Project will be presented at these meetings as well as the findings of the impact assessments. COVID-19 measures during face-to-face meetings will be taken into consideration.

Theme	No.	Question	Response
	2.13.3	ensure participation by vulnerable and disadvantaged persons,	Refer to Section 9.2 of this Scoping Report, describing the public participation process to be implemented for the proposed Project. Focus Group meetings are planned to be held in the scoping and EIA phases of the Project. Efforts will be made at the meetings to be held to ensure that all participants can participate in a language they are able to understand.
	2.13.4	promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	The consultation process seeks to inform affected communities of the positive and negative impacts associated with the proposed Project and provide opportunity for any stakeholder to raise concerns which will be responded to both on record in the reports and through direct written response (where possible). Furthermore, the Applicant will create community forums with guidance form the Municipality.
	2.13.5	ensure openness and transparency, and access to information in terms of the process,	Digby Wells is bound by legislation and regulations to share information pertaining to the Project, to be transparent and impartial.
	2.13.6	ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge, and	All stakeholder needs will be accommodated as far as is reasonable.
	2.13.7	ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein was be promoted?	The EAP cannot force participation from specific demographics. Cultural norms will be respected and adhered to; however, no demographic can be excluded from public consultation and

Theme	No.	Question	Response
	2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	therefore all registered stakeholders and meeting attendees will be considered intrinsic to the public consultation process and outcomes. COVID-19 measures during face-to-face meetings will be taken into consideration.
	2.15	What measures have been taken to ensure that current and/or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected	The Applicant must produce a Health and Safety policy and best practice on site, compliant with the Mine Health and Safety Act, 1996 (Act No. 29 of 1996). Workers must be educated on a regular basis as to the environmental and safety risks that may occur within their work environment. Also, adequate measures need to be taken to ensure that the appropriate personal protective equipment is issued to workers based on the areas that they work and the requirements of their job.
	2.16	Describe how the development will impact on job creation in terms of, amongst other aspects:	
	2.16.1	the number of temporary versus permanent jobs that will be created,	The Arnot South Project will be a contractor-run operation, meaning most of the staffing will be employed by the mining and engineering contractors. The planned workforce will consist 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries.

Theme	No.	Question	Response
	2.16.2	whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area),	The Arnot South Project shall be a contractor-operated mine. The planned workforce will consist of 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries.
	2.16.3	the distance from where labourers will have to travel,	The planned workforce will consist of 168 permanent employees and contractor employees primarily from the Local Municipality with some from other parts of South Africa and/or neighbouring countries. It is too early in the process to confirm from what distance labourers will be required to travel.
	2.16.4	the location of jobs opportunities versus the location of impacts (i.e. equitable distribution of costs and benefits), and	
	2.16.5	the opportunity costs in terms of job creation (e.g. a mine might create 100 jobs, but impact on 1000 agricultural jobs, etc.).	The number of farm workers who may be displaced (if any) should the Project proceed will be determined during the EIA Phase.
	2.17	What measures were taken to ensure:	
	2.17.1	that there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment, and	Digby Wells has identified the relevant government organisations which must be consulted throughout the EIA Process. Furthermore, this application is in terms of the One Environmental System and Digby Wells shall endeavour to align the various procedures to reduce stakeholder fatigue.
	2.17.2	that actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures?	Not Applicable.
	2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	As part of the EIA Process, Financial Liability for the Applicant will be calculated to determine the cost of decommissioning and rehabilitating the mine site to an end-land use which is sustainable

Theme	No.	Question	Response
	2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	and in the best interest of both the surrounding communities and the environment.
	2.20	What measures were taken to ensure that he costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	
	2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	Refer to Section 9 for the description of the process followed to reach the proposed preferred site. This aspect will be further investigated during the EIA Phase.
	2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Cumulative impacts will be assessed during the EIA Phase and presented in the EIA Report.

8 Item 2(g): Period for which the environmental authorisation is required

The proposed LoM for the Project will require Environmental Authorisation for a period of 30 years.

9 Item 2(h): Description of the process followed to reach the proposed preferred site

This section describes the alternatives investigated during the preliminary phase of the Project. This includes the location, mining method, technology and the No-Go alternative.

9.1 Item 2(h)(i): Details of all alternatives considered

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives help identify the most appropriate method of developing the project, taking into account location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives and the no-go alternative. Alternatives also help identify the activity with the least environmental impact.

9.1.1 Location of the Project

The location of the Project has been decided by the location of the identified coal seam (No.2 seam). Exxaro undertook prospecting activities on the area of interest and determined the extent of the mine based on the location of coal. The location is therefore dictated by Exxaro's Prospecting / Mining Right and therefore there are no feasible alternative locations for Exxaro. Farms included in the Mining Right boundary and impacted by mining activities will be investigated during the EIA Phase of the Project. Should any area within the Mining Right be deemed unsuitable for the proposed mining activities, this will be stated in the EIA.

9.1.2 Mining Method Alternatives

The proposed alternatives for coal extraction considered underground versus opencast mining. Due to the depth of the No. 2 coal seam to be mined, the method of coal extraction will be by means of an underground mine using continuous miners. The Arnot South Project shall, therefore, be an underground mine operated by a selected underground mining contractor. The reason behind this choice is based on the following factors:

- The planned annual product sales;
- Potential markets;
- The shape of the resource block;
- The depth, thickness, and distribution of the coal seams;
- Producing from a single access adit while producing consistent products for the selected markets;

- Operating and maintaining five continuous miner's production sections while ensuring consistent production fleet utilisation and consistent operating costs; and
- Ensuring the highest Net Present Value (NPV) for the Project (Arnot South MWP, 2020).

There are potential additional areas where the No. 2 coal seam is mineable by underground continuous miners or drill and blast mining methods and areas where the No. 4 upper and lower coal seams are mineable by opencast mining methods. However, the preferred mining method for these two additional reserves will be confirmed following the completion of drilling activities.

9.1.3 Technology Alternatives

The proposed mine will be an underground mine and bord and pillar mining with continuous miners and shuttle cars will be used.

There are two main types of washing processing technology which could be used for coal beneficiation, namely: dry processing and wet washing. The preferred technology for the Arnot South Project is wet washing. The coal shall be beneficiated through a double-stage dense medium washing plant to produce export and Eskom products. The washing plant feed conveyor shall feed a 3.0 m by 6.0 m single deck horizontal desliming screen where the 50 mm by zero mm shall be wet screened on a 1.0 mm deck.

9.1.4 The "No-Go" Alternative

The No-go alternative is the option of not mining coal in the area. This option also means that all potential negative impacts associated with the proposed mine and its associated infrastructure would not occur. However, the potential benefits associated with the Project would also not occur. According to the Nkangala District Environmental Management Framework, the area within which the proposed Project falls has been earmarked for mining and power generation development as these two sectors currently drive the economic value of production in the Project area.

If the Project were not to proceed, the additional economic activity, skills development and available jobs would not be created, the coal reserve would remain unutilised and the economic activities would continue as at present, with little economic growth developing in the region. With the proven coal reserve in the Witbank Coalfield, prohibiting the Project from proceeding will not only impede valuable socio-economic opportunities in the Arnot South Project area but South Africa as a whole.

9.2 Item 2(h)(ii): Details of the Public Participation Process followed

During the Scoping Phase, the following core stakeholder engagement activities were undertaken:

- Stakeholders (including Government Departments, landowners, land occupiers, communities, Non-Governmental Organisations, agricultural organisations,

Parastatals and businesses) have and will continue to be identified and captured in a stakeholder database;

- A Background Information Document (BID) and letter was distributed to the identified I&APs together with the placement of adverts and site notices around the Project area;
- The environmental Scoping Report and associated documentation is available for public comment for a period of 30 days;
- Consultation with I&APs will be undertaken; and
- Suggestions and concerns will be obtained from I&APs.

Table 9-1 provides a summary of the public participation activities undertaken to date.

Table 9-1: Public Participation Scoping Phase Activities

Activity	Details
Identification of stakeholders	Stakeholder database which represent various sectors of society, including directly affected and adjacent landowners, in and around the proposed Project area.
Distribution of BID announcement letter	A BID with registration and comment form was emailed to stakeholders on 22 January 2021. An SMS was also sent to stakeholders on 22 January 2021 announcing the availability of the Draft scoping report.
Placing of newspaper advertisement	A newspaper advertisement was placed in the Middelburg Observer and Witbank News.
Putting up of site notices	Site notices were put up at the proposed Project site on 21 January 2021. A site notice placement report and map were developed to indicate the locations of site notices in and around the Project area.
Announcement of Draft Scoping Report	Announcement of availability of the Draft Scoping Report was emailed to stakeholders on 22 January 2021. The Draft Scoping Report has been released electronically and copies are available to stakeholders on the Digby Wells website (www.digbywells.com under Public Documents) and can be accessed via our data-free service. Note: ***Due to COVID-19 Regulations, no documents were placed at public areas.*** Stakeholders were sent a data-free link where they can access the reports. http://view.datafree.co/PublicDocuments/.
Consultation with Stakeholders	Focus Group meetings are planned to be held during the public review period. The time and venue will be communicated to stakeholders in due course.
Obtaining comments from stakeholders	Comments, issues of concern and suggestions received from stakeholders will be captured in the Comment and Response Report (CRR). The CRR will be included in the updated Scoping Report, which

Activity	Details
	will be submitted to the DMRE and simultaneously made available to I&APs.
Announcement of Final Scoping Report	The final report will be made available on www.digbywells.com (under Public Documents)

9.3 Item 2(h)(iii): Summary of issues raised by I&APs

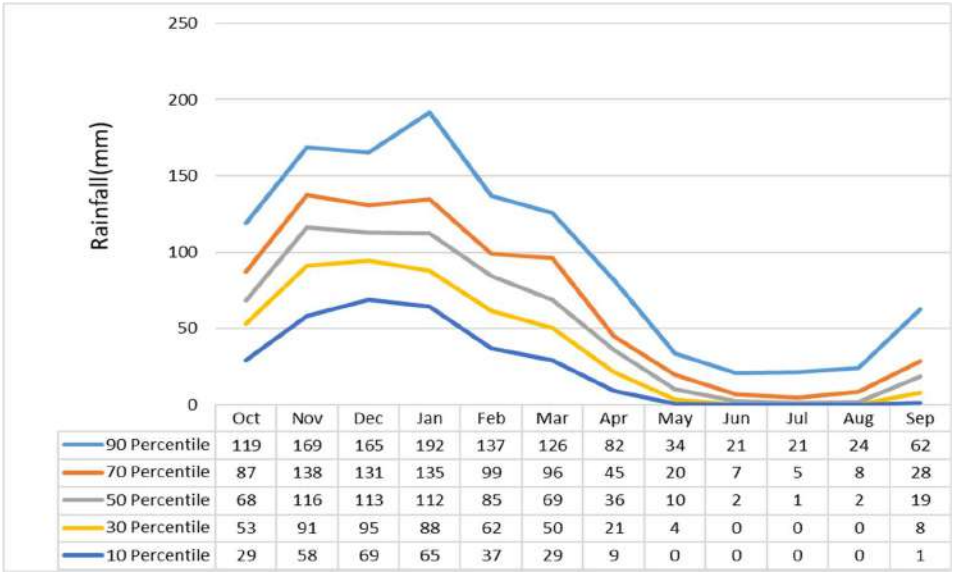
This section will be populated in the Final Scoping Report, once comments and responses have been received from the public. All comments and responses which are received during the 30-day public comment period, as well as comments received prior to the Final Scoping Report being finalised, will be included herein.

10 Item 2(i): The environmental attributes associated with the sites

This section comprises the baseline environment of the proposed Project area as assessed by the relevant specialists at a desktop level. This includes the features of the environment on site and land use which is expected to be affected by the proposed Project. This section is based on desktop research. Field assessments will be undertaken by the specialists prior to the EIA Phase, thereby verifying the environmental baseline in the field.

10.1 Climate

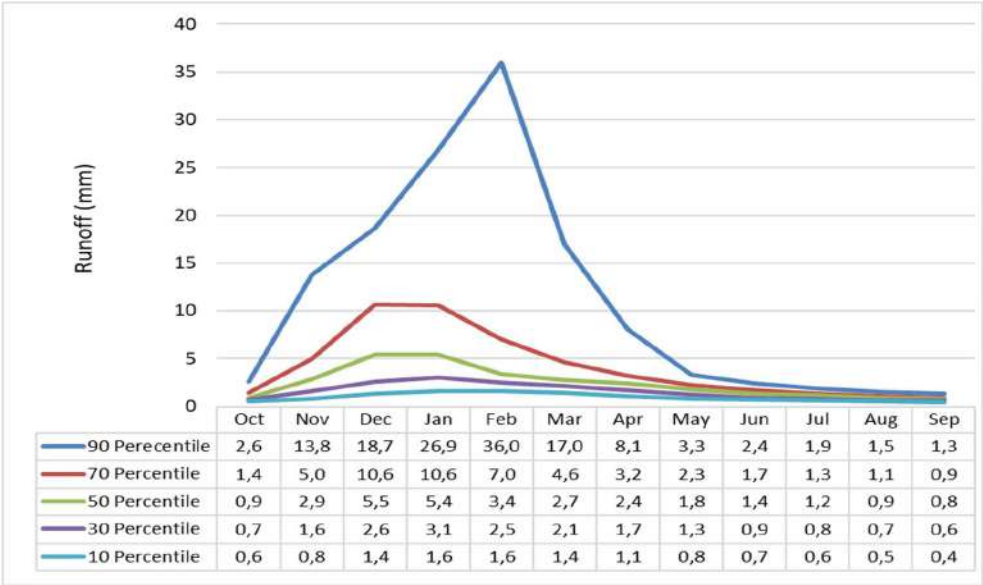
The Arnot South Project area is characterised by warm, rainy summers and dry winters with sharp frost (South African Weather Bureau, 1986). According to the Köppen-Geiger system, the climate here is classified as Cwb (Oceanic Subtropical Highland Climate). The Mean Annual Precipitation (MAP) for B12A, B12B and X11A is 695 mm, 672 mm, and 688 mm, respectively (WRC, 2015). The average MAP for the Project area is estimated at 685 mm, which is likely to be distributed as indicated in Figure 10-1. The wettest month is January with a 90th percentile of 192 mm and 10th percentile of 65 mm. This implies that the region experiences moderate to high volumes of rainfall.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90 Percentile	119	169	165	192	137	126	82	34	21	21	24	62
70 Percentile	87	138	131	135	99	96	45	20	7	5	8	28
50 Percentile	68	116	113	112	85	69	36	10	2	1	2	19
30 Percentile	53	91	95	88	62	50	21	4	0	0	0	8
10 Percentile	29	58	69	65	37	29	9	0	0	0	0	1

Figure 10-1: Monthly Rainfall Distribution

The Mean Annual Runoff (MAR) also differed with each quaternary catchment, however, the average MAR was calculated to be 55.02 mm which is 8% of the MAP. The highest amount of runoff was recorded in February with a 90th percentile of 36 mm and a 10th percentile of 1.6 mm. The indicated rainy months had moderate to high runoff depths. The MAR is likely to be distributed as indicated in Figure 10-2.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
90 Perecentile	2,6	13,8	18,7	26,9	36,0	17,0	8,1	3,3	2,4	1,9	1,5	1,3
70 Percentile	1,4	5,0	10,6	10,6	7,0	4,6	3,2	2,3	1,7	1,3	1,1	0,9
50 Percentile	0,9	2,9	5,5	5,4	3,4	2,7	2,4	1,8	1,4	1,2	0,9	0,8
30 Percentile	0,7	1,6	2,6	3,1	2,5	2,1	1,7	1,3	0,9	0,8	0,7	0,6
10 Percentile	0,6	0,8	1,4	1,6	1,6	1,4	1,1	0,8	0,7	0,6	0,5	0,4

Figure 10-2: Monthly Percentile Distribution of Runoff

On average, the area has a Mean Annual Evaporation (MAE) of 1358 mm, which is much greater than the average MAP of 685 mm. Figure 10-3 indicates the distribution of runoff, the highest evaporation loss is observed in January (151 mm) which is also the wettest month.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Evaporation(mm)	138	133	149	151	128	126	96	82	67	73	95	119
Rainfall(mm)	73	114	116	119	87	77	40	15	8	6	7	24

Figure 10-3: Monthly Distribution of Potential Evaporation and Rainfall

10.1.1 Temperature and Humidity

The monthly temperature and humidity records (three-year average) for the Project area are presented in Table 10-1 and Figure 10-4 below. The data indicate that the monthly temperature average varied between 10°C and 20°C. Ambient temperatures were observed to be higher during the summer months. The relative humidity records ranged between 62% and 73% with May as the highest humidity month and November presenting the lowest level at 62%.

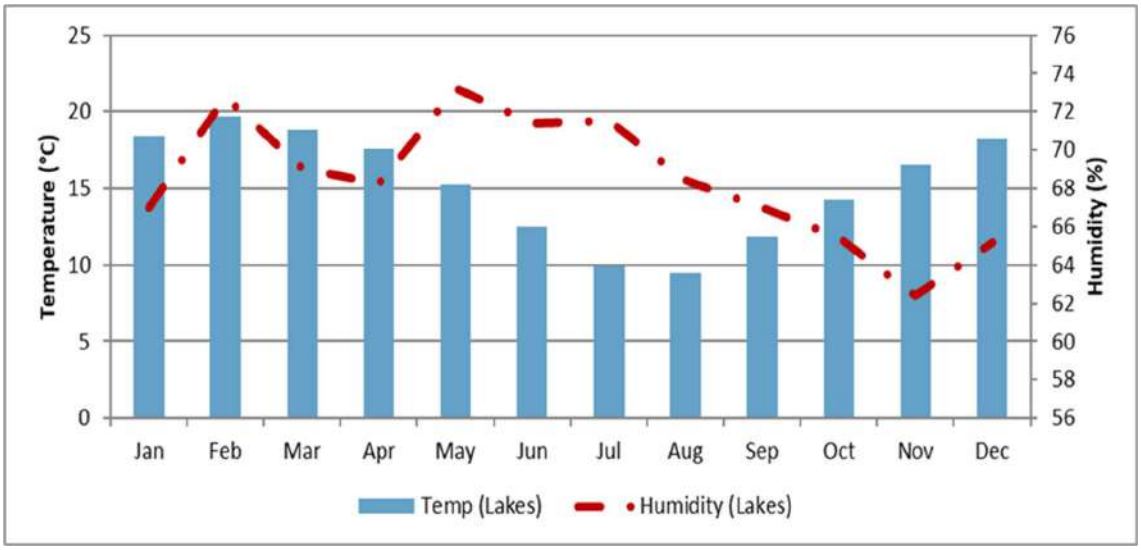


Figure 10-4: Monthly Temperature and Humidity (2017- 2019)

10.1.2 Rainfall

The total monthly rainfall records (three-year average) are provided in Table 10-1 and Figure 10-5. Based on the rainfall data, the summer months (December – February) received more rainfall (i.e. >66%) with December and January being the peak rainfall months (Figure 10-5), followed by Spring with 24% and Autumn with 10%. The least rainfall (less than 1%) was experienced in winter (June – August). The annual total rainfall is at 629 mm.

The average annual temperature of the nearest town, Hendrina (10 km east of the Project area), is 14.8°C and the rainfall is approximately 726 mm per year (Climate-data.org, n.d.).

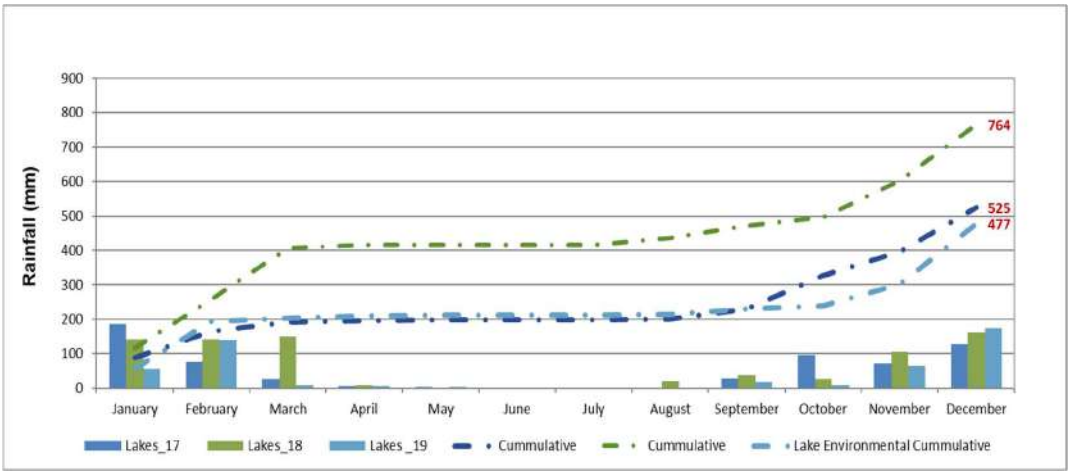


Figure 10-5: Rainfall (2017- 2019)

Table 10-1: Climate Statistics

Parameters	3-year average (2017-2019)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Temp. (◦C)	18	20	19	18	15	13	10	10	12	14	17	18	15
Total Mon. Rain (mm)	127	119	62	6	2	1	0	7	27	43	80	155	629
Rel. Hum. (%)	67	73	69	68	73	71	72	68	67	65	62	65	68

(Source: Lakes Environmental)

10.1.3 Wind Speed

Hourly meteorological data was analysed and used to understand the prevailing wind patterns in the Project area. The wind rose for the Project area is depicted in Figure 10-6. The prevailing winds are from the east-north-east (15.7%) and west-northwest (10.3%). Secondary contributions are from the northwest (9.8%) and northwest (9.8%). The average wind speed

at the Project area is 3.2 m/s and calm conditions (<0.5 m/s) occurred for some 3.6% of the time.

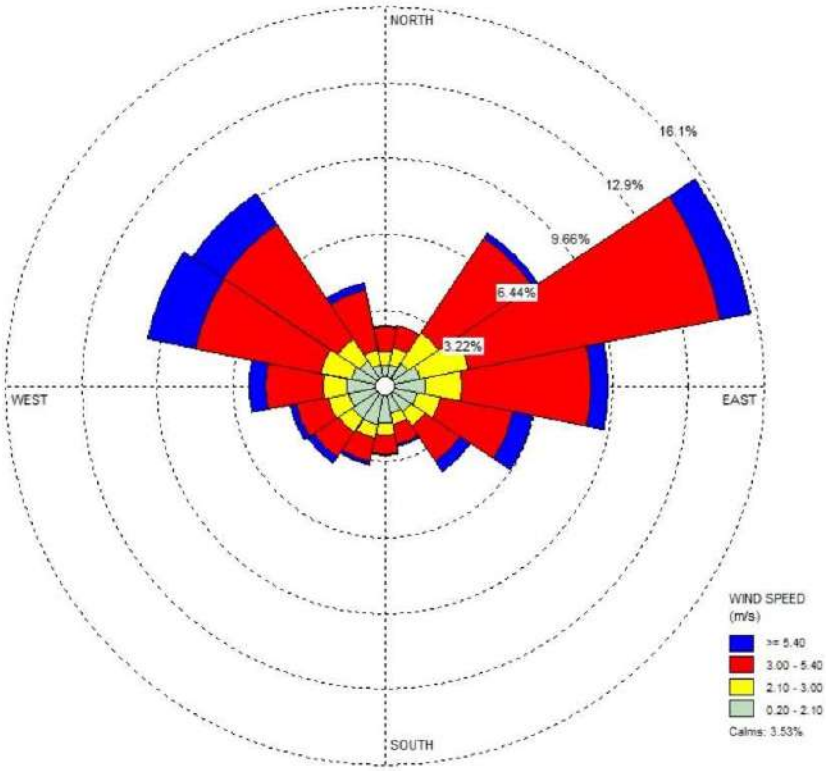


Figure 10-6: surface wind Rose

10.2 Topography and Drainage

The topography of the Project area is generally flat, with a gentle rise of 15 m from the western boundary to the centres of the Project area and dip of 60 m over 7 km to the eastern boundary. The topography ranges from high elevations on the northern and southern side of the Project area to lower elevations in the east and central area (Figure 10-7). The elevation of the Project area ranges from 1,565 to 1,745 metres above mean sea level (mamsl), which equates to a range of 180 m between the lowest and highest points of elevation within the area. The average slope for the entire Project area is approximately 2.8 degrees (°) (Figure 10-8).

One of the major tributaries of the Olifants River is the Klein Olifants River which flows within the portion of the Project area that is located within the Olifants Water Management Area (WMA). Drainage within the portion of the Project area that is located within the Inkomati-Usuthu WMA is facilitated by the Vaalrivierspruit, which drains into the Nooitgedacht Dam that adjoins the Komati River.

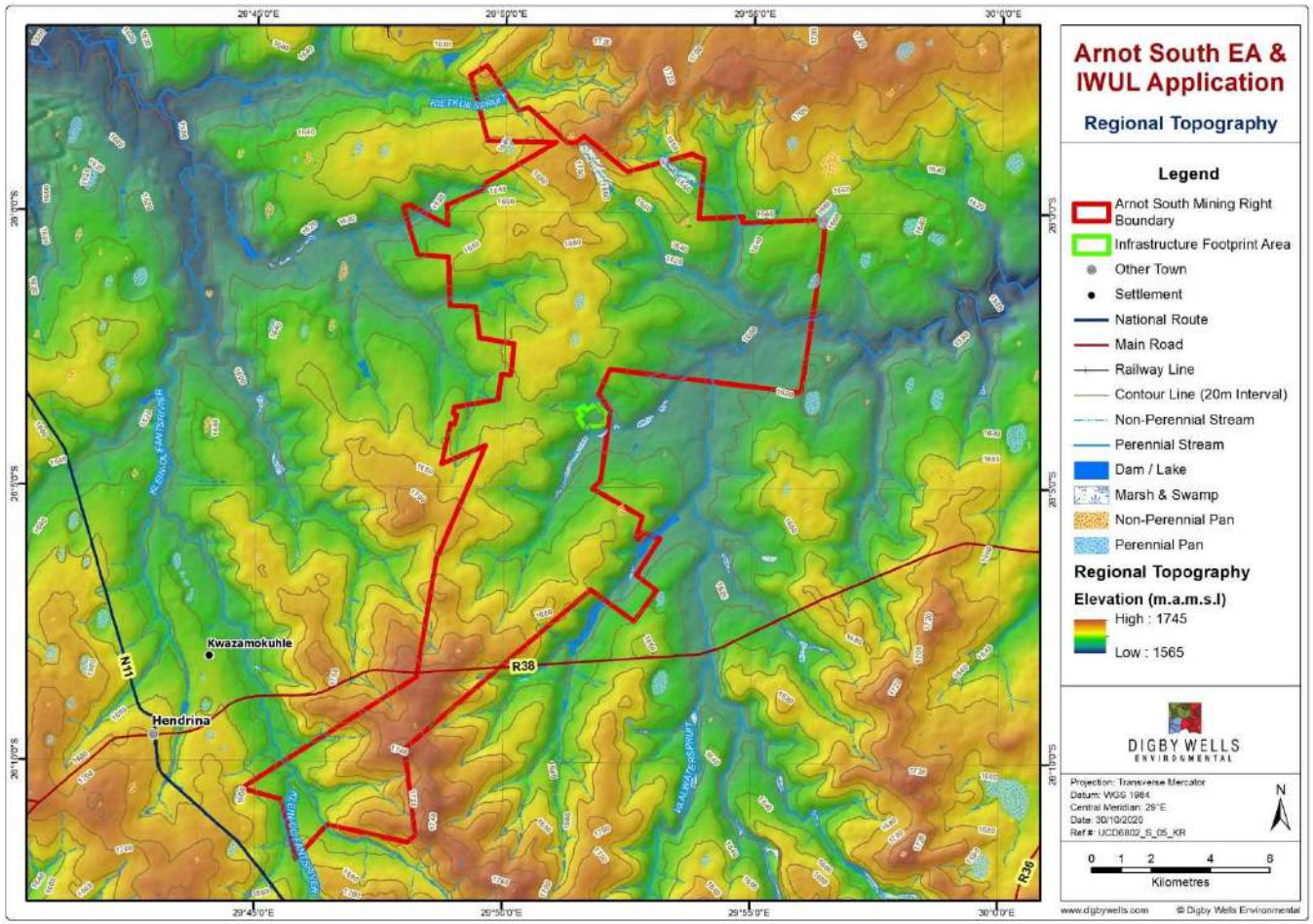


Figure 10-7: Topography of the Arnot South Project area

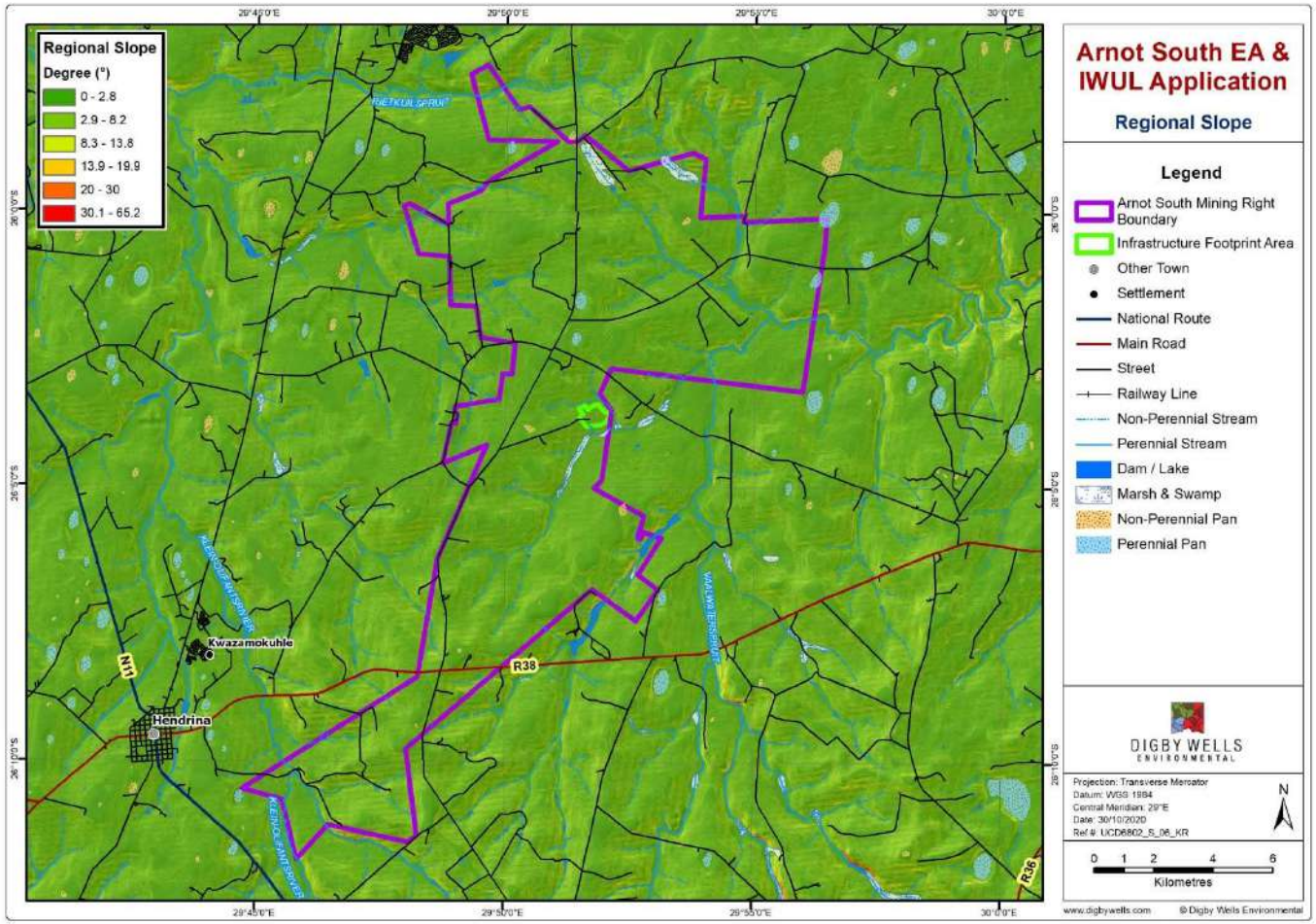


Figure 10-8: Slope of the Arnot South Project area

10.3 Geology

The Arnot South Project area is situated within the Witbank Coalfield, which is underlain by formations of the Dwyka and Ecca Groups as shown in Figure 10-9.

Woodford & Chevallier (2002) states that the Dwyka Group is composed of glacial ice-shelf deposits, displaying well-developed striated glacial pavements in places. The group consists mainly of diamictite (tillite) and to a lesser extent also contains conglomerate, sandstone, rhythmite and mudrock. The Ecca Group comprises a total of 16 formations which are observed from the lateral facies changes that characterise this succession. The two groups collectively are known to host coal seams and sedimentary rocks, such as conglomerates, sandstone, shale and mudstone (siliciclastic rocks). In line with the area being located on the Ecca and Dwyka Groups, the surface geology presented in Figure 10-10 indicates that the Project area is predominantly underlain by siliciclastic rocks.

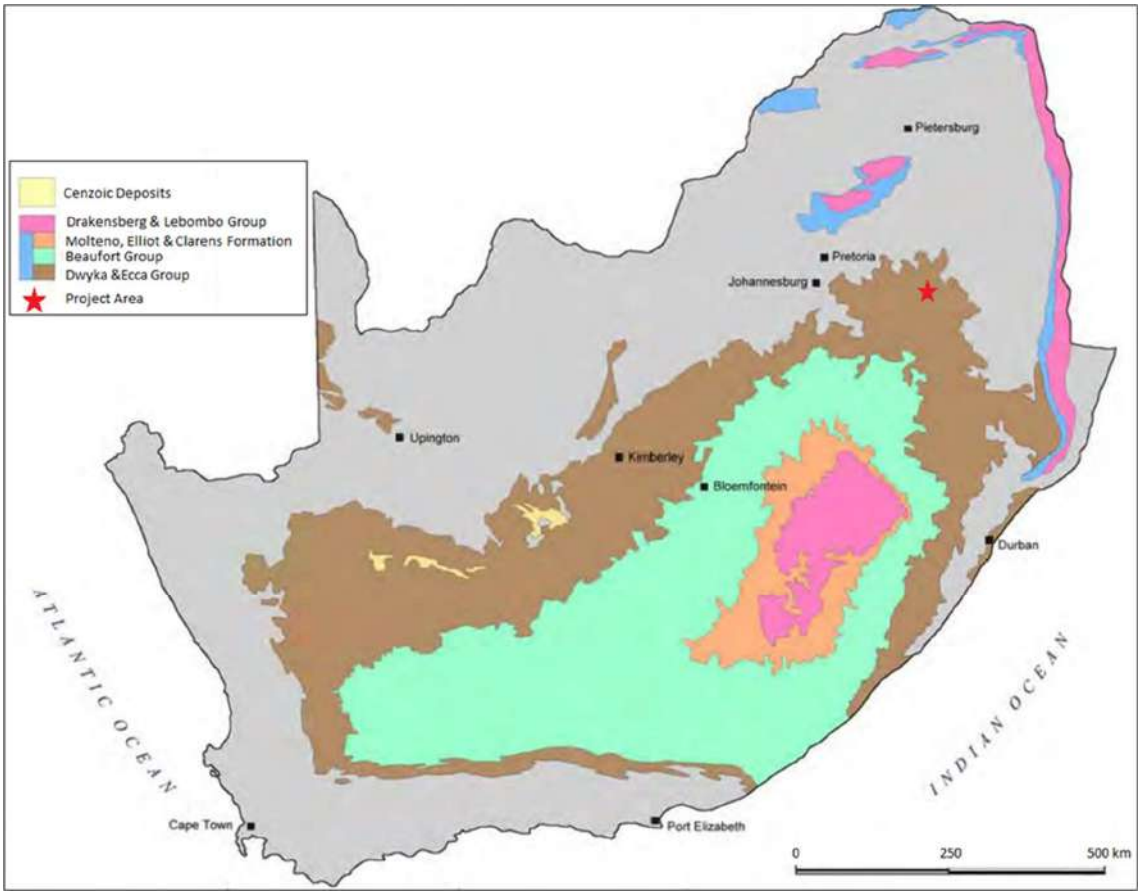


Figure 10-9: Simplified Geology of the Karoo Supergroup in South Africa (Woodford & Chevallier, 2002)

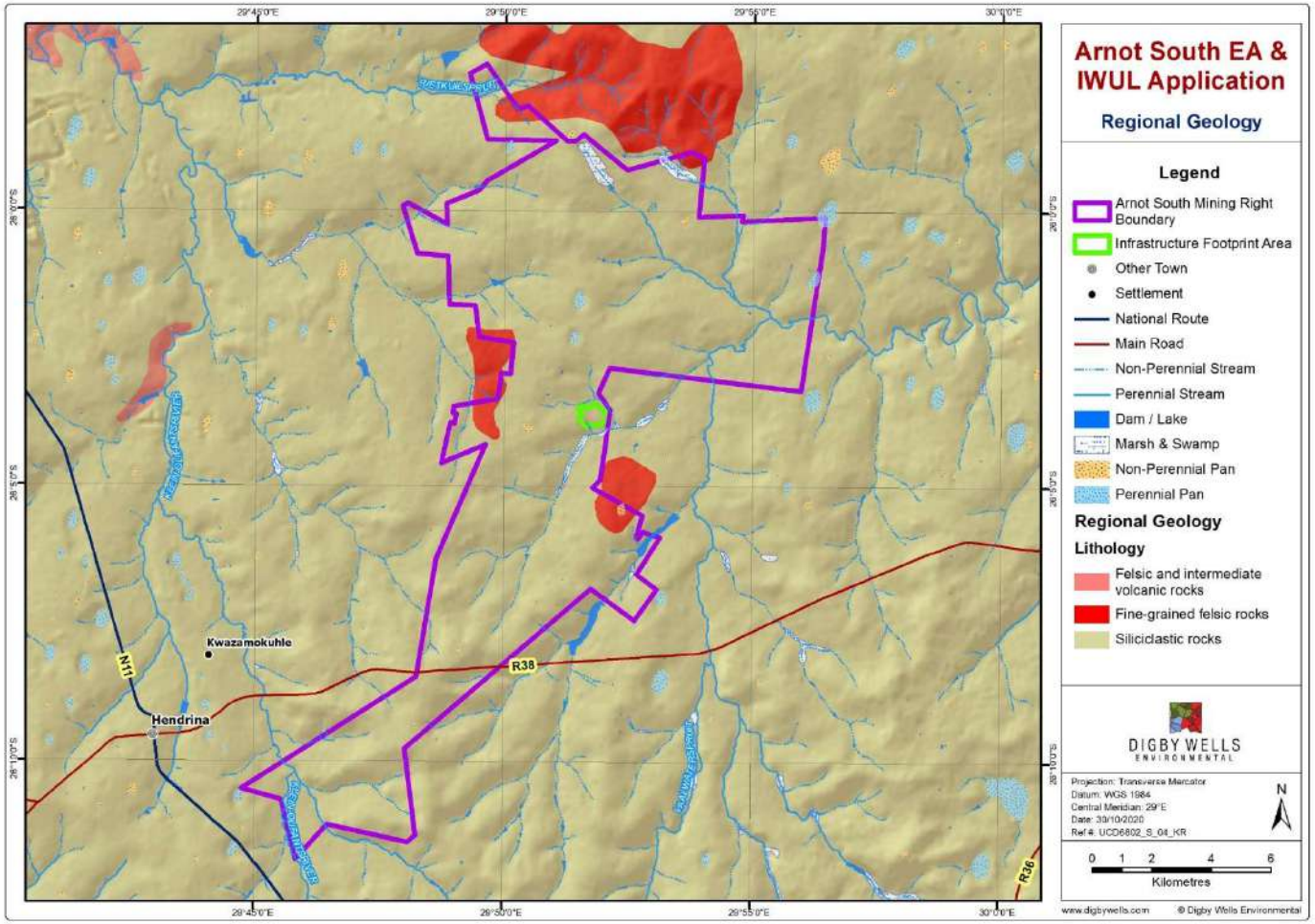


Figure 10-10: Regional Geology

10.4 Surface Water

The Arnot South Project area falls within three quaternary catchments, namely, B12A and B12B of the Olifants Water Management Area 2 (WMA2) and X11A which falls within the Inkomati-Usuthu WMA3 (Figure 10-11). The B12A and B12B quaternary catchments are found within the Olifants River Catchment. The X11A quaternary catchment is found in the Inkomati River Basin, which is shared between South Africa, Eswatini and Mozambique. The proposed development footprint is in Quaternary Catchment X11A.

Within the Project area lies one of the major tributaries of the Olifants River called the Klein Olifants River. The site is also drained by several streams from the Inkomati River Basin. The Vaalrivierspruit which passes through the Project area drains into the Nooitgedacht Dam which adjoins the Komati River. There are several small dams located on farms in and around the Project area, and the Nooitgedacht Dam is located within a radius of approximately 12 km from the northern end of the Project boundary.

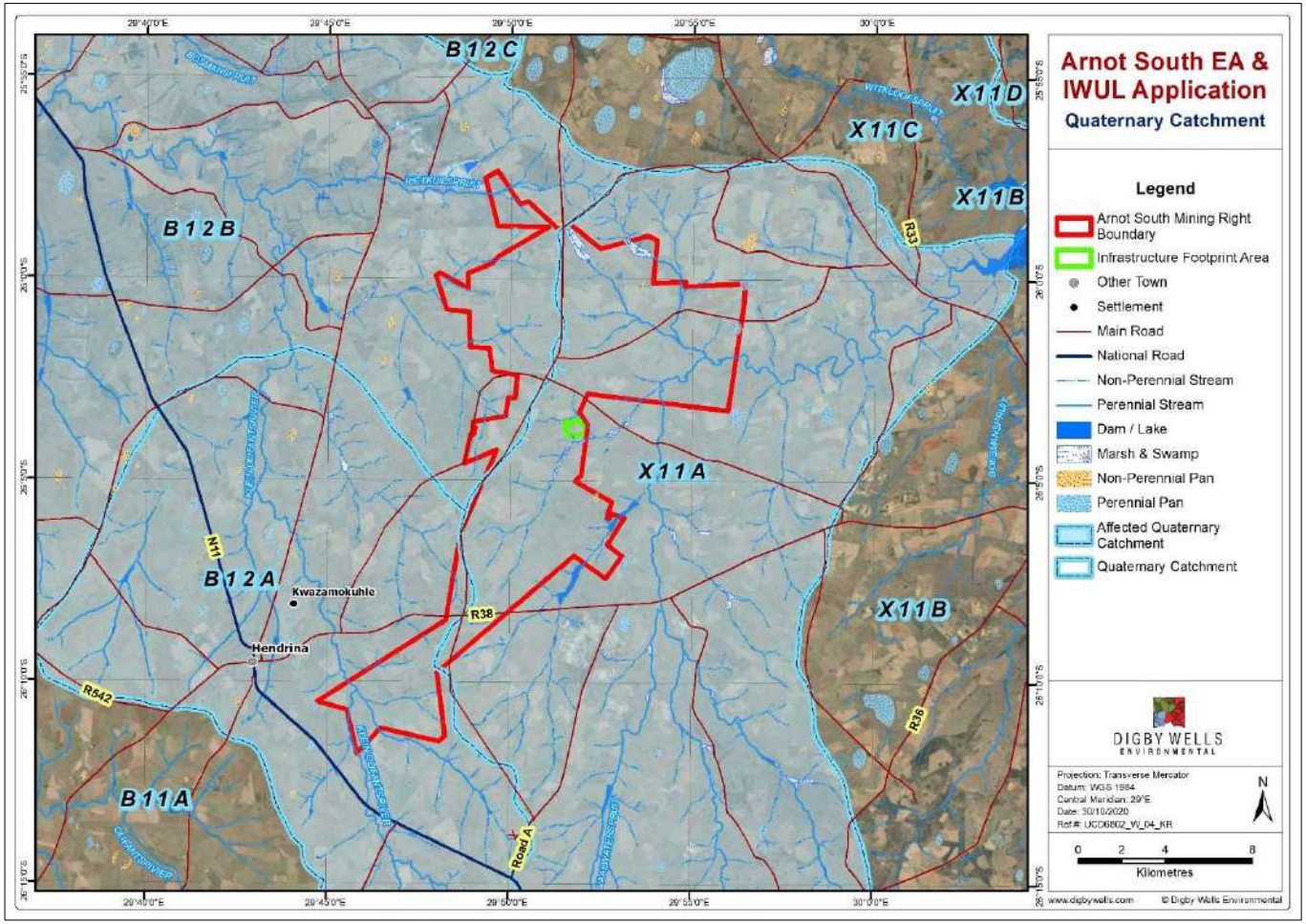


Figure 10-11: Quaternary Catchments

10.5 Groundwater

The conceptual hydrogeological model of the area is based on the generally accepted model for the Mpumalanga coal fields. The following three principal aquifers were identified:

- The weathered Karoo aquifer;
- The fractured Karoo aquifer; and
- The fractured pre-Karoo aquifer (Hodgson and Krantz, 1998).

The Karoo rocks are not known for large scale development of aquifers, but occasional high-yielding boreholes can be present. The aquifers that occur in the area can therefore be classified as minor aquifers (low yielding), but of high importance (Parsons, 1995) and are understood to have a low to medium development potential, mostly used for small-scale domestic purposes or occasionally for large-scale irrigation.

The expected aquifer yields from the Arnot South project area are presented in Figure 10-12. Predominant aquifer yields are found to be <0.5 litres per second (L/s) and the alluvial aquifer within the area of the Vaalwaterspruit is found to have aquifer yields ranging from 0.1 to 0.5 L/s.

Three distinct superimposed groundwater systems are present within the Project area (Hodgson and Krantz, 1998, Woodford and Chevallier, 2002) and can be classified as:

- The upper weathered Ecca aquifer (shallow, intergranular type aquifer formed in the weathered zone of the Karoo sediments; can locally form a perched aquifer on top of fresh bedrock);
- The fractured aquifers within the unweathered, fractured Ecca sediments; and
- The aquifer below the Ecca sediments (deeper aquifer formed by fracturing of pre-Karoo sediments and dolerite intrusions).

These types of groundwater systems are common to the groundwater regime in the Karoo environment. The systems do not necessarily occur in isolation and often form a composite groundwater regime that is comprised of one, some, or all of the systems. Based on the exploration drilling at the site all three aquifer types are present at the site.

In general, the shallow Karoo weathered aquifer depth ranges between 5 m and 20 m overlying the fractured Karoo rock formations throughout the region. This is in line with the results from the on-site exploration drilling, which indicated that the depth of the highly and moderately weathered Karoo aquifer varies between 3 and 20 metres below ground level (mbgl) with an average of ~8 mbgl. In terms of susceptibility to pollution, the shallow primary aquifer is understood to be highly susceptible to pollution due to coal mining in the area as the pollutants travel shorter distance to reach the aquifer system (Hodgson and Krantz, 1998). Low-lying wetlands, where groundwater levels are close to the surface, can indicate interaction between groundwater and surface water and can also serve as conduits for potential contamination.

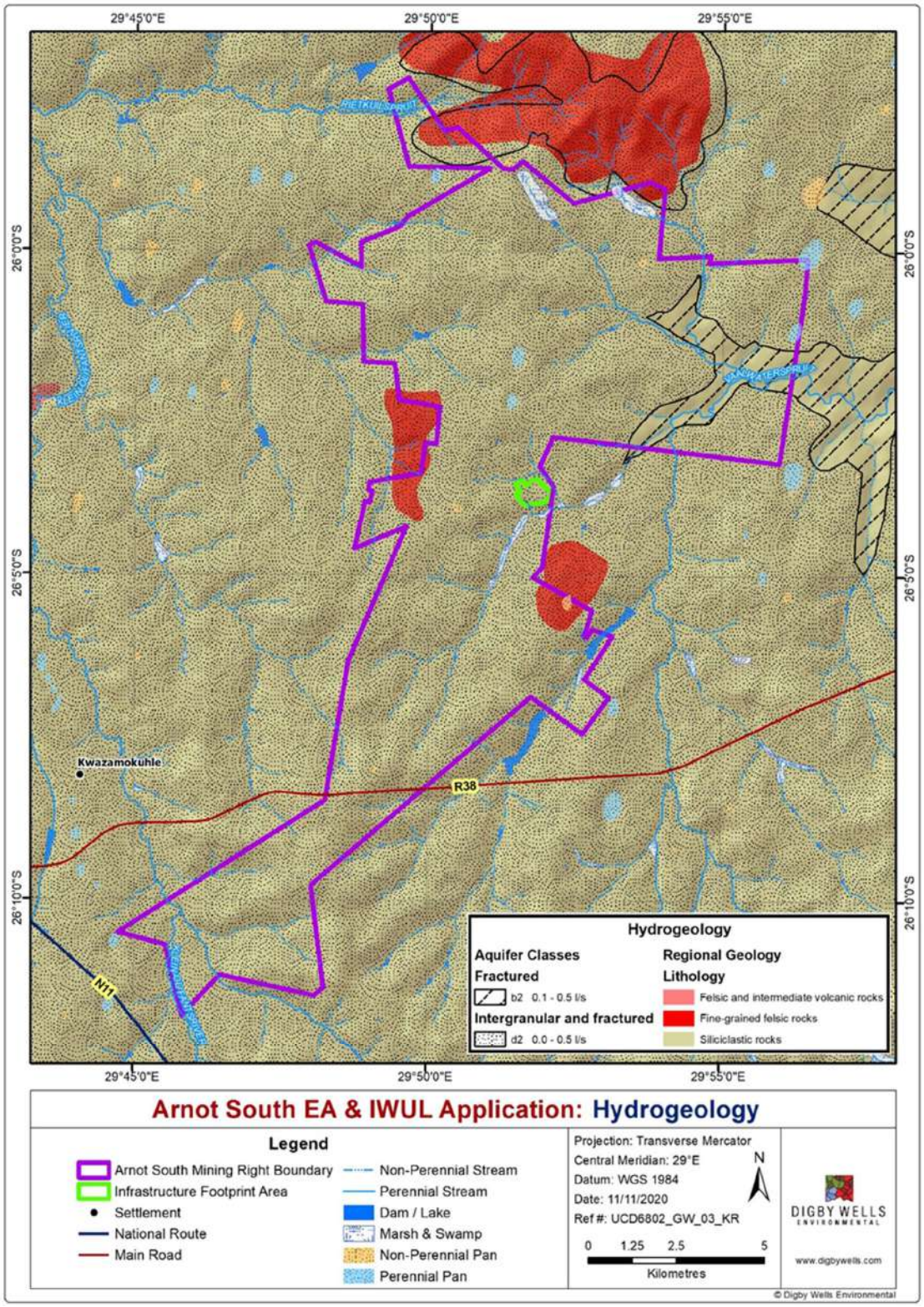


Figure 10-12: Aquifer yields

10.5.1 Groundwater Quality

The depositional setting of the Dwyka sediments (marine conditions) has caused associated aquifers to have a tendency of having elevated salinity. The information regarding baseline water quality within the Project area was obtained from a study conducted by Woodford and Chevallier (2002). The expected water quality is described based on the measured geometric mean over representative lithological units presented from Figure 10-13 to Figure 10-15, for Total Dissolved Solids (TDS), pH and sulphate. The findings are summarised as follows:

- TDS ranges from 100 to 450 mg/L;
- pH ranges from 7 to 7.25; and
- Sulphate ranges from 10 to 100 mg/L.

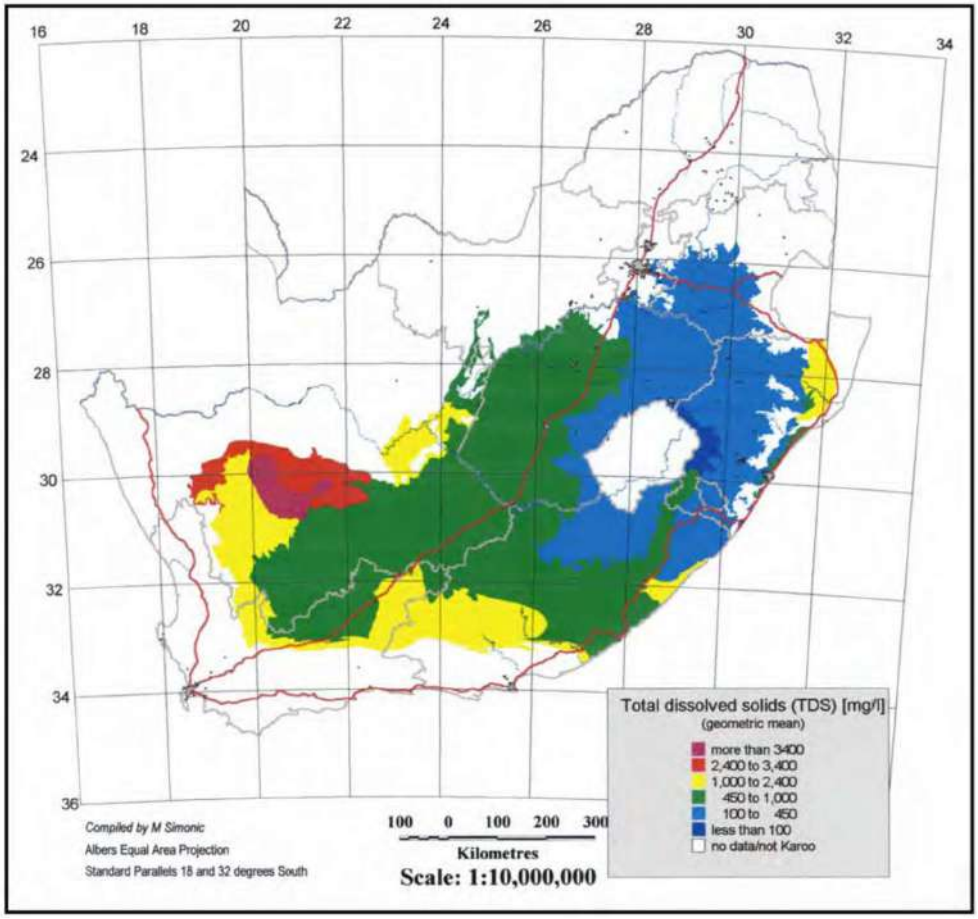


Figure 10-13: TDS concentrations (Woodford & Chevallier, 2002)

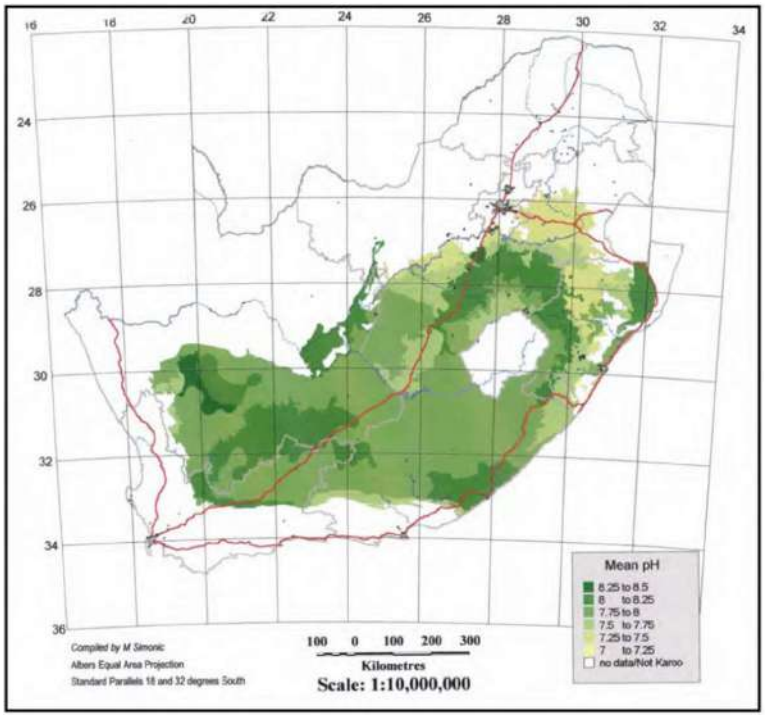


Figure 10-14: Mean pH for Representative Lithological Units (Woodford & Chevallier, 2002)

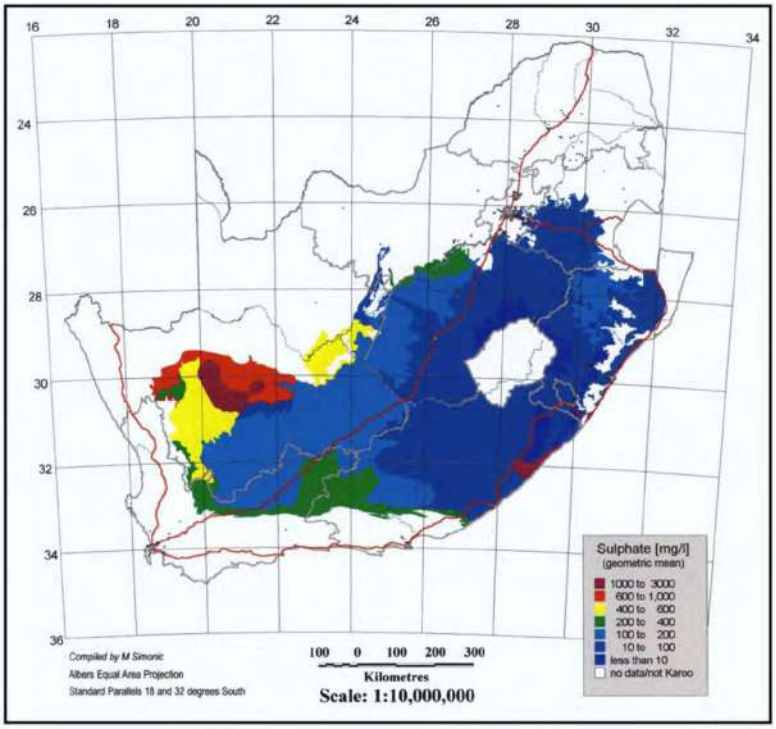


Figure 10-15: Sulphate Concentrations (Woodford & Chevallier, 2002)

10.5.2 Groundwater Levels

Groundwater flow directions at the Project area will be derived from a hydrocensus survey planned in the EIA Phase of the project. In general, groundwater level contours for the Karoo Supergroup have a tendency to mimic the topography. Based on this assumption, the Project area is predicted to indicate three dominant groundwater flow directions for each quaternary catchment in which the Project area lies (B12A, B12B and X11A). Some dewatering activities from privately owned boreholes within the area are expected to result in localised drawdown and can therefore affect the groundwater flow directions on a local scale. The dominant groundwater flow directions are shown in Figure 10-16 where groundwater flow for quaternary catchments B12A and B12B is in a general north-westerly direction and flow for quaternary catchment X11A is in a north-easterly direction.

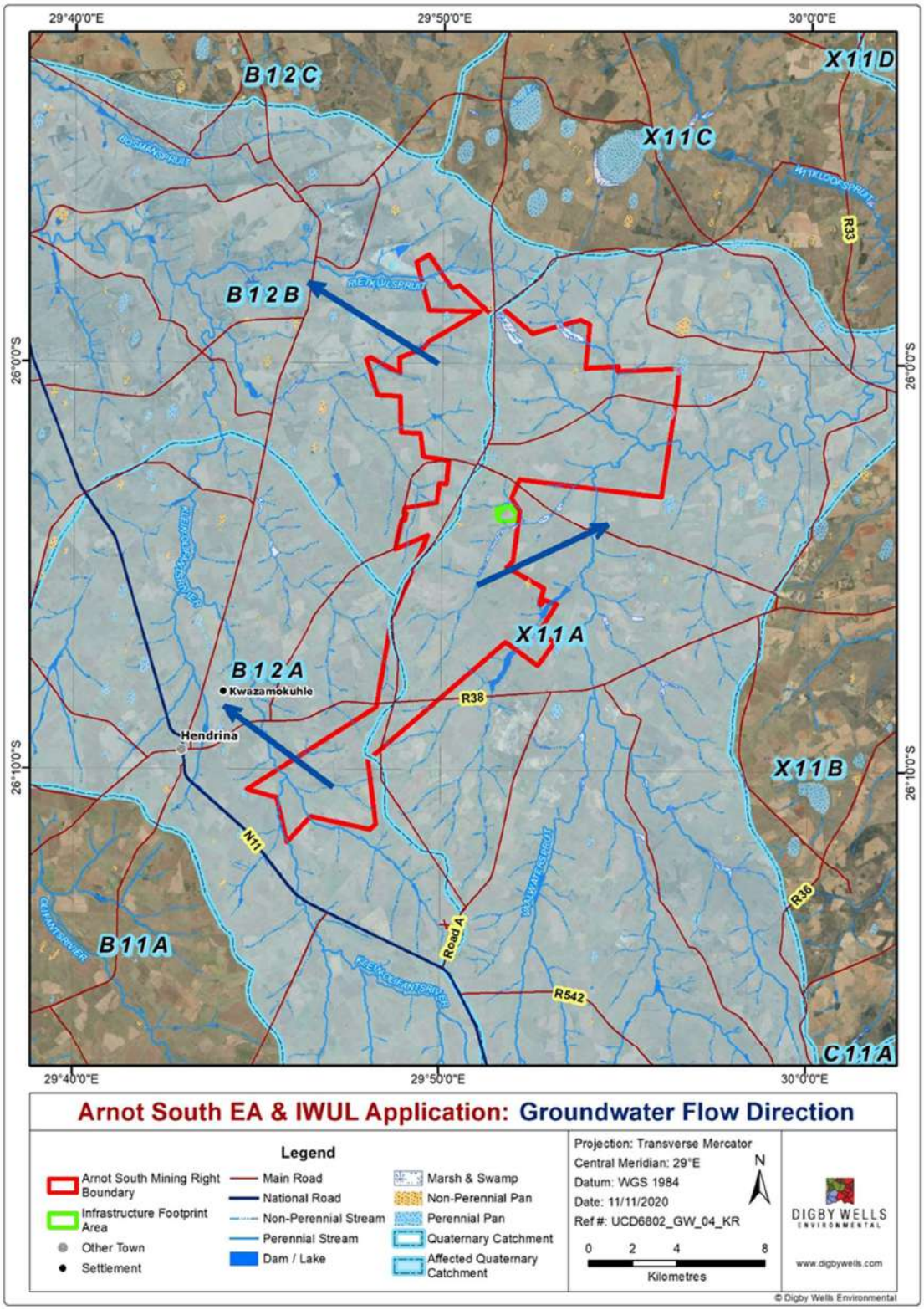


Figure 10-16: General Groundwater Flow Direction

10.6 Hydropedology – Sensitivity Assessment

The sensitivity assessment considers the sensitive water features within the study area, such as rivers, dams and wetlands (Figure 10-17). These water resources are sensitive to developmental impacts and due care should be taken to ensure that they are protected from degradation. Contamination of the water resources will impact on downstream water users including aquatic ecosystems which rely on these resources for water supply and habitat. Where interaction between groundwater, subsurface and surface water domains exist, pollutants can be conveyed from source areas through hillslope flow paths to surface water bodies. Any development that intercepts water flow paths at crests or mid-slope positions will deprive water supply to foot-slope and valley bottom positions. The issue of whether groundwater/surface water interaction exists within the project site will further be investigated by a detailed hydro-pedological assessment during the EIA Phase.

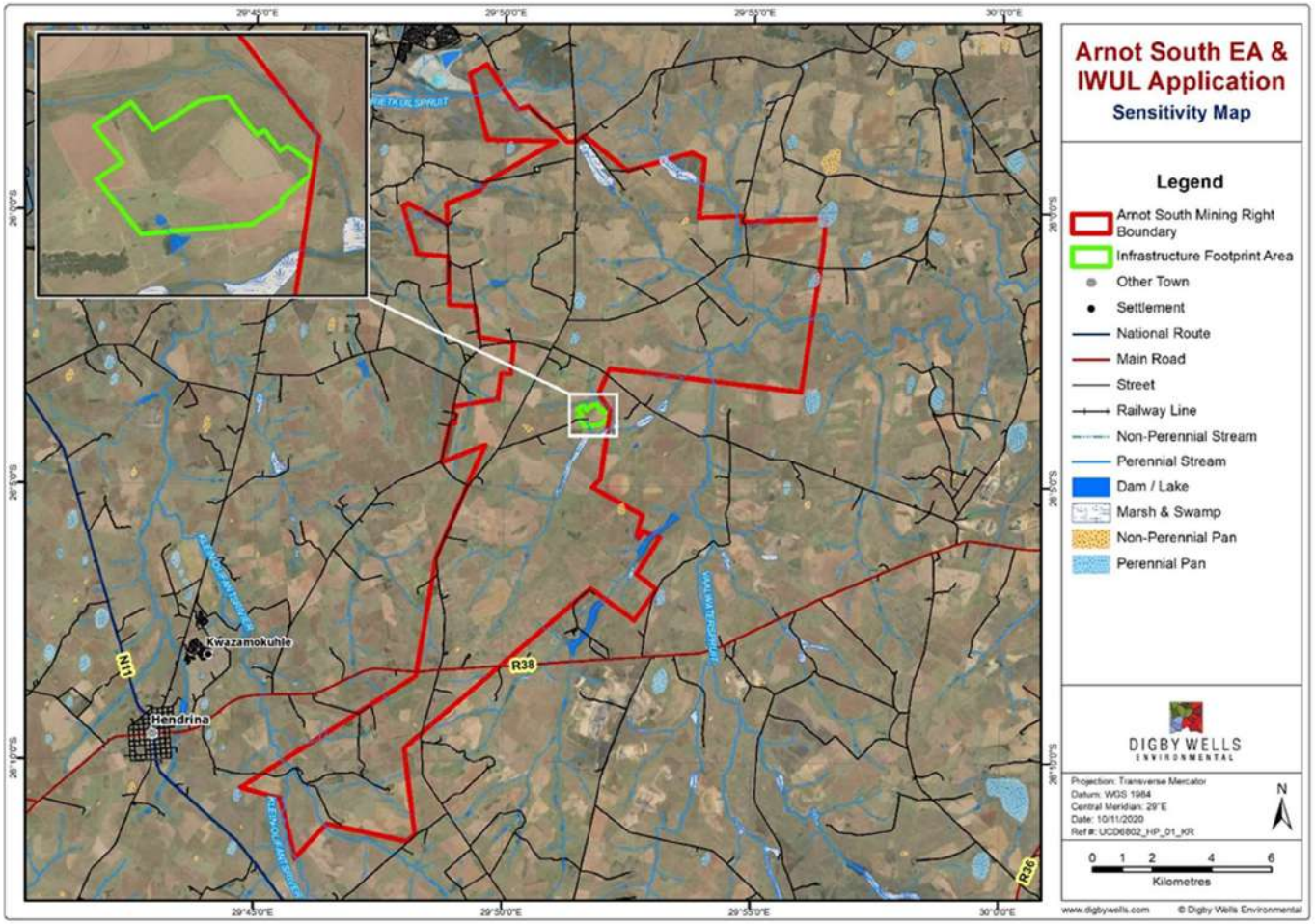


Figure 10-17: Identified Sensitive Water Areas within the Arnot South Project area

10.7 Soil, Land Use and Land Capability

This section provides the baseline environment regarding soils, land use and land capability associated with the proposed Project.

10.7.1 Land Type and Soil Forms

Existing land type and soil data was used to obtain generalised soil patterns and terrain types for the Project area. Land Type data exists in the form of published 1:250 000 maps. These maps indicate delineated areas of similar climate and pedosystems which includes areas of uniform terrain and soil patterns (Land Type Survey Staff, 1972 - 2006).

Baseline data suggested that the land types for the Project area are predominantly of the Ba22 type with minor areas of the Bb15 and Ba19 types. The main land types and dominant soil forms are briefly described below in Table 10-2 and illustrated in Figure 10-18.

Table 10-2: Land Type and Dominant Soil Forms

Land Type	Soil Forms	Geology	Characteristics
Ba22	• Avalon • Cartref • Clovelly • Glencoe • Glenrosa • Hutton • Katspruit • Kroonstad • Longlands • Mispah • Rensburg • Wasbank • Willowbrook	• Shale, shaly sandstone, grit, sandstone and conglomerate of the Ecca Group and Karoo Sequence; and • Dolerite.	• Red and yellow, dystrophic/mesotrophic, apedal soils with plinthic subsoils (plinthic soils comprise >10% of land type, red soils comprise >33% of land type).
Bb15	• Avalon • Cartref • Clovelly • Glencoe • Hutton • Katspruit • Kroonstad • Longlands • Mispah • Rensburg • Wasbank • Willowbrook	• Shale, shaly sandstone, grit, sandstone and conglomerate of the Ecca Group; and • Tillite and shale of the Dwyka Formation, Karoo Sequence.	• Red and yellow, dystrophic/mesotrophic, apedal soils with plinthic subsoils (plinthic soils comprise >10% of land type, red soils comprise <33% of land type).

Land Type	Soil Forms	Geology	Characteristics
Ba19	• Avalon • Clovelly • Dundee • Fernwood • Glenrosa • Hutton • Katspruit • Longlands • Mispah • Pinedene • Wasbank	• Mainly shale, grit, sandstone and conglomerate (Ecca Group); • Volcanic rocks (Selonsrivier Formation, Rooiberg Group); • Granophyre (Rashoop Suite, Bushveld Complex); and • Ferro-gabbro, ferro-diorite and diorite (Rustenburg Suite, Bushveld Complex) and rhyolite (Damwal Formation, Rooiberg Group).	• Red and yellow, dystrophic/mesotrophic, apedal soils with plinthic subsoils (plinthic soils comprise >10% of land type, red soils comprise >33% of land type).

10.7.2 Land Use

The current land use of the Arnot South Project area was identified by aerial imagery during the desktop assessment. The land use in the Project area is dominated by grassland and cultivated land. Other land use types identified include wetlands, plantations or woodlots, thicket or dense bush, urban area and bare land or non-vegetated areas. These are visually depicted in Figure 10-19.

10.7.3 Land Capability

The land capability was determined by assessing a combination of soil type, terrain and climate features. Land capability is defined as the most intensive long-term sustainable use of land under rain-fed conditions (Soil Conservation Service: U.S. Department of Agriculture, 1973; Schoeman *et al*., 2000). The dominant land capability class in the Project area is Class III (Arable Land – Moderate Cultivation/Intensive Cultivation - Figure 10-20), which is not suitable for agriculture but has a high land use potential for pastures, woodland, rangeland, wildlife food or cover. A detailed breakdown is given below (Table 10-3).

Table 10-3: Land Capability Classification of the Arnot South Project area

Class	Classification	Dominant Limitation Influencing the Physical Suitability for Agricultural Use
III	Arable Land – Moderate Cultivation/Intensive Cultivation	Soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

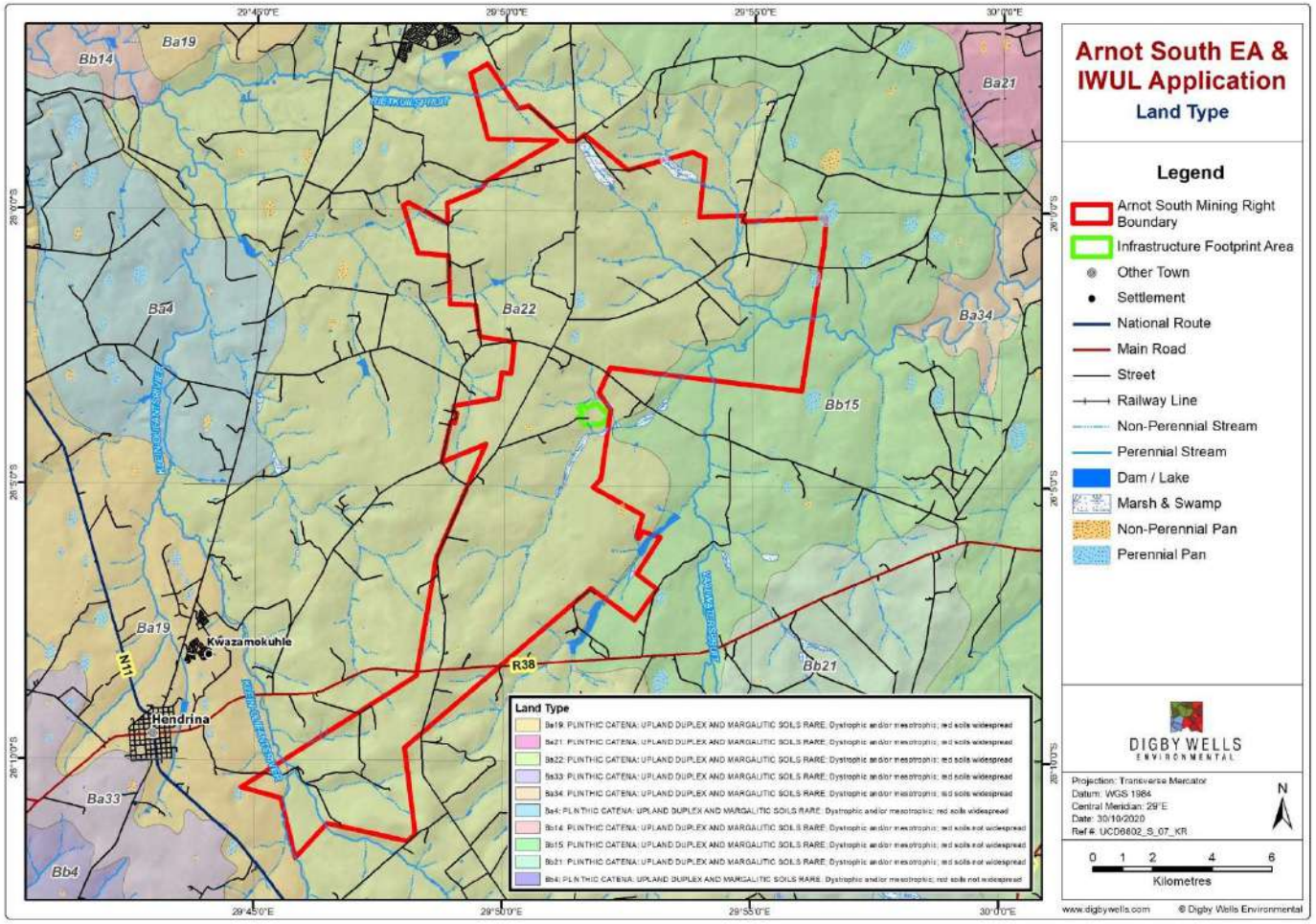


Figure 10-18: Land Type Map

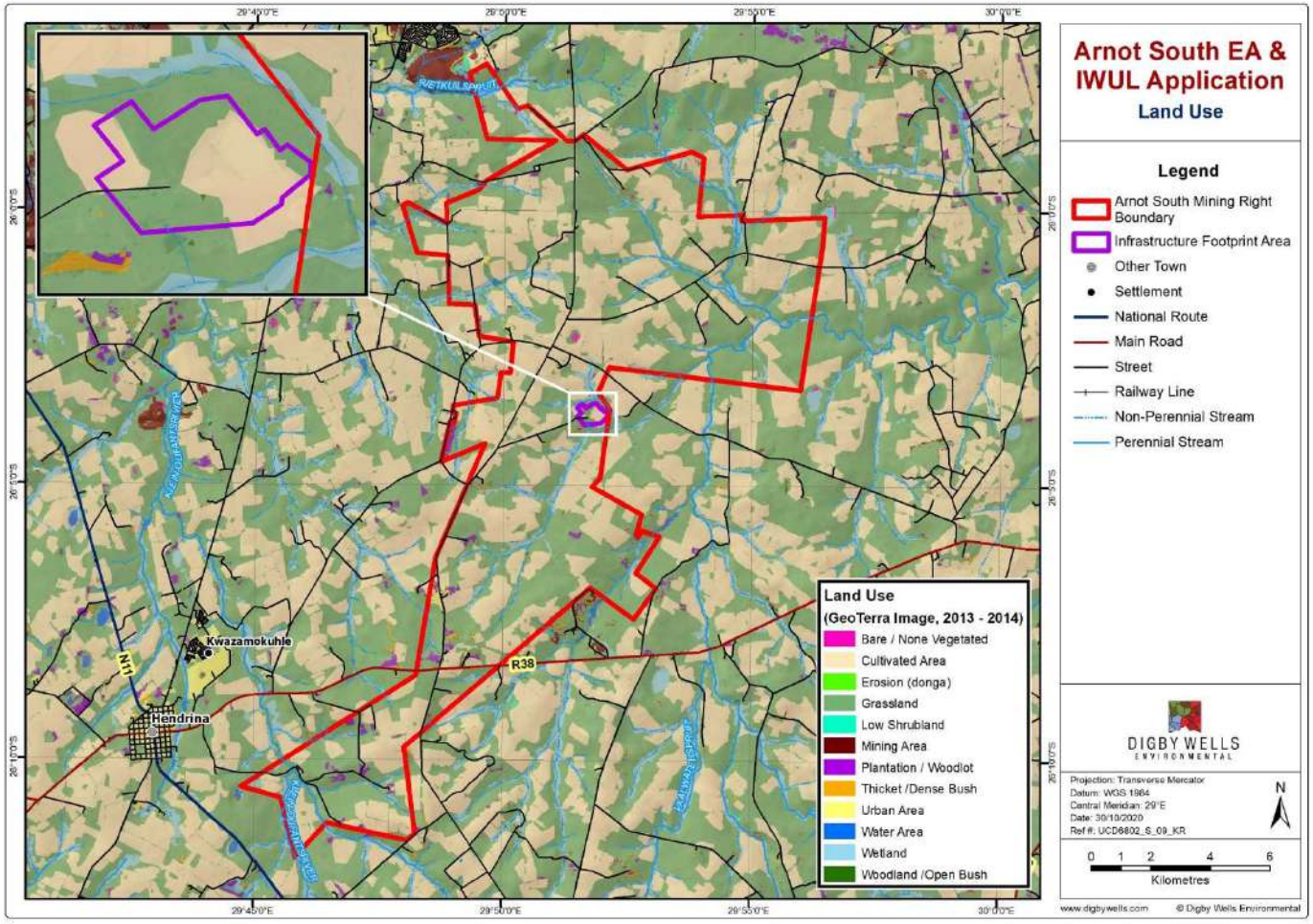


Figure 10-19: Land Use Map

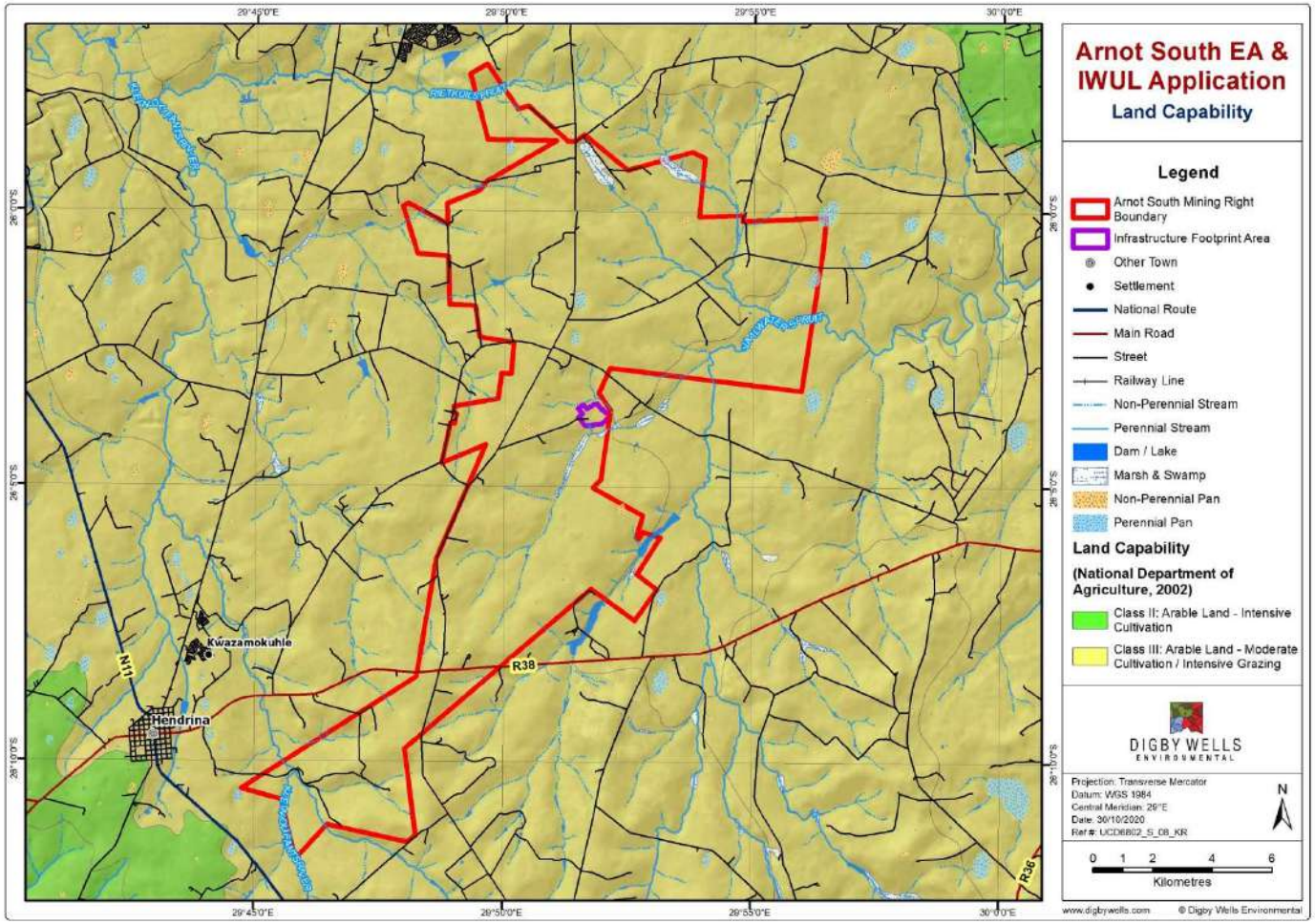


Figure 10-20: Land Capability Map

10.8 Flora

The Arnot South Project area falls within the Eastern Highveld Grassland (Gm12) vegetation type (Mucina & Rutherford, 2012) (Figure 10-21). The Grassland Biome is one of the nine South African plant Biomes and the second most diverse biome in South Africa. The Grassland Biome is situated primarily on the central plateau of South Africa, and the inland areas of Kwa-Zulu Natal and the Eastern Cape provinces. The biome is rich in flora and fauna diversity but is under threat due to agricultural activities, expansion of mining and industrial activities.

The Eastern Highveld Grassland is characterised by slightly to moderately undulating plains, including some low hills and pan depressions. This vegetation type is considered to be "Endangered" on the National List of Threatened Terrestrial Ecosystems and is considered approximately 55% altered. It is considered to be "poorly protected" with only 13% of its' target percentage protected (Lötter, 2015). The primary factor responsible for this status is on-going cultivation activities within the area. The vegetation of the landscape is short dense grassland dominated by the usual highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc.) (Mucina & Rutherford, 2012). Table 10-4 lists species expected to occur within this region.

The Project area consists of areas that are classified as CBA Irreplaceable in the northern and southern regions of the Mining Right area, as well as scattered portions of CBA Optimal, other natural areas and moderately modified old lands (Figure 10-22).

Table 10-4: Flora Species Characteristics of the Eastern Highveld Grassland

Plant Form	Species
Graminoids	*Aristida aequiglumis, A. congesta, A. junciformis* subsp. *galpinii, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. capensis, E. curvula, E. gummiflua, E. patentissima, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rehmannii, Alloteropsis semialata* subsp. *eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides.*
Herbs	*Berkheya setifera, Haplocarpha scaposa, Justicia anagalloides, Pelargonium luridum, Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvaalensis* subsp. *setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides* subsp. *latifolia, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata.*

Plant Form	Species
Geophytic Herbs	*Gladiolus crassifolius, Haemanthus humilis* subsp. *hirsutus, Hypoxis rigidula* var. *pilosissima, Ledebouria ovatifolia.*
Succulent Herbs	*Aloe ecklonis.*
Low Shrubs	*Anthospermum rigidum* subsp. *pumilum, Seriphium plumosum.*

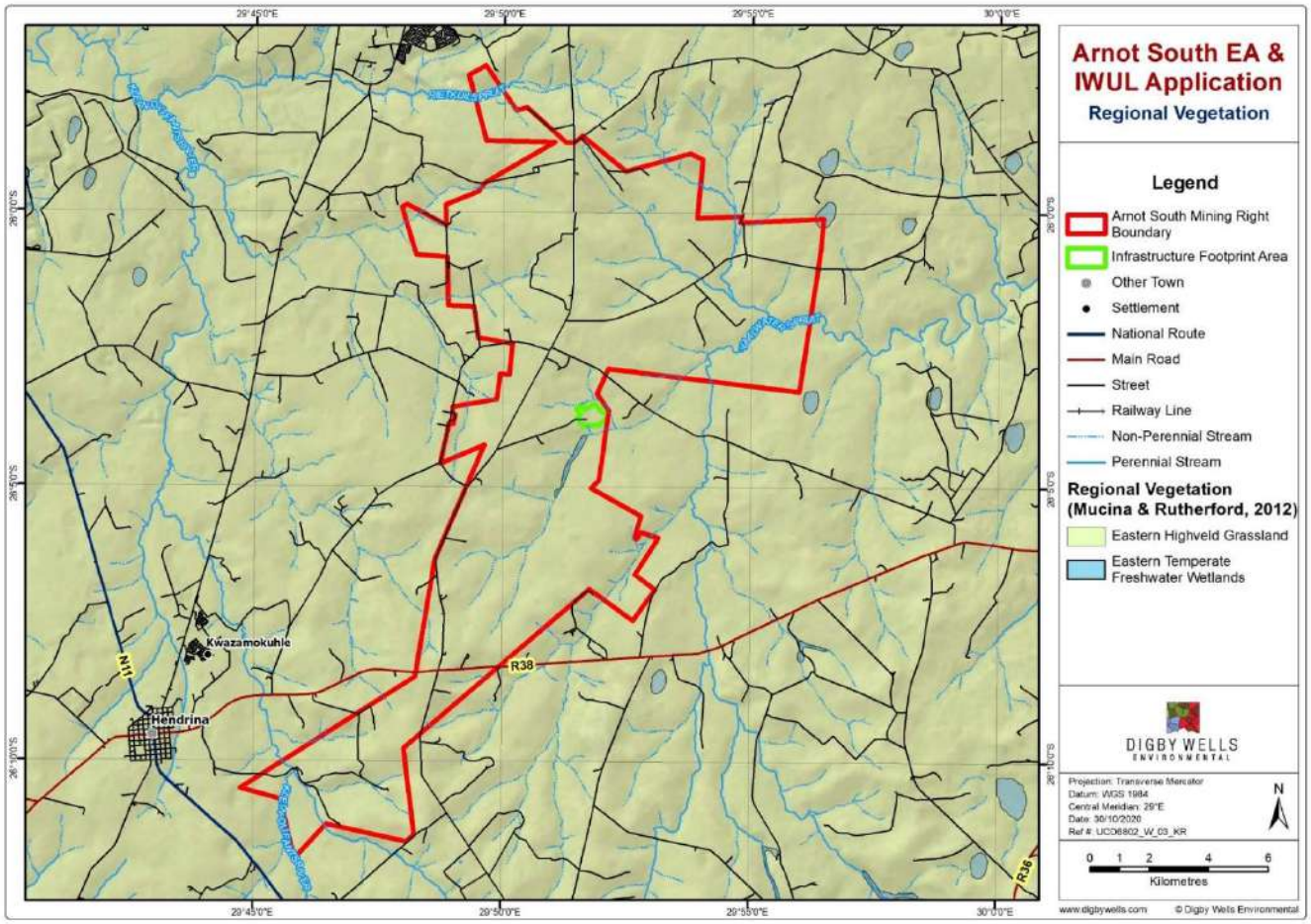


Figure 10-21: Regional Vegetation

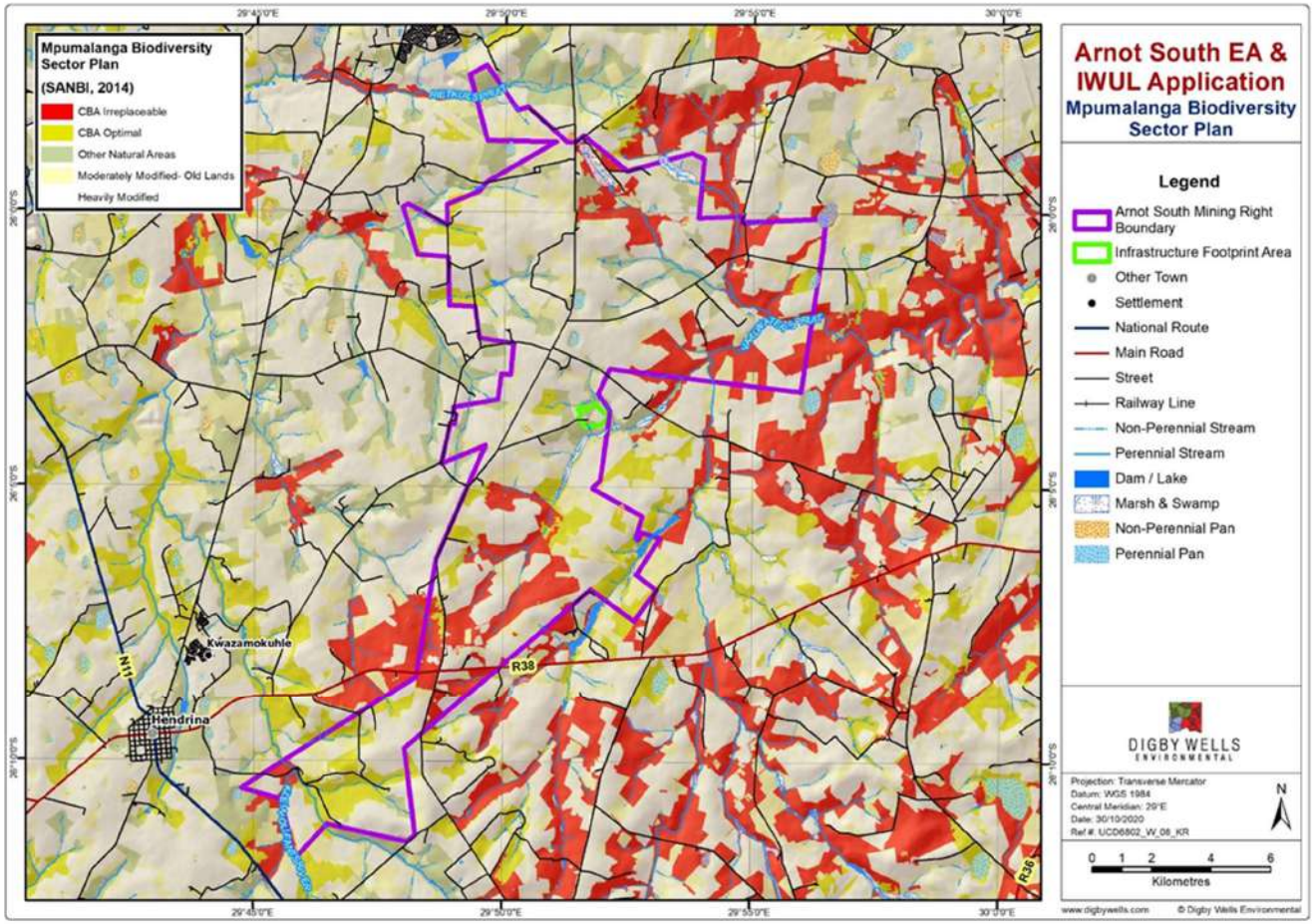


Figure 10-22: Mpumalanga Biodiversity Sector Plan

10.8.1 Protected Areas

Several Protected Areas are situated within close proximity to the Project area (Figure 10-23). The nearest and most apparent is the Nooitgedacht Dam Nature Reserve located approximately 10 km east of the Project area. The Nooitgetdacht reserve is 3,000 ha and holds host to a numerous number of game species such as Blesbuck, Springbok, Zebra, Red Hartebeest, Reedbuck, Oribi and recently introduced Buffalo. The Reserve surrounds the Nooitgedacht Dam where the Komati River originates. Other important tributaries are the Boesmanspruit, Witkloofspruit, and the Vaalwaterspruit. This Reserve is within the GSDM and is a custodian of the Mpumalanga Tourism and Parks Agency (MTPA).

Several other Nature Reserves are within a 100 km radius of the Arnot South Project area and include the St Louis Private Nature Reserve approximately 50 km southeast), Cecillia Private Nature Reserve (approximately 20 km north) and Heyns Private Nature Reserve (approximately 40 km west). These Reserves are not affiliated with the MTPA and are believed to be privately owned. The Nature Reserves collectively play a fundamental role in enhancing and conserving Mpumalanga's biological diversity and providing key ecological corridors for the movement of fauna. Their locations in relation to the Arnot South Project area are illustrated in Figure 10-23 below. Three Important Bird Areas (IBAs) have been identified within and in close proximity to the Project area (Figure 10-24).

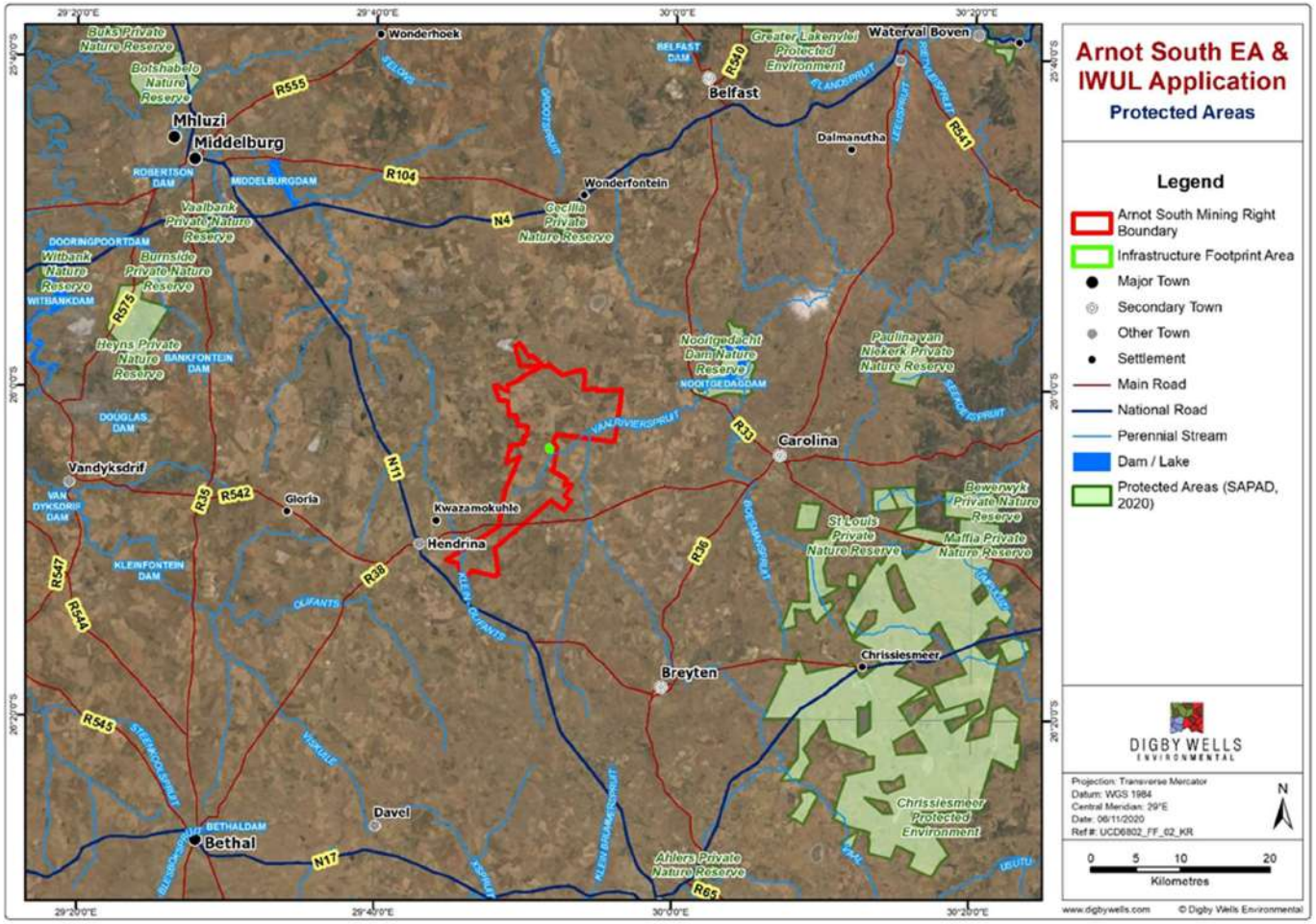


Figure 10-23: Protected Areas in close proximity to the Project area

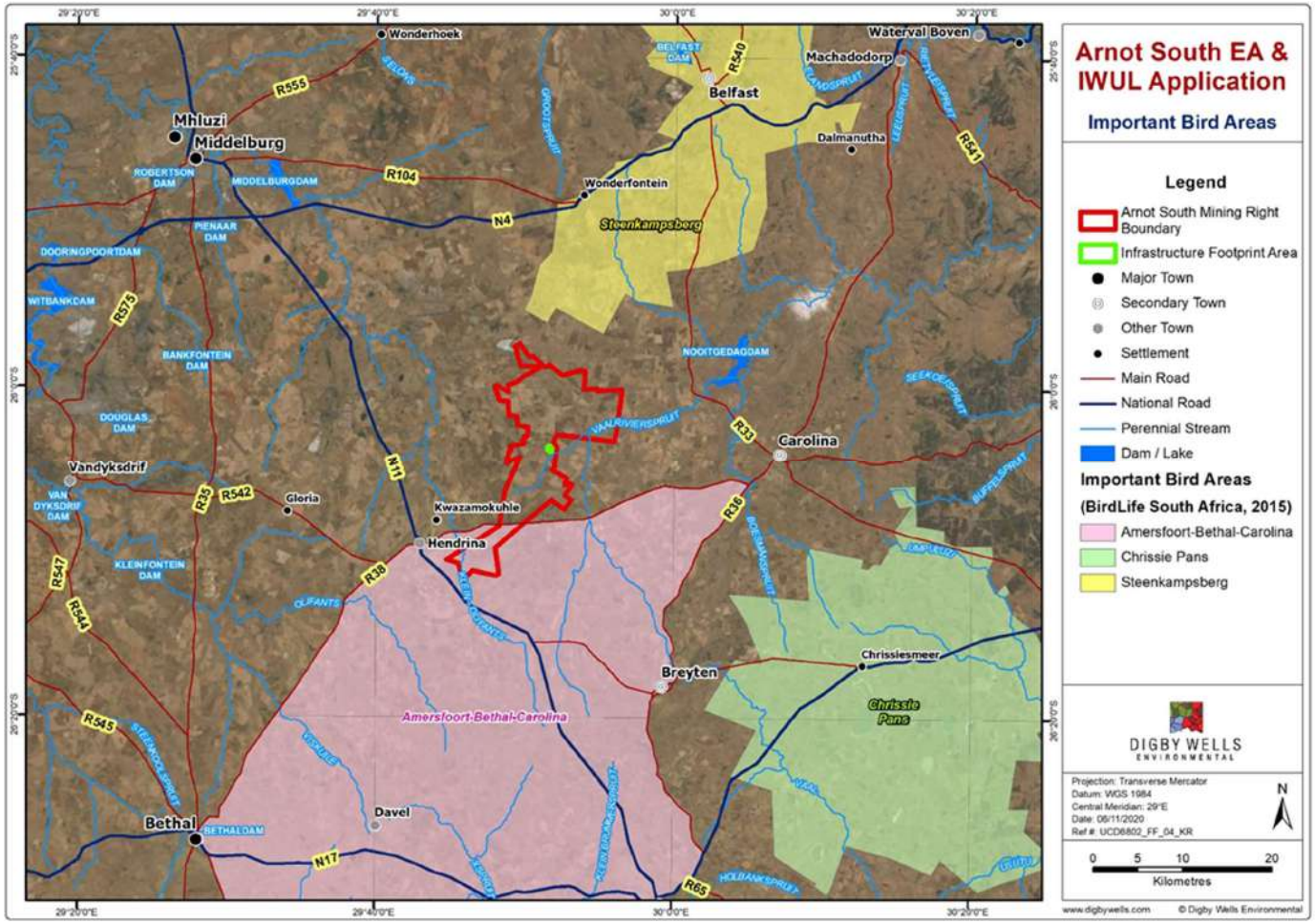


Figure 10-24: Important Bird Areas in proximity to the Project area

10.8.2 International Union for the Conservation of Nature (IUCN) Red Data Species

The proposed Project area lies within two Quarter Degree Square (QDS) namely 2629BB and 2529DD. According to Pretoria Computerised Information System (PRECIS) (BODATSA-POSA, 2016) several Red Data listed species are expected to be present within the identified QDS and expected plant species to occur is listed in Appendix D of the Scoping Report.

10.8.3 Protected Flora – Species of Conservation Concern

The Plants of South Africa (NEWPOSA) species list was obtained from the South African National Biodiversity Institute (SANBI) (https://newposa.sanbi.org/). It lists all the Red Data plant species officially recorded by SANBI for South African QDS grid. In order for a flora species to be included in this list, a specimen collected in this grid must be supplied to SANBI to be verified and recorded. This list is therefore not a comprehensive list representing only those species that may occur in the aforementioned grids, but rather a guideline as to what is to be expected. Generally, the sites sampled are small portions of the whole grid and habitats suitable for certain species. It is, therefore, not unusual for species in the POSA list to be absent from the sampling sites.

The flora species list obtained from the NEWPOSA indicate that eleven species are classified as Vulnerable (VU) or Near Threatened (NT), and two species are classified as Rare, might occur within in the Project area. The species are considered SCC and are listed in Table 10-5 below.

Table 10-5: Flora Species of Conservation Concern

Species	Red Data status	SA Endemic
Aloe cooperi subsp. cooperi	Least Concern (LC)	No
Aloe reitzii var. reitzii	NT	Yes
Brachystelma minor	VU	Yes
Brachystelma stellatum	Rare	Yes
Crassula setulosa var. deminuta	NE	Yes
Crassula setulosa. var. setulosa	NE	Yes
Cryptocarya transvaalensis	LC	No
Dactylis glomerata	NE	No
Dianthus zeyheri subsp. natalensis	NE	Yes
Disa alticola	VU	Yes
Disa zuluensis	EN	Yes
Eucomis autumnalis subsp. clavata	NE	No

Species	Red Data status	SA Endemic
Eucomis vandermerwei	VU	Yes
Graderia linearifolia	VU	Yes
Habenaria barbertoni	NT	Yes
Helichrysum aureum. var. argenteum	NE	Yes
Jamesbrittenia macrantha	NT	Yes
Khadia alticola	Rare	Yes
Khadia carolinensis	VU	Yes
Lydenburgia cassinoides	NT	Yes
Merwilla natalensis	NT	No
Protea parvula	NT	No
Zantedeschia pentlandii	VU	Yes

10.9 Fauna

This section covers various groups of animals including mammals, birds, reptiles, amphibians and invertebrates.

10.9.1 Mammals

Mammals form a vital component of ecosystems. Not only are they important for nutrient cycling, habitat modification, consumers of plants and seed dispersal but they're also a considerable component of predators in healthy ecosystems.

Mammals expected to occur within the Project area are listed in Appendix D. It has been noted that 29 of these potentially occurring species have been assigned a Red Data status, either as part of the SANBI Red Data list or the IUCN (2017). The protected species are tabulated below in Table 10-6 below.

Table 10-6: Red Data mammal species

Species Name	Common Name	SA Red List (2016)	IUCN 2017	TOPS (NEMBA)
Georychus capensis	Cape Mole Rat	LC	LC	Not Evaluated
Chlorotalpa sclateri montana	Sclater's Golden Mole	LC	LC	Not Evaluated
Amblysomus septentrionalis	Highveld Golden Mole	NT	NT	Not Evaluated
Chrysospalax villosus	Rough-haired Golden Mole	VU	VU	Not Evaluated
Neamblysomus julianae	Juliana's Golden Mole	EN	EN	Not Evaluated
Amblysomus robustus	Robust Golden Mole	VU	VU	Not Evaluated

Species Name	Common Name	SA Red List (2016)	IUCN 2017	TOPS (NEMBA)
Amblysomus hottentotus meesteri	Hottetnot Golden Mole	LC	LC	Not Evaluated
Otomys laminatus	Laminate Vlei Rat	NT	LC	Not Evaluated
Rhinolophus blasii empusa	Peak-Saddle Horseshoe Bat	NT	LC	Not Evaluated
Miniopterus fraterculus	Lesser Long-Fingered Bat	LC	LC	Not Evaluated
Myotis welwitschii	Welwitsch's Hairy Bat	LC	LC	Not Evaluated
Cleotis percivali australis	Short-Eared Trident Bat	EN	LC	Not Evaluated
Orycteropus afer	Antbear	LC	LC	Not Evaluated
Ourebia ourebi	Oribi	EN, Criteria C2a(ii)	LC	EN
Poecilogale albinucha	African Striped Weasel	NT	LC	Not Evaluated
Lycaon pictus	Wild Dog	EN, Criteria D	EN	Not Evaluated
Manis temminckii	Pangolin	VU	VU	Not Evaluated
Proteles cristatus	Aardwolf	LC	LC	Not Evaluated
Panthera pardus	African Leopard	VU	VU	Not Evaluated
Pronolagus crassicaudatus ruddi	Natal Red Rock Rabbit	LC	LC	Not Evaluated
Atelerixs frontalis	South African Hedgehog	NT	LC	Not Evaluated
Dasymys incomtus	African Marsh Rat	NT	LC	Not Evaluated
Hyaena brunnea	Brown Hyaena	NT	NT	Listed
Leptailurus serval	Serval	NT	LC	Listed
Hydrictis maculicollis	Spotted-Necked Otter	NT	NT	Not Evaluated
Miniopterus schreibersii	Schreiber's Long-fingered Bat	NT	NT	Not Evaluated
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	LC	LC	Not Evaluated
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	LC	Not Evaluated

Species Name	Common Name	SA Red List (2016)	IUCN 2017	TOPS (NEMBA)
Dendrohyrax arboreus arboreus	Tree Hyrax	EN	LC	Not Evaluated

10.9.2 Avifauna

Birds have been viewed as good ecological indicators, since their presence or absence tends to represent conditions pertaining to the proper functioning of an ecosystem. Bird communities and ecological conditions are linked to land cover. As the land cover of an area changes, so do the types of birds in that area. Land cover is directly linked to habitats within the study area. The diversity of these habitats should support many different species.

According to the South African Bird Atlas Project (SABAP), almost 100 species of birds have been identified in the area (see Appendix D); the majority of these birds are comprised of grassland species. Of these species, 31 have been assigned a Red Data status and are listed in Table 10-7 below. Furthermore, an additional 41 species are endemic to the area and are listed in Table 10-8 below.

Table 10-7: Red Data bird species

Species Name	Common Name	IUCN Status	NEMBA
Botaurus stellaris	Eurasian Bittern	LC	LC
Spizocorys fringillaris	Botha's Lark	EN	EN
Mirafra cheniana	Melodious Lark	LC (Decreasing)	NT
Alcedo semitorquata	Half-collared Kingfisher	LC	NT
Charadrius pallidus	Chestnut-banded Plover	NT	NT
Ciconia nigra	Black Stork	LC	VU
Circus maurus	Black Harrier	EN	EN
Circus pygargus	Montagu's Harrier	LC	LC
Eupodotis caerulescens	Blue Korhaan	LC	NT
Falco biarmicus	Lanner Falcon	VU	VU
Falco peregrinus	Peregrine Falcon	LC	VU
Glareola nordmanni	Black-winged Pratincole	NT	NT
Hieraaetus ayresii	Ayres's Hawk-Eagle	LC	LC
Leptoptilos crumeniferus	Marabou Stork	LC	NT
Mirafra cheniana	Melodious Lark	LC	LC
Mycteria ibis	Yellow-billed Stork	LC	EN
Phoenicopterus minor	Lesser Flamingo	NT	NT

Species Name	Common Name	IUCN Status	NEMBA
Phoenicopterus ruber	Greater Flamingo	LC	-
Rostratula benghalensis	Greater Painted snipe	LC	NT
Sagittarius serpentarius	Secretarybird	VU	VU
Sterna caspia	Caspian Tern	LC	VU
Anthropoides paradisea	Blue Crane	VU	VU
Circus ranivorus	African Marsh-Harrier	LC	Protected
Crex crex	Corn Crake	LC	LC
Falco naumanni	Lesser Kestrel	LC	VU
Geronticus calvus	Southern Bald Ibis	VU	VU
Gyps coprotheres	Cape Vulture	EN	EN
Neotis denhami	Denham's Bustard	VU	VU
Podica senegalensis	African Finfoot	VU	VU
Polemaetus bellicosus	Martial Eagle	EN	VU
Tyto capensis	African Grass-Owl	VU	VU

EN = Endangered, CR = Critically Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern

Table 10-8: Endemic bird species

Species Name	Common Name	General Status
Amadina erythrocephala	Red-headed Finch	Endemic
Anas smithii	Cape Shoveler	Endemic
Bradornis mariquensis	Marico Flycatcher	Endemic
Buteo rufofuscus	Jackal Buzzard	Endemic
Calendulauda sabota	Sabota Lark	Endemic
Certhilauda semitorquata	Eastern Long-billed Lark	Endemic
Chersomanes albofasciata	Spike-heeled Lark	Endemic
Cinnyris afra	Greater Double-collared Sunbird	Endemic
Emberiza impetuani	Lark-like Bunting	Endemic
Estrilda melanotis	Swee Waxbill	Endemic
Eupodotis afraoides	Northern Black Korhaan	Endemic
Eupodotis barrowii	Barrow's Korhaan	Endemic
Granatina granatina	Violet-eared Waxbill	Endemic
Hirundo spilodera	South African Cliff-Swallow	Endemic

Species Name	Common Name	General Status
Lamprotornis nitens	Cape Glossy Starling	Endemic
Laniarius atrococcineus	Crimson-breasted Shrike	Endemic
Laniarius ferrugineus	Southern Boubou	Endemic
Macronyx capensis	Cape Longclaw	Endemic
Mirafra fasciolata	Eastern Clapper Lark	Endemic
Monticola explorator	Sentinel Rock-Thrush	Endemic
Monticola rupestris	Cape Rock-Thrush	Endemic
Myrmecocichla formicivora	Anteating Chat	Endemic
Oenanthe monticola	Mountain Wheatear	Endemic
Parisoma subcaeruleum	Chestnut-vented Tit-Babbler	Endemic
Parus niger	Southern Black Tit	Endemic
Passer diffusus	Southern Grey-headed Sparrow	Endemic
Passer melanurus	Cape Sparrow	Endemic
Ploceus capensis	Cape Weaver	Endemic
Prinia flavicans	Black-chested Prinia	Endemic
Pternistis natalensis	Natal Francolin	Endemic
Pternistis swainsonii	Swainson's Spurfowl	Endemic
Sigelus silens	Fiscal Flycatcher	Endemic
Sphenoeacus afer	Cape Grassbird	Endemic
Spizocorys conirostris	Pink-billed Lark	Endemic
Spreo bicolor	Pied Starling	Endemic
Stenostira scita	Fairy Flycatcher	Endemic
Tadorna cana	South African Shelduck	Endemic
Telophorus zeylonus	Bokmakierie	Endemic
Tricholaema leucomelas	Acacia Pied Barbet	Endemic
Turdus smithi	Karoo Thrush	Endemic
Zosterops virens	Cape White-eye	Endemic

10.9.3 Reptiles

Reptiles are ectothermic (cold-blooded) meaning their internal basal temperature is influenced by their surrounding external environment, as a result, reptiles are dependent on environmental heat sources. Thus, many reptiles regulate their body temperatures by basking in the sun, or warmer surfaces (or substrates). Substrates are an important determining factor for identifying which habitats are suitable for which species of reptile. Rocky outcrops and suitable woody vegetation would increase habitat and diversity of reptiles within the Project area.

Of the reptile species that could potentially occur within the Project area, two have been assigned Red Data status and are presented in Table 10-9 below.

Table 10-9: Red Data reptile species

Species name	Common English name	NEM:BA Status
Lamprophis aurora	Aurora House Snake	LC
Python natalensis	Southern African Python	VU

VU = Vulnerable, LC = Least Concern

10.9.4 Amphibians

Amphibians are viewed to be good indicators of changes to the whole ecosystem as they are sensitive to changes in the aquatic and terrestrial environments (Waddle, 2006). Most species of amphibians are dependent on the aquatic environment for reproduction. Additionally, amphibians are sensitive to water quality and ultraviolet radiation because of their permeable skin (Gerlanc, 2005).

Wetland clusters are groups of wetlands (within a 1 km buffer) that are considered to function as a unit in the landscape, allowing for important ecological processes such as migration of frogs and insects between wetlands to take place. Numerous pans and wetlands have been identified within the Project area and thus provide ideal habitat (among others) for the SCC Giant African Bullfrog (*Pyxicephalus adspersus*), thus this species is therefore likely to occur. The Giant African Bullfrog is listed as Near Threatened in South Africa (Table 10-10).

Table 10-10: Red Data amphibian species

Species Name	Common name	NEM:BA Status
Pyxicephalus adspersus	Giant African Bullfrog	NT

10.9.5 Invertebrates

Butterflies are a good indication of the various habitats available in a specific area (Woodhall, 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall, 2005). Butterflies are useful indicators as they are relatively easy to locate and

catch, and to identify. It is for this reason that Lepidoptera (moths and butterflies) will be used as the primary focus for the invertebrate survey. One SCC that is likely to occur is the Marsh Sylph (*Metisella meninx*). This is a marsh species that requires thick clumps of grass, particularly *Leersia hexandra* (Poacea), and unpolluted environments. A marsh habitat is one of the most easily disrupted habitats and the apparent plight of this species brings it sharply into focus (Henning, 2009). Likely occurring Red Data species are listed below in Table 10-11. The specific Red Data conservation status is not always known.

Table 10-11: Red Data Lepidoptera Species

Scientific name	Habitat	NEM: BA status
Acraea (Acreae) machequena	Bushveld	LC
Aloeides dentatis maseruna	Grassland	LC
Andronymus neander neander	Bushveld	LC
Gegenes hottentota	Riparian	LC
Lepidochrysops hypopodia	Grassland	LC
Lepidochrysops praeterita	Grassland	EN
Metisella meninx	Riparian	NT
Neita neita	Bushveld	LC
Platylesches dolomitica	Grassland	LC
Spialia paula	Bushveld	LC
Tuxentius melaena griqua	Riparian	DD

10.10 Wetlands

The baseline has been conducted at a desktop level and a site visit to delineate wetlands will be conducted during the EIA investigation.

10.10.1 Regional Biodiversity Importance

10.10.1.1 *National Freshwater Ecosystem Priority Areas*

The NFEPA project provides a collated, nationally consistent information source of wetland and river ecosystems for incorporating freshwater ecosystem and biodiversity goals into planning and decision-making processes (Nel *et al.,* 2011). The spatial layers (Freshwater Ecological Priority Area (FEPAs)) include the nationally delineated wetland areas that are classified into Hydro-geomorphic (HGM) units and ranked in terms of their biodiversity importance. These layers were assessed to evaluate the importance of the wetlands.

Based on a desktop-based modelled wetland condition and a combination of special features, including expert knowledge (e.g. intact peat wetlands, presence of rare plants and animals, etc.) and available spatial data on the occurrence of threatened frogs and wetland-dependent

birds, each of the wetlands within the inventory were ranked in terms of their biodiversity importance and as such, Wetland FEPAs were identified in an effort to achieve biodiversity targets (Driver *et al*., 2011). Whilst being a valuable tool, it is important to note that the FEPAs were delineated and studied at a desktop and relatively low-resolution level. Thus, the wetlands delineated via the desktop delineations and on-site verification work done through this study may differ from the NFEPA data layers. The NFEPA assessment does, however, hold significance from a national perspective.

The Project area comprises channelled valley bottom, seep, depression and flat NFEPA Wetlands. Within the infrastructure footprint area, only a minor area is classified as a channelled valley bottom NFEPA Wetland.

Based on the current outputs of the NFEPA project (Nel *et a*l., 2011), the sub-quaternary catchment associated with the proposed Project area was defined as a River FEPA and as an Upstream management area. Figure 10-25 and Figure 10-26 illustrates these NFEPA wetlands and River FEPAs, respectively.

The associated unnamed tributary of the Vaalwaterspruit was assigned a B ecological category and identified as a River FEPA, thus considered to achieve biodiversity targets for river ecosystems and threatened/near threatened fish species. The stream therefore needs to be manged in a way that maintains the good condition. Upstream management areas are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas.

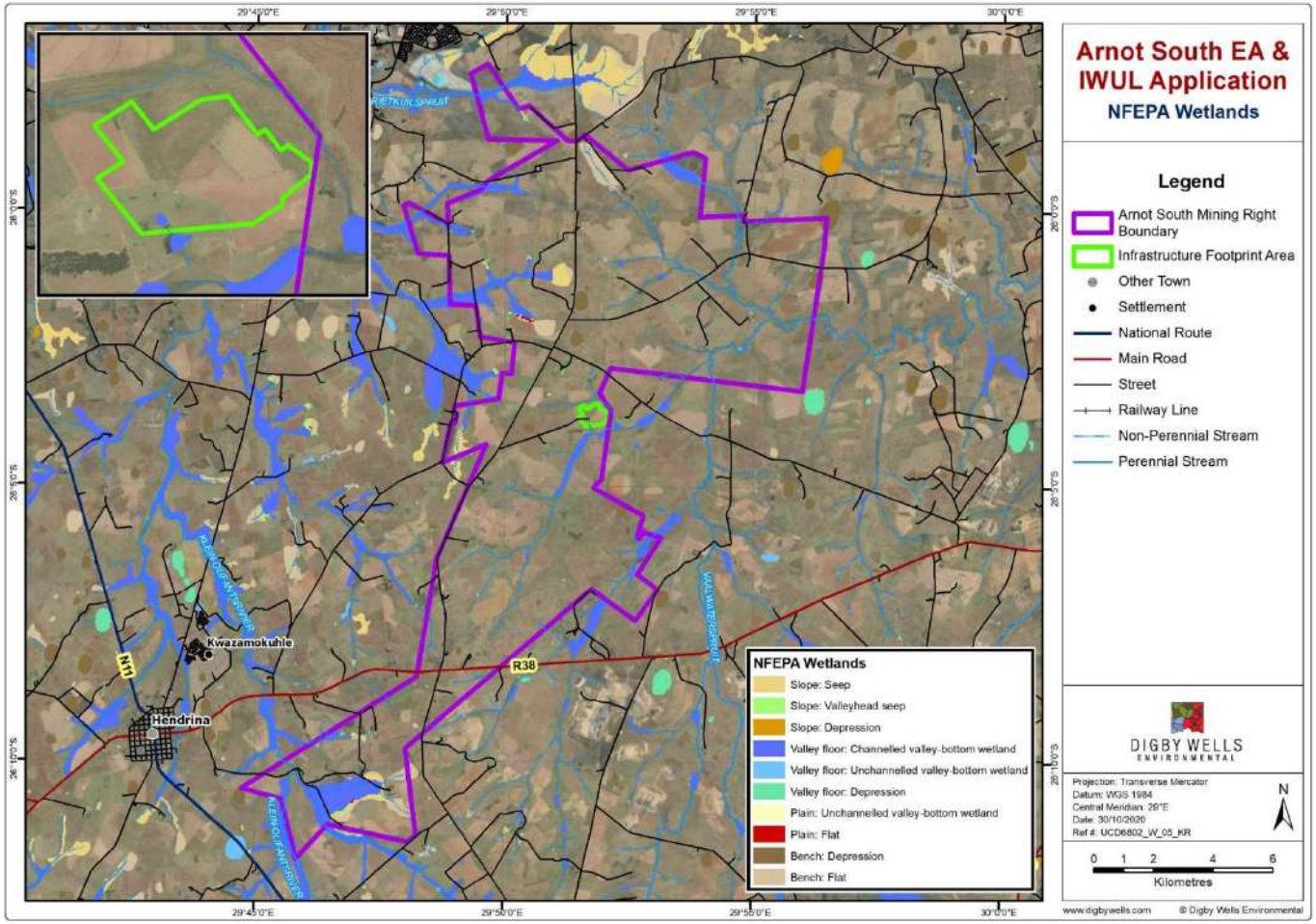


Figure 10-25: NFEPA Wetlands

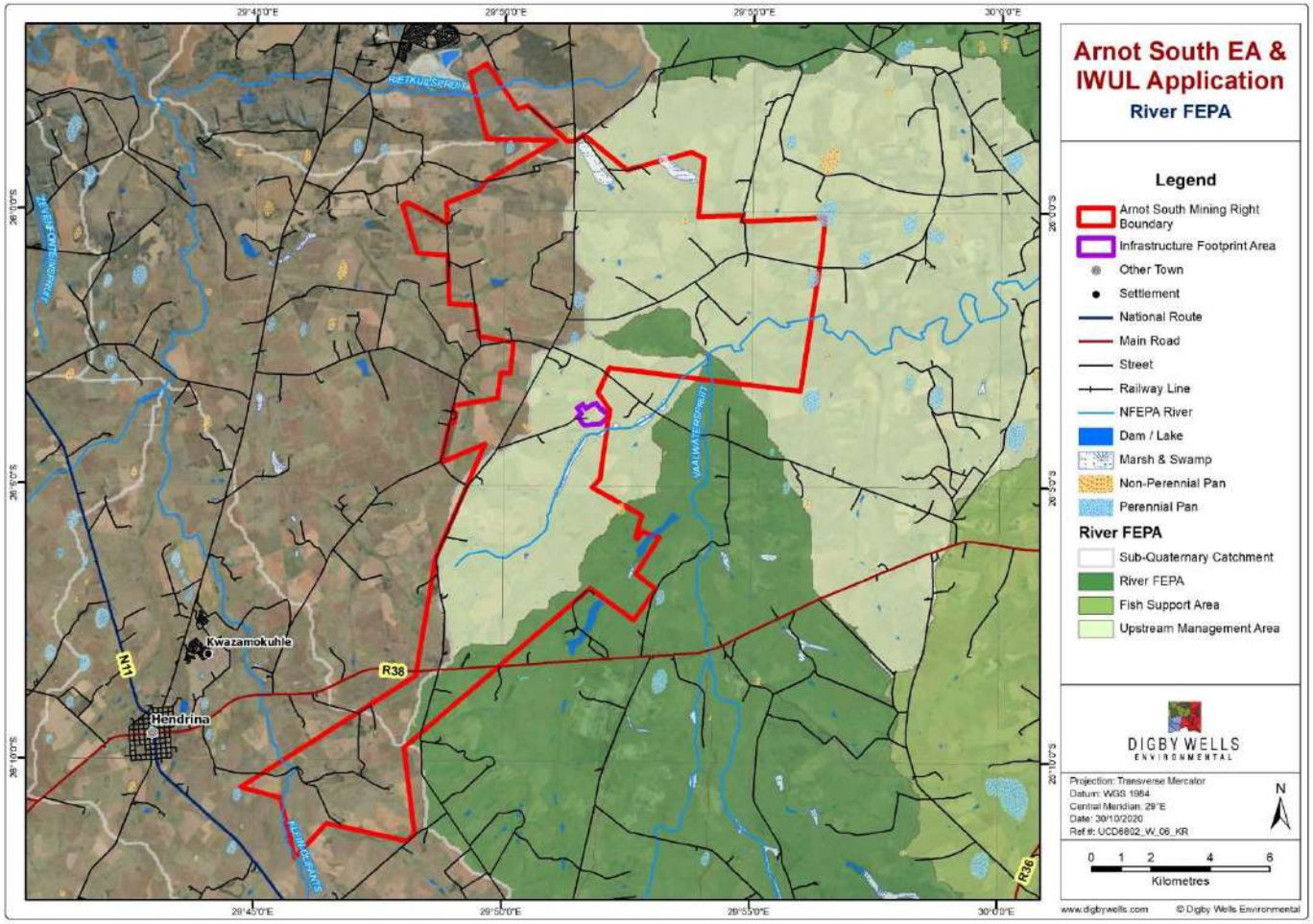


Figure 10-26: River FEPAs

10.10.1.2 *Mining and Biodiversity Guidelines*

The Mining and Biodiversity Guideline was developed collaboratively by SANBI, DEA, DMRE and the Chamber of Mines and the South African Mining and Biodiversity Forum in 2013. The purpose of the guideline was to provide the mining sector with a manual to integrate biodiversity into the planning process thereby encouraging informed decision-making around mining development and environmental authorizations. The aim of the guideline is to explain the value for mining companies to consider biodiversity management throughout the planning process. The guideline highlights the importance of biodiversity in managing the social, economic and environmental risk of the proposed mining Project. The country has been mapped into biodiversity priority areas including the four categories listed in Table 10-12 below, each with associated risks and implications (DEA *et al*., 2013).

Table 10-12: Mining and Biodiversity Guideline Categories (Department of Environmental Affairs *et al.* 2013)

Category	Risk and Implications for Mining
Legally Protected	Mining prohibited; unless authorised by ministers of both the DEA and DMRE.
Highest Biodiversity Importance	Highest Risk for Mining: The Environmental Impact Assessment (EIA) process must confirm significance of the biodiversity features that may be a fatal flaw to the proposed Project. Specialists must provide site-specific recommendations for the application of the mitigation hierarchy that informs the decision-making processes of mining licences, water use licences and environmental authorisations. If granted, authorisations should set limits on allowed activities and specify biodiversity related management outcomes.
High Biodiversity Importance	High Risk for Mining: the EIA process must confirm the significance of the biodiversity features for the conservation of biodiversity priority areas. Significance of impacts must be discussed as mining options are possible but must be limited. Authorisations may set limits and specify biodiversity related management outcomes.
Moderate Biodiversity Importance	Moderate Risk for Mining: the EIA process must confirm the significance of the biodiversity features and the potential impacts as mining options must be limited but are possible. Authorisations may set limits and specify biodiversity related management outcomes.

The Project area, including the infrastructure footprint area, has large areas classified as Highest Biodiversity Importance – Highest Risk for Mining, with minor areas classified as Moderate Biodiversity Importance – Moderate Risk for Mining (Figure 10-27).

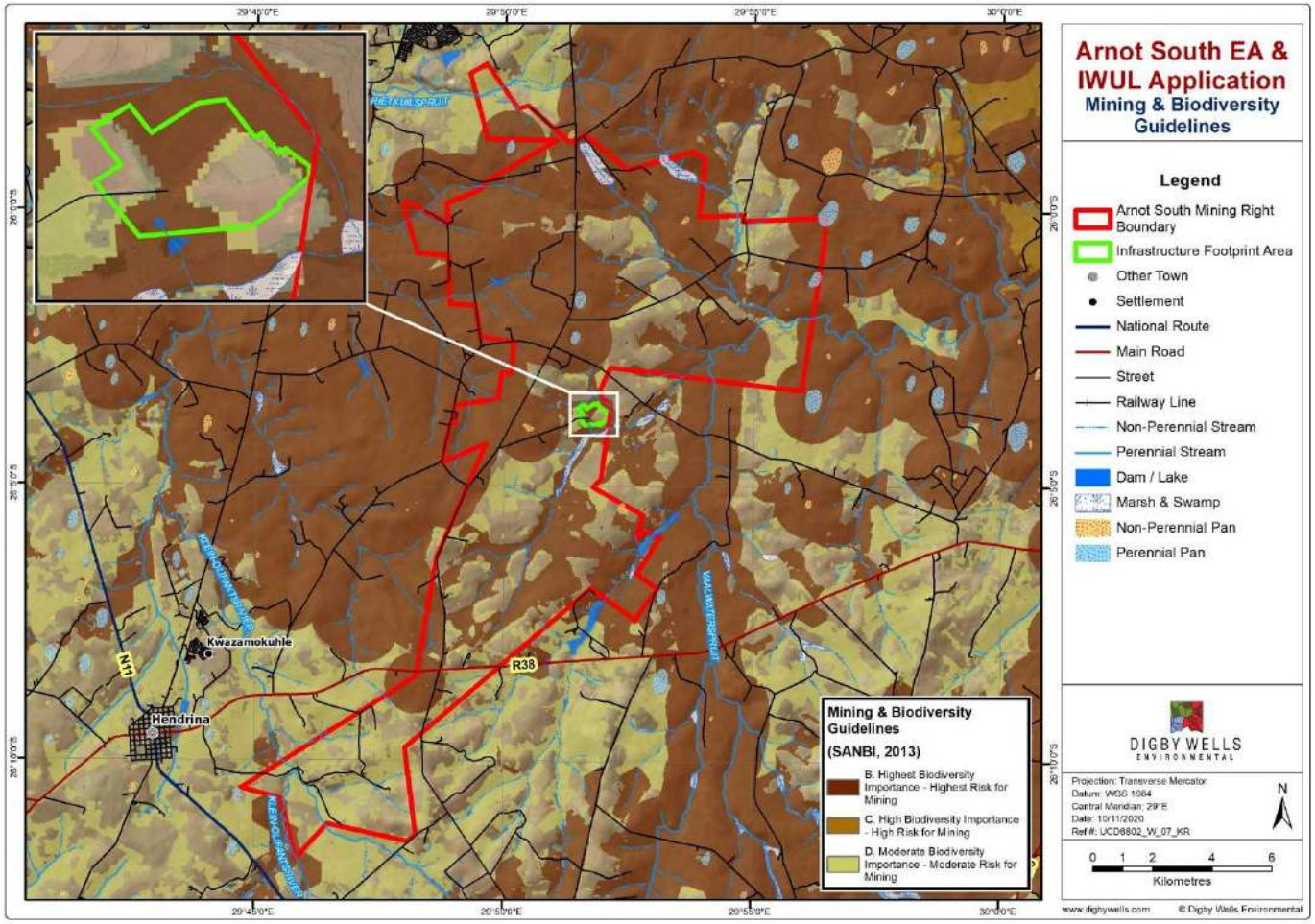


Figure 10-27: Mining and Biodiversity Guideline

10.10.1.3 *Mpumalanga Biodiversity Sector Plan*

Wetlands in the Mpumalanga Province have been extensively degraded and, in many cases, irreversibly modified and lost through a combination of inappropriate land-use practices, development, agriculture and mining. Wetlands represent ecosystems of high value for delivering, managing and storing good water quality for anthropological and animal use yet they are vulnerable to undesirable impacts. It is therefore in the interest of national water security that all wetlands are protected by law.

The Project area consists of areas classified as CBA Irreplaceable to the north east and south of the Mining Right area, as well as scattered portions of CBA Optimal, ONAs and moderately modified old lands (Figure 10-22 above).

10.11 Aquatic Ecology

The Project area is located within the Highveld Ecoregion (Level II Ecoregion 11.02), falling under the Southern Temperate Highveld Freshwater Ecoregion (Darwall *et al.*, 2009). This ecoregion is characterised by plains with a moderate to low relief and soils that are mostly coarse, sandy and shallow. Consequently, the drainage density is mostly low, but medium in some areas. There are various grassland vegetation types (with moist types present towards the east and drier types towards the west and south). Table 10-13 provides a summary of the main attributes of the Highveld Ecoregion (Kleynhans & Hill, 1999; Kleynhans, Thirion, & Moolman, 2005).

Table 10-13: Main Attributes of the Highveld Ecoregion

Main Attributes	Highveld Ecoregion
Terrain morphology: Broad division (dominant types in bold) (Primary)	**Plains; Low Relief; Plains; Moderate Relief**; Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to high Relief Closed Hills. Mountains; Moderate and High Relief.
Vegetation types (dominant types in bold) (Primary)	Mixed Bushveld (limited); Rocky Highveld Grassland; **Dry Sandy Highveld Grassland**; Dry Clay Highveld Grassland; **Moist Cool Highveld Grassland**; Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited).
Altitude (mamsl) (modifying)	1 100-2 100, 2 100-2 300 (very limited)
MAP (mm) (Secondary)	400 to 1 000
Coefficient of Variation (% of annual precipitation)	<20 to 35

Main Attributes	Highveld Ecoregion
Rainfall concentration index	45 to 65
Rainfall seasonality	Early to late summer
Mean annual temp. (Degree Celsius (°C))	12 to 20
Mean daily max. temp. (°C): February	20 to 32
Mean daily max. temp. (°C): July	14 to 22
Mean daily min. temp. (°C): February	10 to 18
Mean daily min temp. (°C): July	-2 to 4
Median annual simulated runoff (mm) for quaternary catchment	5 to >250

10.11.1.1 *Desktop Present Ecological State, Importance and Sensitivity*

Table 10-14 outlines the desktop aquatic-related data obtained for the potentially affected Quaternary Catchments (DWS, 2014).

Table 10-14: Desktop Aquatic Data pertaining to River Reaches Associated with the Project

SQR Code	EC	Category Description	EI	ES
B12A-01309	C	Moderately modified	High	High
B12B-01256	C	Moderately modified	High	High
B12B-01213	E	Seriously modified	Moderate	Moderate
X11A-01300	B	Largely natural	Moderate	Moderate
X11A-01295	B	Largely natural	Moderate	High
X11A-01248				

EC = Ecological Category; EI = Ecological Importance; ES = Ecologiacal Sensitivity

Both the river reaches of the Klein-Olifants (B12A-01309 and B12B-01256 SQRs) appear to be in a *Moderately modified* state (i.e. Ecological Category C; DWS, 2014). Surrounding these reaches are mining and agricultural land uses. Impacts associated with these activities include mining roads runoff, vegetation removal, erosion, alien vegetation, water abstraction, increased flows and small dams. The Ecological Importance and Ecological Sensitivity of both SQRs has been classified as “High” with a total of six fish species and 51 macroinvertebrate taxa expected.

The Rietkuilspruit B12B-01213 SQR is said to be in a *Seriously modified* state and impacted by activities associated with agricultural, mining and residential land uses, which include low water crossings, effluent discharge, canalisation, erosion, abstraction, increased flows (DWS, 2014). The Ecological Importance and Ecological Sensitivity of both SQRs has been classified as “Moderate” with only three fish species and 41 macroinvertebrate taxa expected.

The Vaalwaterspruit river reaches (X11A-01300, X11A-01295 and X11A-01248 SQRs) appear to be in a *Largely natural* state (i.e. Ecological Category B). Agricultural land uses are present in the upper reaches associated with the Project Area. Impacts associated with these agricultural activities include low-water crossings, erosion, vegetation removal, water abstraction, algal growth, dams, alien vegetation encroachment, overgrazing and trampling, irrigation, roads and sedimentation (DWS, 2014). The Ecological Importance of the Vaalwaterspruit tributary SQR has been classified as "Moderate". It is expected to contain a total of seven fish species and 48 macroinvertebrate taxa.

10.11.1.2 *Expected Macroinvertebrates*

The expected macroinvertebrate taxa for the associated watercourses are presented in Table 10-15.

Table 10-15: Expected Macroinvertebrate Taxa in Watercourses Associated with the Project area

Family Names		
Porifera	Belostomatidae	Hydraenidae
Coelenterata	Corixidae	Hydrophilidae
Turbellaria	Gerridae	Ceratopogonidae
Oligochaeta	Hydrometridae	Chironomidae
Hirudinea	Naucoridae	Culicidae
Potamonautidae	Nepidae	Dixidae
Atyidae	Notonectidae	Muscidae
Hydracarina	Pleidae	Psychodidae
Baetidae 1 sp	Veliidae/Mesoveliidae	Simuliidae
Caenidae	Ecnomidae	Tabanidae
Leptophlebiidae	Hydropsychidae 2 sp	Tipulidae
Tricorythidae	Hydrophilidae	Ancylidae
Coenagrionidae	Leptoceridae	Lymnaeidae
Aeshnidae	Dytiscidae	Physidae
Corduliidae	Elmidae	Planorbinae
Gomphidae	Gyrinidae	Corbiculidae
Libellulidae	Haliplidae	Sphaeriidae

Blue shading = high dependence for fast-flowing water; **Orange** shading = moderate water quality dependence; **Green** shading = dependence for both fast-flowing water and moderate water quality

The expected aquatic macroinvertebrate assemblage is largely composed of taxa (or families) with preference for slow-flowing to moderately-flowing water and low water quality dependence, only seven of the expected 51 species have preference for fast-flowing water and only 10 taxa are sensitive to water quality modifications (DWS, 2014).

Based on distribution records, no macroinvertebrate species of conservation concern are likely to occur within the study area (Darwall *et al*., 2009) and no aquatic macroinvertebrate species of commercial or economic value were listed on the original NEM:BA Threatened and Protected Species (ToPS) regulations.

10.11.1.3 *Expected fish species*

The fish species expected in the river reaches associated with the Project Area have been provided for in Table 10-16 (DWS, 2014). Additionally, each species' sensitivity ratings towards modified physio-chemical and no-flow conditions have been provided for, together with their conservation status according to the IUCN Red List of Threatened Species (2018).

Table 10-16: Expected Fish Species in the Reaches Associated with the Project area

Fish Species	Common Name	Tolerance/Preference		Conservation Status
		Modified Water Quality	No-flow	
Amphilius uranoscopus	Common Mountain Catfish	4.8	4.8	LC
Chiloglanis pretoriae	Shortspine Suckermouth	4.5	4.8	LC
Clarias gariepinus	Sharptooth Catfish	1	1.7	LC
Enteromius anoplus	Chubbyhead Barb	-	-	LC
Enteromius neefi	Sidespot Barb	-	-	LC
Enteromius paludinosus	Straightfin Barb	1.8	-	LC
Labeobarbus polylepis	Bushveld Samllscale Yellowfish	-	-	LC
Pseudocrenilabrus philander	Southern Mouthbrooder	1.4	1	LC
Tilapia sparrmanii	Banded Tilapia	1.4	0.9	LC

Tolerance: Red Shading = intolerant, Green shading = tolerant,
Conservation Status: LC=Least Concern

Following a review of available collection records of fish species occurring within the watercourses associated with the study area (including records from FBIS), a total of nine fish species are expected to occur within the B12A, B12B and X11A catchments. Four of the species are tolerant to modified water quality and three of those are also tolerant to no-flow

conditions (DWS, 2014). The other two species are intolerant to both conditions. According to Skelton (2001), all the species are indigenous to South Africa and their conservation status is regarded as Least Concern.

10.12 Air Quality

Figure 10-28 shows the Project boundary, surrounding sensitive receptor, and historical dust monitoring points. In Google Earth® Imagery, these monitoring points were selected as sensitive receptors. According to the United States Environmental Protection Agency (USEPA) (2016), a sensitive receptor encompasses but is not limited to “hospitals, schools, daycare facilities, elderly housing, and convalescent facilities. These are areas where the occupants are more susceptible to pollutants”.

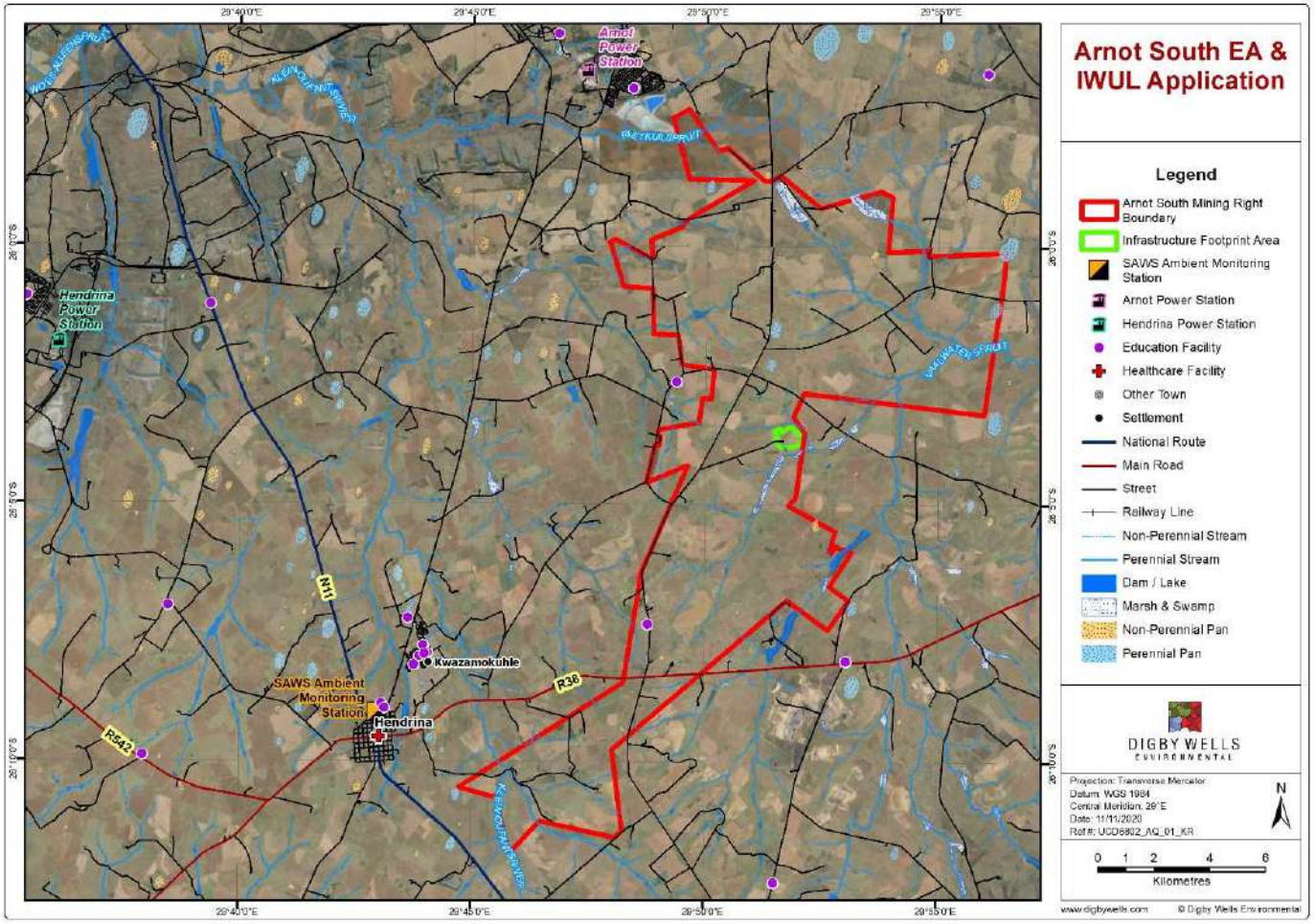


Figure 10-28: Project Boundary Showing Surrounding Sensitive Receptors

10.12.1 Existing Air Quality

Ambient air quality records measured by the South African Weather Service (SAWS) station at Kwazamokuli High School, Ackerman Street, Kwazamokuhle Township in Hendrina were used to assess the background scenario. The ambient air quality record comprises of both particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) and gases, such as sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO). Data covering the period October 2019 to November 2020 was assessed.

10.12.1.1 *Fine Particulate Matter*

The daily concentrations of $PM_{2.5}$ and PM_{10} measured at the SAWS station in Hendrina are generally below the South African ambient air quality standards (red dotted line) of 40 µg/m^3 and 75 µg/m^3, respectively, except for a day or two with exceedances (Figure 10-29 and Figure 10-30: Background PM_{10} Levels (SAWS: Ambient Air Quality Station)).

The $PM_{2.5}$ standard was exceeded on 26 June 2020, 22 July 2020, 10 and 11 October 2020 with ambient concentrations of 41 µg/m^3, 41 µg/m^3, 61 µg/m^3, and 120 µg/m^3 measured, respectively. For $PM_{2.5}$ daily, the 90th percentile was below 24 µg/m^3. The highest $PM_{2.5}$ concentration recorded during the period was 120 µg/m^3 (Figure 10-29).

For PM_{10}, the daily ambient levels were mostly below the PM_{10} standard, except for the exceedance that was observed on the 11 October 2020, which correlates with the day and time the $PM_{2.5}$ standard was exceeded (Figure 10-30). The 90th percentile of measured data was at 44 µg/m^3, and the highest PM_{10} concentration observed over the one-year period (October 2019 to November 2020) was at 134 µg/m^3. The ambient air quality results collected are summarised in Table 10-17.

Table 10-17: Summary of the Ambient Air Quality Records Measured at SAWS Station in Hendrina Mpumalanga

Pollutant	Averaging period	SA Standard	Ambient Level below 90th Percentile	Highest Ambient Level Measured on-site	Exceedance of the Standard
$PM_{2.5}$	24 hours	40 µg/m^3 (2)	24	120	4
PM_{10}	24 hours	75 µg/m^3 (1)	44	134	1
CO	8 hours	26 ppm (1)	0.6	1.3	0
NO_2	1 hour	106 ppb (1)	16	234	1
SO_2	24 hours	48 ppb (1)	13	29	0

(1) South African Standard, Government Notice 1210, Government Gazette 32816
(2) South African Standard, Government Notice 486, Government Gazette 35463

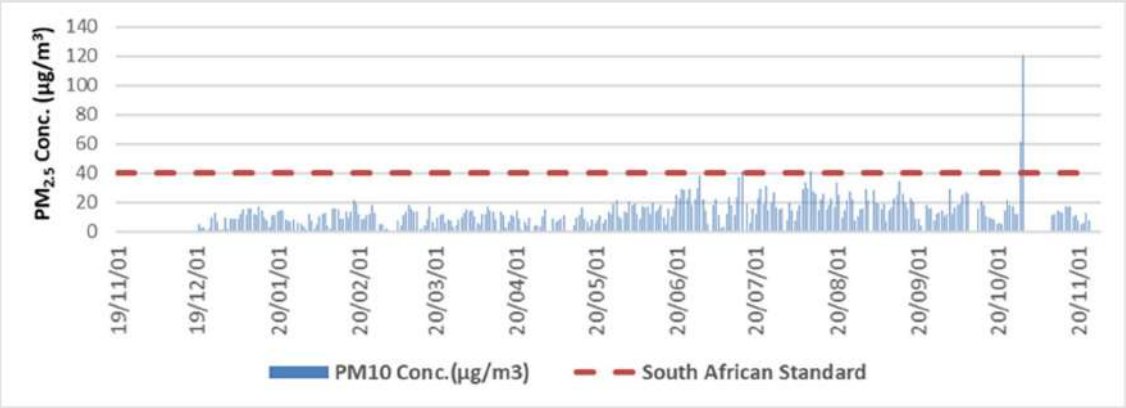


Figure 10-29: Background $PM_{2.5}$ Levels (SAWS: Ambient Air Quality Station)

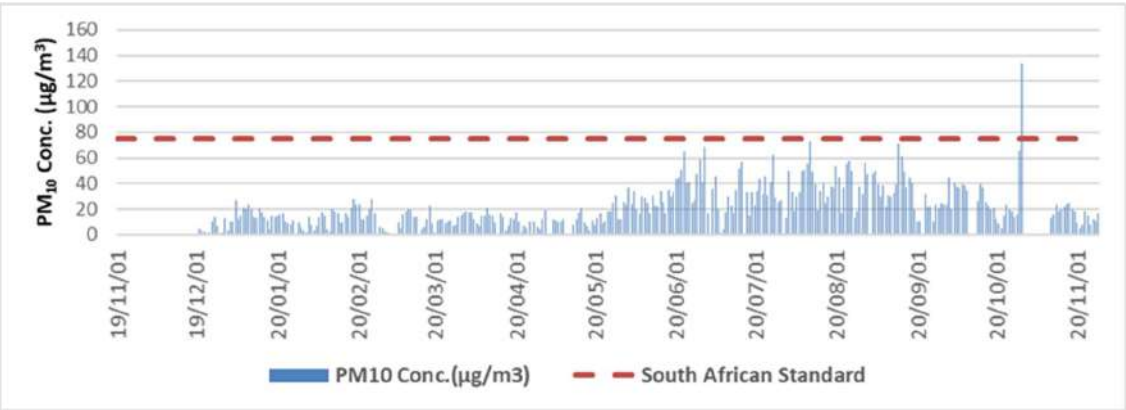


Figure 10-30: Background PM_{10} Levels (SAWS: Ambient Air Quality Station)

10.12.1.2 *Gaseous Pollutants*

The gaseous pollutant data from the SAWS ambient air quality station such as SO_2, NO_2 and CO are discussed below.

The daily SO_2 concentrations measured at the SAWS station in Hendrina were low (the 90th percentile of the daily SO_2 levels was 13 parts per billion (ppb)). The maximum daily concentration over the one-year record considered was 29 ppb (Figure 10-31). No exceedance of the South African standard of 48 ppb was recorded.

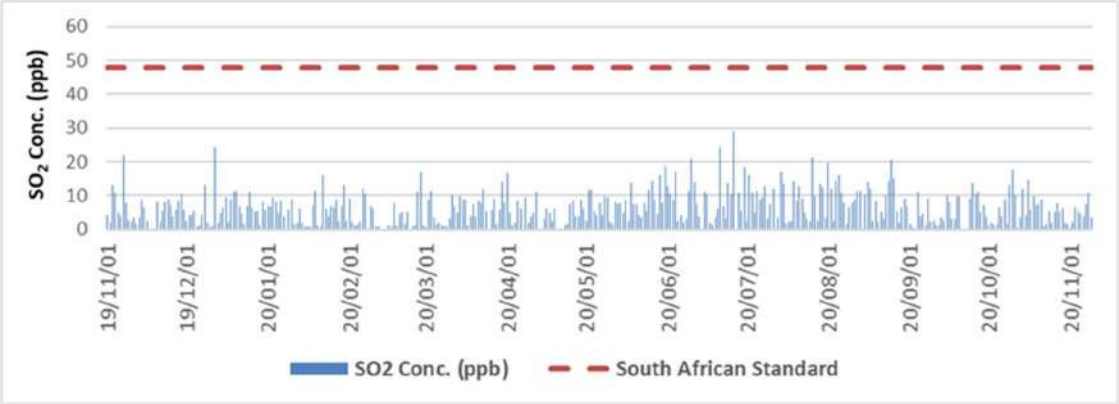


Figure 10-31: Background SO_2 Levels (SAWS: Ambient Air Quality Station)

The daily NO_2 concentrations measured at the SAWS station in Hendrina were low (the 90th percentile of the daily NO_2 levels was 16 ppb). The maximum daily concentration over the one-year record considered was 234 ppb. One exceedance of the South African standard of 106 ppb was measured on 8 November 2020 (Figure 10-32).

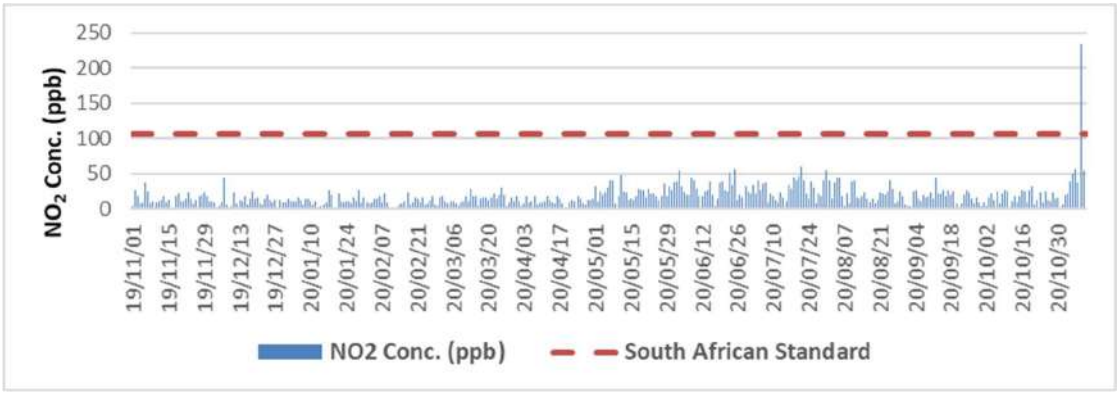


Figure 10-32: Background NO2 Levels (SAWS: Ambient Air Quality Station)

Data was not available for 87% of the survey period. Ambient CO data were available for 13% of the time. The eight-hourly CO concentrations measured at the SAWS station in Hendrina were low (the 90th percentile of CO levels measured was 0.6 ppm). The maximum concentration measured over the period was 1.3 ppm (Figure 10-33). No exceedance of the South African standard of 26 ppm was observed.

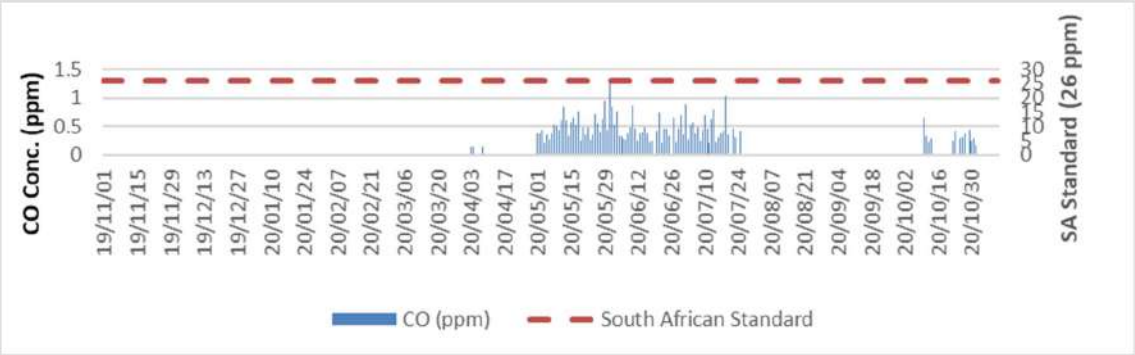


Figure 10-33: Background CO Levels (SAWS: Ambient Air Quality Station)

10.13 Noise

The baseline characterisation encompasses a description of the proposed monitoring locations, existing sources of noise that will affect the general landscape of the area and existing receiver likely to be impacted. The existing soundscape of the Project area will be established before the EIA Phase using mismeasurements from sound level meters.

10.13.1 Existing Noise Soundscape in the Project Area

A desktop assessment of the Project area and surroundings was conducted. Google Earth® Imagery was used to identify the exact locations of these sources that may impact the existing noise soundscape within the Project area. The Project area is characterised by scattered farmsteads, low population density and can therefore be classified as a Rural area (Pateman, 2011).

The predominant land use types in the Project area encompasses farming (animal husbandry and crop farming), mining activity and industrial (Arnot and Hendrina Power Stations), all of which are clearly visible outside of the Project area (Figure 10-34). The activities associated with these land use types have the potential to generate noise that may have an influence on the existing noise soundscape of the Project area. The ambient noise levels within the Project boundary and selected receivers will be assessed during the EIA Phase, by conducting daytime and night-time measurements at predetermined noise monitoring locations. Figure 10-34 depicts the mine boundary and the proposed noise monitoring locations (labelled N1 to N4).

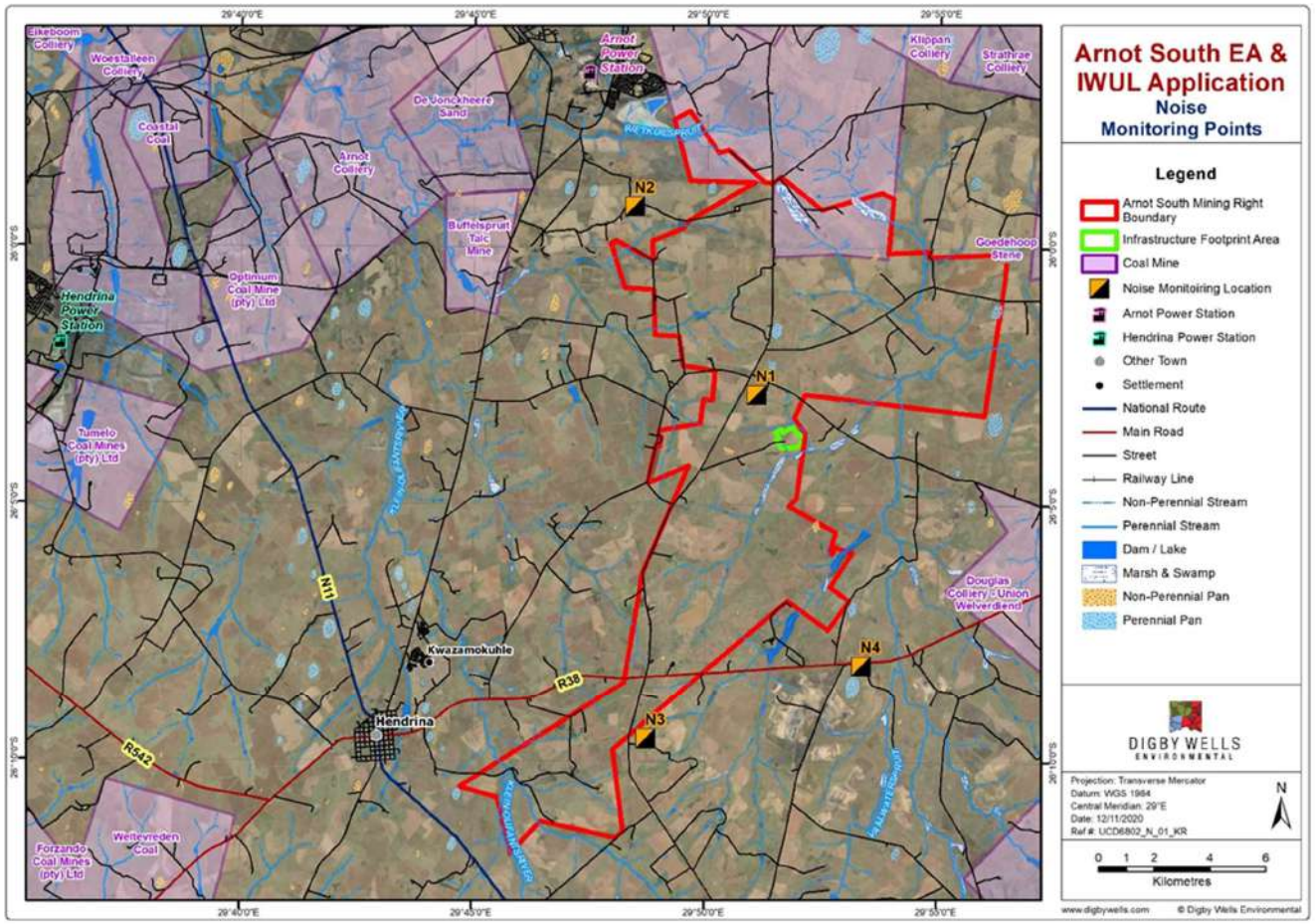


Figure 10-34: Potential Noise Monitoring Locations

10.14 Cultural Heritage

The Mpumalanga Province is underlain by valuable geological formations, both in terms of mineral and fossil wealth. Coal is formed through the compression and heat alteration of plant matter. During these processes, alteration happens to such an extent that potential plant fossil remains are no longer recognisable. The shales between the coal horizons, however, have the potential to preserve very good examples of plant fossils (Bamford, 2014; 2016). To a lesser extent, the sandstone surface outcrops may also preserve fossil plants. Coal deposits can potentially also include fossils of mammal-like reptiles and mammals, but these are rarely, if ever, preserved with plant fossils.

The greater study area forms part of the Highveld Coalfield, which extends approximately 7 000 km^2 (Johnson *et al*., 2006). The regional and local study areas are predominantly underlain by the Main Karoo Basin, which comprises lithostratigraphic units associated with the Karoo Supergroup. Table 10-18 presents a truncated geological sequence applicable to the regional study area. The specialist Palaeontological Impact Assessment (PIA) report will present the site-specific geological context and the associated palaeontological sensitivities in more detail.

The Main Karoo Basin dates to the late Carboniferous to Middle Jurassic Periods, roughly 320 to 145 million years ago (mya). Within the Karoo Supergroup are the sediments of the Ecca Group. These sediments date to the Permian Period and overlie the *Dywka Formation*. These layers also include significant coal reserves and is the most palaeontologically sensitive unit of the Karoo Supergroup (Johnson *et al*., 2006; Groenewald & Groenewald, 2014). The Ecca Group is well known for its wealth of plant fossils, characterised by the assemblage of *Glossopteris* fossils (a plant species defined through fossil leaves).

The Ecca Group includes three formations:

- The *Pietermaritzburg Formation*, which is of moderate palaeontological sensitivity. This formation rarely forms good outcrops and fossils are rare and difficult to find;
- The *Vryheid Formation*, which is the main coal-producing formation in South Africa. This formation has produced a number of fossils, including extensive *Glossopteris* fossil assemblages. Trace fossils, rare insects, possible conchostracans (bivalve crustaceans and shrimp clams, which are still extant), non-marine bivalves and fish scales. This formation is of very high palaeosensitivity; and
- The *Volksrust Formation*: a monotonous sequence of grey shale. Fossils are significant but rare and include temnospondyl amphibian remains, invertebrates and minor coal with plant remains, petrified wood and trace fossils assemblages (Groenewald & Groenewald, 2014).

The *Vryheid Formation* is the predominant geographical present in proximity to the Project area. As indicated above, this feature is known for its wealth of plant fossils. These include fossils of *Breytenia*. These fossils are extremely rare, comprising only four known instances, one of which is available for research. The other three examples were identified during site inspections for a coal mine less than 15 km away from the Arnot South Project area.

Table 10-18: Geological sequence and palaeontological sensitivity for the local study area

Eon	Era	Period	Mya	Lithographic Units			Significance	Fossils
				Supergroup	Group	Formation		
Phanerozoic	Palaeozoic	Permian	300	Karoo Supergroup	Ecca Group	Volksrust	High	The Volksrust Formation comprises of trace fossils, rare temnospondyl amphibian remains, invertebrates (bivalves, insects), minor coals with plant remains, petrified wood, organic microfossils (acritarchs), and low-diversity marine to non-marine trace fossil assemblages.
						Vryheid	Very-high	Abundant plant fossils of Glossopteris and other plants. Trace fossils. The reptile Mesosaurus has been found in the southern part of the Karoo Basin. Rich fossil plant assemblages of the Permian Glossopteris flora (lycopods, rare ferns and horsetails, abundant glossopterids, cordaitaleans, conifers, ginkgoaleans), rare fossil wood, diverse palynomorphs. Abundant, low diversity trace fossils, rare insects, possible conchostracans, non-marine bivalves, fish scales.

Table 10-19 presents an overview of the broad timeframes for the major periods of the past in Mpumalanga. Figure 10-35 presents a summary of the heritage resources identified within the larger study area. The figure presents the relative abundance of these heritage resources as grouped by the periods listed in Table 10-19.

Table 10-19: Archaeological Periods in Mpumalanga

The Stone Age	Earlier Stone Age (ESA)	2 mya to 250 thousand years ago (kya)
	Middle Stone Age (MSA)	250 kya to 20 kya
	Later Stone Age (LSA)	20 kya to 500 CE (Common Era[2])
There appears to be a gap in the record in Mpumalanga between approximately 7000 and 2000 BCE.		
Farming Communities	Early Farming communities (EFC)	500 to 1400 CE
	Late Farming Communities (LFC)	1100 to 1800 CE
Historical Period[3]	-	1500 CE to 1850 (Behrens & Swanepoel, 2008)

Adapted from Esterhuysen & Smith (2007)

[2] Common Era (CE) refers to the same period as *Anno Domini* ("In the year of our Lord", referred to as AD): i.e. the time after the accepted year of the birth of Jesus Christ and which forms the basis of the Julian and Gregorian calendars. Years before this time are referred to as 'Before Christ' (BC) or, here, BCE (Before Common Era).

[3] The author acknowledges that in southern Africa, especially in Mpumalanga, the last 500 years represents a formative period that is marked by enormous internal economic invention and political experimentation that shaped the cultural contours and categories of modern identities outside of European contact. This period is currently not well documented and is being explored through the 500 Year Initiative **Invalid source specified.**.

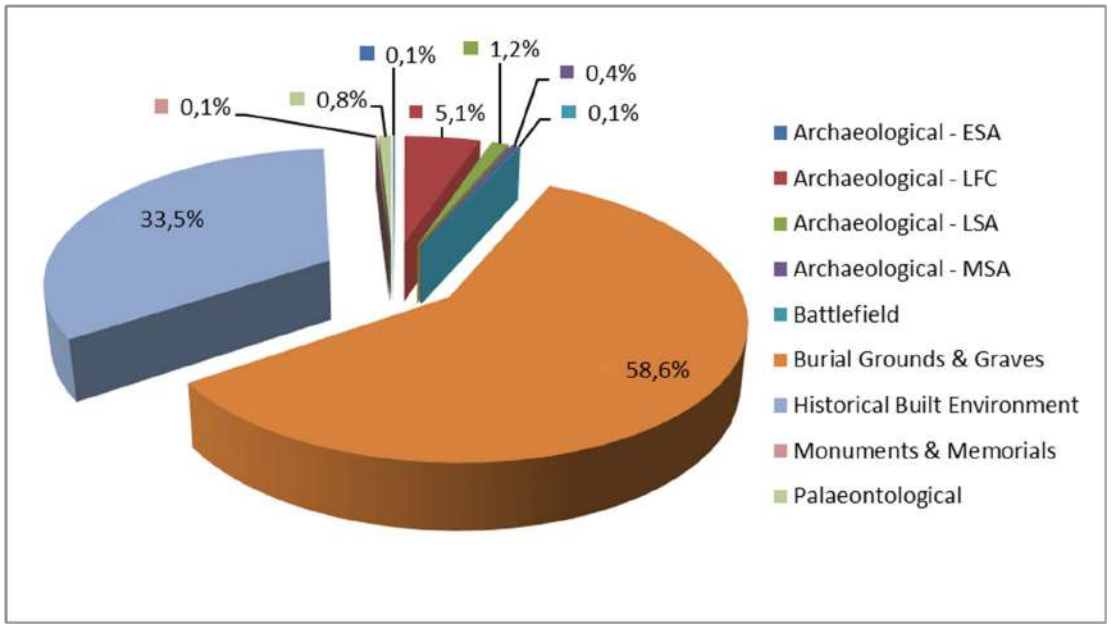


Figure 10-35: Heritage Resources identified within the Greater Study Area

In total, 948 heritage resources were identified within the regional, local and site-specific study areas. The predominant tangible heritage resources recorded in the area under consideration demonstrate affiliations with the historical period, including the historical built environment and burial grounds and graves. This notwithstanding, expressions of the Stone Age, the Farming Community Period, battlegrounds and monuments and memorials have also been recorded in the regional study area (area bounded by the district municipality demarcation).

The southern African Stone Age comprises three broad phases: the ESA, MSA and LSA. These phases are determined according the various hominid species and the lithic tools and associated materials they created through time.

The ESA is comprised predominantly of large hand-axes and cleavers made of coarse-grained materials (Esterhuysen & Smith, 2007). This period occurred between 2 mya and 250 kya and is associated with *Australopithecus* and early *Homo* hominid species. Within the reviewed data, one example of ESA lithics was identified, which comprised a low-density artefact scatter (Huffman, 1999). This represents 0.1% of the data set.

The MSA dates between approximately 300 kya and 20 kya. High proportions of minimally-modified blades, created using the Levallois technique, the use of good quality raw material and the use of bone tools, ochre and pendants characterise the early MSA lithic industries (Clark, 1982; Deacon & Deacon, 1999). These tools were made and used by archaic *Homo sapiens.* The review of available data included 4 records of expressions of MSA (0.4% of the total identified heritage resources). These expressions included an isolated artefact and low-density surface scatters (Fourie *et al.*, 2000; du Piesanie *et al.*, 2013; du Piesanie & Nel, 2016a).

The LSA dates from approximately 40 kya to the historical period. LSA lithics are specialised, i.e. specific tools each have specific uses (Mitchell, 2002). Assemblages from this period

commonly include diagnostic tools such as scrapers and segments and may include bone points as well. In southern Africa, the LSA is closely associated with hunter-gatherers. The San (including hunter-gatherer, Basarwa and Bathwa groups) are generally accepted as the first inhabitants of southern Africa (and Mpumalanga) (Makhura, 2007).

The review of available data included few expressions of the LSA (11 records or 1.2% of the total identified heritage resources). Within the regional study area, expressions of the LSA include:

- Isolated artefacts and low-density scatters of lithic accumulations (du Piesanie *et al.*, 2013; Karodia *et al.,* 2013);
- Rock shelters with deposit and artefacts (Fourie *et al*., 2000); and
- Rock Art (van Schalkwyk, 2003a; du Piesanie *et al*., 2013; du Piesanie & Nel, 2016a).

In Mpumalanga, three rock art painting traditions occur and are associated with particular cultural groups. These traditions are widely dispersed and include:

- Fine line painting associated with autochthonous LSA hunter-gatherer groups (Eastwood *et al*., 2002);
- Finger paintings associated with the later arrival of pastoralists (Smith & Ouzman, 2004; Eastwood *et al*., 2002; Smith & Zubieta, 2007); and
- Finger paintings associated with much later, possibly historic, farming communities. No expressions of this tradition are known to occur within the study area under consideration.

The San were later followed by the various peoples of the Farming Community, including ancestors of modern Sotho-Tswana and Nguni peoples (Makhura, 2007). The farming community period correlates to the movements of Bantu-speaking agro-pastoralists moving into southern Africa. Farming Community settlements are identified through stonewalling and secondary tangible surface indicators, such as ceramics and evidence for domesticated animals, i.e. dung deposits or faunal remains.

The Farming Community Period is divided into two phases: the EFC and the LFC. No material associated with the EFC was identified. The LFC resources accounted for 48 (or 5.1%) of the identified heritage resources in the regional study area. The identified LFC heritage resources include:

- Sites of low and medium complexity (van Schalkwyk, 2003a; du Piesanie *et al*., 2013; Karodia & Nel, 2014; Van Vollenhoven, 2014);
- Structural sites, including stone walling or structural remains (ruins of homesteads or circular stone structures) (Fourie *et al.,* 2000; van Schalkwyk, 2003c; 2007; Van Schalkwyk & Moifatswane, 2003; Pelser & van Vollenhoven, 2008; du Piesanie *et al.,* 2013; Karodia *et al*., 2013; Higgit *et al*., 2014; Karodia & Nel, 2014);

- Isolated ceramic potsherds and low-density surface scatters (de Jong, 2006; du Piesanie *et al*., 2013; Karodia *et al*., 2013; Karodia & Nel, 2014; Pelser, 2015; Hardwick & du Piesanie, 2018); and
- Ash deposits or middens, which are most likely the remains of cattle kraals or refuse dumps containing artefacts relating to this period (van Schalkwyk, 2003c).

The historical period is commonly regarded as the period characterised by contact between Europeans and Bantu-speaking African groups and the written records associated with this interaction. However, the division between the LFC and historical period is artificial, as there is a large amount of overlap between the two.

Throughout the transitions between the LFC and the historical period (and through the historical period itself), migration, population growth, climatic variation and trade to the east significantly impacted the Pedi, Koni and other groups on the Mpumalanga Highveld. The rise of power blocs, including violent displacement and political centralisation, characterised this time (Makhura, 2007). Within this region, the Pedi developed a system of centralisation where subordinate communities could retain their independence in exchange for tribute in various forms. The Pedi grew to become the strongest power in the north-east, amongst the escalating conflict and intensifying violence (Delius *et al*., 2014).

An example of the overlap between the LFC and the historical period is the Mfecane or, north of the Orange River, the Difaqane. These terms refer to a period of violence and unrest between approximately 1817 to 1826 AD (Landau, 2010). Many aspects of the Mfecane/Difaqane have been debated and challenged. The traditional understanding of the period is that Mzilikazi and his Ndebele group were pushed out of their territory by the Zulu group led by Shaka. This displacement had a knock-on effect, as multiple groups were subsequently displaced to the north and the west. A drought during this time exacerbated the instability and increased the pressure on food supplies, which were already running low.

European settlers, traders, missionaries and travellers moving into the interior further added to instability and resulting power struggles (Landau, 2010). The Mfecane/Difaqane was characterised by unprecedented (at least within the records of the Europeans travelling within southern Africa) social and political mobilisation and violence across the Highveld as individuals sought personal and food security. The Mpumalanga Highveld was vulnerable to intrusive groups including the Swazi and the *Voortrekkers*.

Groups of Afrikaaners initiated a move from the Cape to the interior to establish an independent state in approximately 1835, in reaction to increased British liberalism and the abolishment of slavery and pass laws. The migration of these *Voortrekkers* is commonly referred to as the Great Trek (or *Groot Trek*) and it started with the first group, the Robert Schoon Party, in 1836. The first permanent settlement that was established as a result of this movement was Ohrigstad in 1845 – the *Voortrekkers* at this time were intruding into an already volatile interior and exacerbated the strife in this area, frequently skirmishing with remnant Pedi, Nduzundza Ndebele and Kopa groups (Delius & Cope, 2007; Voortrekkers, 2014).

In 1852, *Voortrekker* and British representatives signed the Sand River Convention into effect; the convention acknowledged Trekboer independence and officially established the *Zuid-Afrikaansche Republiek* (ZAR). ZAR independence allowed for land to be distributed to its citizens, though the demarcation of farms and the issuing of title deeds. The Trekboers continued their violent encounters with the smaller groups in this region, armed with their perceived right to land under the ZAR. These conflicts resulted in a Trekboer-Swazi alliance: the Swazi besieged and destroyed the Kopa and orchestrated assaults against the Ndzundza Ndebele. The Ndzundza Ndebele remained undefeated, but came to a compromise with the Trekboers where land would be leased by the Trekboers through a system of tribute (Delius & Cope, 2007; Voortrekkers, 2014).

Soon after settling in the area, the Trekboers (now farmers) discovered and exploited the Highveld Coalfields. The coal was initially used by the Boers as a domestic resource; however, the discovery of gold in the Witwatersrand in 1886 created an enormous demand for coal (Brodie, 2008; Pistorious, 2008; 2008b). This increase in the demand for coal drove the commercial exploitation of the coal, until the industry was put on hold by the outbreak of war.

The South African War of 1899-1902 (also referred to as the Second Anglo-Boer War) officially started on October 9th, 1899. The war was the result of building tensions and conflicting political agendas between the Trekboers and the British. There are multiple notable battles associated with the South African War within the regional study area, one of which is the Battle of Bakenlaagte (October 30th, 1901). A battlefield relating to this event has been recorded within the greater study area.

Lieutenant Colonel George Benson's No. 3 Flying Column moved from the farm Syferfontein, marching north-west to the Bakenlaagte farmstead, where they intended to camp. The advance guard reached the farmstead and set up the camp, but by midday, the rear-guard had been hampered by unfavourable weather and were still some distance away from the farm. General Botha of the Boer commando and his 800 reinforcements planned to attack Benson's Column and this division of the force provided the Boers with an advantage. Outnumbered four to one, the Boers decimated the rear-guard in a gun battle that lasted just 20 minutes; but the attack did allow the main column to deploy and set up a defensive perimeter. This perimeter prevented the Boers from capturing the main column as they had envisaged, and the Boers left with what spoils they could. The British transported their 134 wounded to the entrenched camp during the night (Pakenham, 1979; Willsworth, 2006; Wessels, 2010; von der Heyde, 2013). British losses included at least 66 dead, 120 were taken prisoner and the loss of two British guns. Boer casualties included at least 52 who were killed or wounded (Wessels, 2010)

Other important events associated with the South African War in the broader area include:

- The Battle of Lake Chrissie (February 6th, 1901);
- Trigaardsfontein (10 December 1901),
- Klippan (18 February 1902); and
- Boschmanskop (1 April 1904) (Van Vollenhoven 2012).

Historical heritage resources associated with the early settlement of these groups in the region make up the large majority of the identified heritage resources in the area under consideration. Historical heritage resources within the regional study area are represented as:

- The Bakenlaagte battlefield referred to above (Van Vollenhoven, 2012a; 2014; Hardwick & Du Piesanie, 2018);
- Burial grounds and graves, ranging from single burials to graveyards containing over one hundred individuals; (van Schalkwyk, 1997a; 1997b; 2002a; 2002b; 2003a; 2003b; 2003c; 2003d; 2013; Fourie *et al*., 2000; Van Schalkwyk & Moifatswane, 2003; Pistorius, 2004a; 2004b; 2007; 2008; 2011; 2012; 2013; 2014; 2015; 2016; de Jong, 2006; 2007; Fourie, 2007; 2008, 2009; Pelser & van Vollenhoven, 2008; Miller, 2010; Birkholtz, 2011; 2013; van Vollenhoven & Pelser, 2011; Van Vollenhoven, 2012a; 2012b; 2015a; 2015b; 2017a; 2017b; Fourie & Hutton, 2012; Fourie *et al*., 2012; Magoma, 2013; du Piesanie *et al*., 2013; Karodia, et al., 2013; Pelser, 2013a; 2013b; Seliane, 2013; Higgit *et al*., 2014; Karodia & Nel, 2014; van Vollenhoven & du Bruyn, 2014; van Wyke Rowe, 2014; Coetzee & Behrens 2015; van der Walt, 2015; du Piesanie & Nel, 2016a; du Piesanie & Nel, 2016b; Coetzee & Fivaz, 2017; Hardwick & du Piesanie, 2018); and
- Historical built environment resources, such as structural remains (stonewall structures, homesteads, farmhouses and functional structures) and structural complexes; middens and ash deposits (Huffman & Calabrese, 1996; Van Schalkwyk *et al* 1996; Van Schalkwyk 1997a, 1997b, 2002a, 2002c, 2003d, 2013; Huffman 1999; De Jong 2006, 2007; Pistorius 2007, 2008, 2011, 2012, 2013, 2016; Van der Walt 2007; Pelser & van Vollenhoven 2008; Miller 2010; Fourie 2012; Van Vollenhoven & Pelser, 2011; Birkholtz, 2013; du Piesanie *et al*., 2013; Karodia *et al*., 2013; Pelser 2013a, 2013b; Seliane, 2013; Higgit *et al.,* 2014; Karodia & Nel, 2014; Van Wyk Rowe, 2014; Coetzee & Behrens 2015; Van Vollenhoven 2015a, 2015b, 2017a; du Piesanie & Nel, 2016a, 2016b; Coetzee & Fivaz, 2017; Hardwick & du Piesanie, 2018).

10.15 Socio-Economic

The socio-economic baseline profile presented in this section focuses on the primary and secondary study areas, defined in Table 10-20. The bold text indicates the ward within which the infrastructure footprint area is located. The other wards are those within which the Mining Right is located.

Table 10-20: Primary and secondary study areas

Primary Study Area	Secondary Study Areas		
Ward 21	CALLM	GSDM	Mpumalanga
Ward 3 Ward 7	STLM	NDM	

Data presented in this baseline was primarily sourced from Wazimap (Wazimap, 2017). The data was selected as it realigns the Statistics South Africa 2011 Census data[4] with new municipal boundaries used in the 2016 Municipal Elections (Open Up, 2017). The results of the Community Survey (2016) does not present the ward data and as such the study uses the Census 2011 data as a source of ward level information. This data is supplemented by the most recent IDPs developed by the NDM (2020) and GSDM (2020).

10.15.1 Geographical Setting

Table 10-20 above summarises the Project area and the broad geographical setting. The Project is located within the Mpumalanga Province. The greater Arnot South Project area is located within Wards 3 and 7 of the STLM within the NDM and Ward 21 of the CALLM in GSDM. The current extent of underground mining (the 17-year LoM) is located in this latter ward and incorporates four farms, namely: Mooiplaats 165 IS, Schoonoord 164 IS, Vlakfontein 166 IS and Weltevreden 174 IS. The land is currently used for game farming and includes five homesteads of farm dwellers.

10.15.2 Population Demographics

The 2011 Census recorded 4,039,939 people living in the Mpumalanga Province, which accounts for approximately 8% of the national population (Statistics South Africa, 2011; Wazimap, 2017). The province is divided into three district municipalities, namely: the NDM, the GSDM and Ehlanzeni District Municipality. The GSDM and NDM are the two larger of the district municipalities in terms of population size and the smallest and largest (respectively) in terms of their land size.

The GSDM is divided into seven local municipalities. Of these, the CALLM is the second smallest in terms of population size, which includes 186,011 residents. CALLM is further divided in 25 wards. At the time of the 2011 Census, 8095 people were living in Ward 21.

In turn, the NDM is divided into six local municipalities of which STLM is the third largest in terms of population size with 229,831 residents. The STLM is further divided into 29 wards. As of the 2011 census, Ward 3 had a population of 7,801 people and Ward 7 had a population of 5,822.

Table 10-21 and Table 10-22 provide a summary of the indicative population statistics for the ward under consideration as compared to the secondary study area.

[4] http://www.statssa.gov.za/?page_id=964

Table 10-21: Indicative Statistics related to the Population in the Secondary Study Area

Indicators	MP	NDM	GSDM	CALLM	STLM
Population	4 039 939	1 308 129	1 043 195	186 011	229 831
Size (*km²*)	76 544.30	16 899.20	32 097.30	5 569.90	3 984.10
Population Density (*whole people / km²*)	53	77	33	33	58
Number of Households	1 102 205	366 307	281 518	48 518	68 976
Average household size	3.67	3.57	3.71	3.83	3.33
Number of child-headed households[5]	10 369	2 367	2 201	627	259
Percentage of child-headed households[6]	0.94	0.65	0.78	1.29	0.38

Adapted from Statistics South Africa (2011) and Wazimap (2017)

Table 10-22: Indicative Statistics related to the Population in the Primary Study Area

Indicators	Ward 3 (STLM)	Ward 7 (STLM)	Ward 21 (CALLM)
Population	7 801	5 822	8 095
Size (*km²*)	539.9	348.1	1995.7
Population Density (*whole people / km²*)	14	17	4
Number of Households	2114	1529	2 170
Average household size	3.69	3.81	3.73
Number of child-headed households	9	5	29
Percentage of child-headed households	0.43	0.33	1.34

Adapted from Statistics South Africa (2011) and Wazimap (2017)

The NDM undertakes community outreach programmes to consult with and provide feedback to communities within the six local municipalities of the district twice within a financial year (NDM, 2020). During these meetings, the STLM representatives raised the following concerns and priority needs:

- Provision of water supply;

[5] Head of the household is younger than 18 years

[6] Child-headed households expressed as a percentage of the total number of households in the area.

- Access to health services (24-hour clinics and hospitals);
- Improved clinic services;
- Sports and recreation facilities; and
- Local Economic Development (LED).

Outcomes from the GSDM consultation meeting in April 2019 with the CALLM included the following:

- A request for boreholes;
- Dirty water was raised as an issue;
- Disaster management services require improvement;
- Cooperatives require monitoring;
- Recreational facilities were raised as an issue; and
- The maintenance of sports grounds was raised as an issue.

10.15.2.1 *Population of the Broader Study Area by Race*

Across all study areas, the majority population is black African, followed by white; while Coloured and Indian or Asian comprise of the least racial groups. “Other” population groups constitute the smallest portion of the population. The percentage component of Indian/Asian and coloured varies across the study areas, but the coloured population is generally larger than the Indian/Asian population. Table 10-23 provides a summary of the racial distribution of the population of the primary and secondary study areas.

Table 10-23: Population of the Broader Study Area by Race (in percentages)

Race	MP	NDM	STLM	Ward 3	Ward 7	GSDM	CALLM	Ward 21
Black African	90.7	88.6	73.6	75.7	80.3	88.6	97.6	80.3
Coloured	0.9	1.0	2.6	0.7	0.7	1.0	0.2	0.5
Indian or Asian	0.7	1.1	1.6	0.7	0.1	1.1	0.4	0.7
White	7.5	9.0	21.8	22.4	18.8	9.0	1.6	18.4
Other	0.2	0.3	0.4	0.4	0.1	0.3	0.2	0.2

Adapted from Wazimap (2017)

10.15.2.2 *Most Common Home Languages within the Study Areas*

The trends across these areas are very variable. Between 1.29% and 3.54% of the respondents reported they speak ‘other’ languages as their first language. Table 10-24

provides an overview of the most and least common languages spoken at the various levels of interest.

Table 10-24: Most Common Home Languages within the Study Areas

Language	MP	NDM	STLM	Ward 3	Ward 7	GSDM	CALLM	Ward 21
Most Common	SiSwati	Ndebele	IsiZulu	IsiZulu	Ndebele	IsiZulu	SiSwati	IsiZulu
Second	IsiZulu	IsiZulu	Afrikaans	Afrikaans	Afrikaans	SiSwati	IsiZulu	SiSwati
Third	Xitsonga	Sepedi	Ndebele	Ndebele	IsiZulu	Afrikaans	English	Afrikaans

Adapted from Wazimap (2017)

10.15.2.3 *Population of the Broader Study Area by Age Groups*

The age at which the largest proportion of the population was at the time of the 2011 Census varies slightly, with most of the population being of young children and children within the 00 to 19 year age range, although the NDM, STLM, Ward 3 and Ward 7 have slightly older populations.

Furthermore, across all study areas, the lowest portion of the population is between the ages of 75 to 85 and older. Ward 21 has a lower portion of people aged 55 to 59 compared to their population aged 75-79. Table 10-25 presents an overview of the population by age.

Table 10-25: Population by Age Range (in Percentages)

Language	MP	NDM	STLM	Ward 3	Ward 7	GSDM	CALLM	Ward 21
Under 18	37.5	34.1	29.9	30.4	28.0	37.9	44.2	34.2
18 to 64	57.8	60.9	65.8	62.3	68.5	57.6	50.5	57.0
65 and over	4.7	5.0	4.3	7.3	3.5	4.5	5.3	8.8

Adapted from Wazimap (2017)

10.15.2.4 *Population of the Broader Study Area by Gender*

Figure 10-36 presents the distribution with respect to gender within the population of the greater study area, as per the 2011 Census. The population is divided fairly equally along these lines.

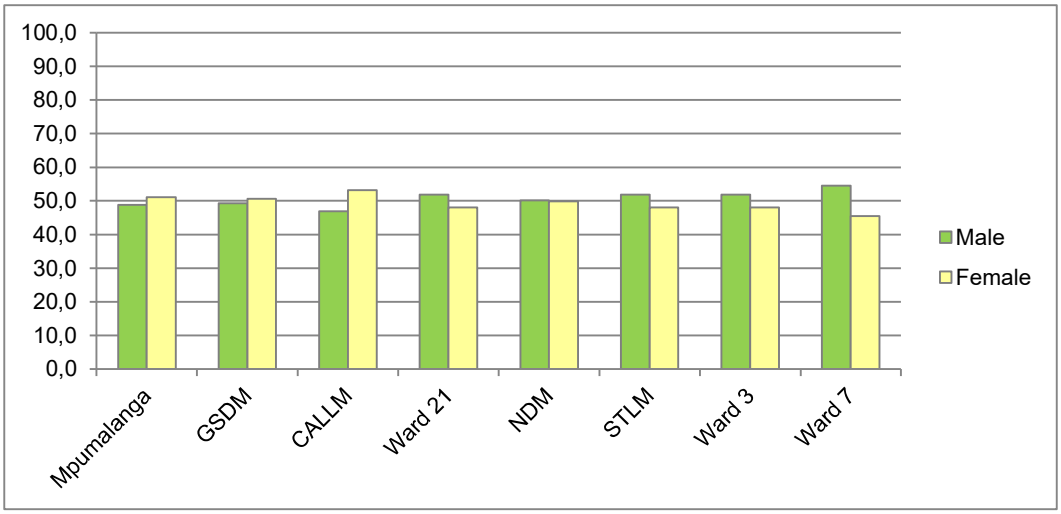


Figure 10-36: Population of the Broader Study Area by Gender

Adapted from Wazimap (2017)

10.15.3 Education

Within the Mpumalanga Province, CALMM, STLM, Ward 3 and Ward 7, the majority of the population have completed high school (i.e. Matric or Grade 12 equivalent); while the majority of the population has completed some high school (i.e. no Matric or Grade 12 equivalent) in the GSDM, Ward 21 and NDM. Figure 10-37 presents a breakdown of the highest level of education achieved by the population of the areas under investigation older than 20 years of age.

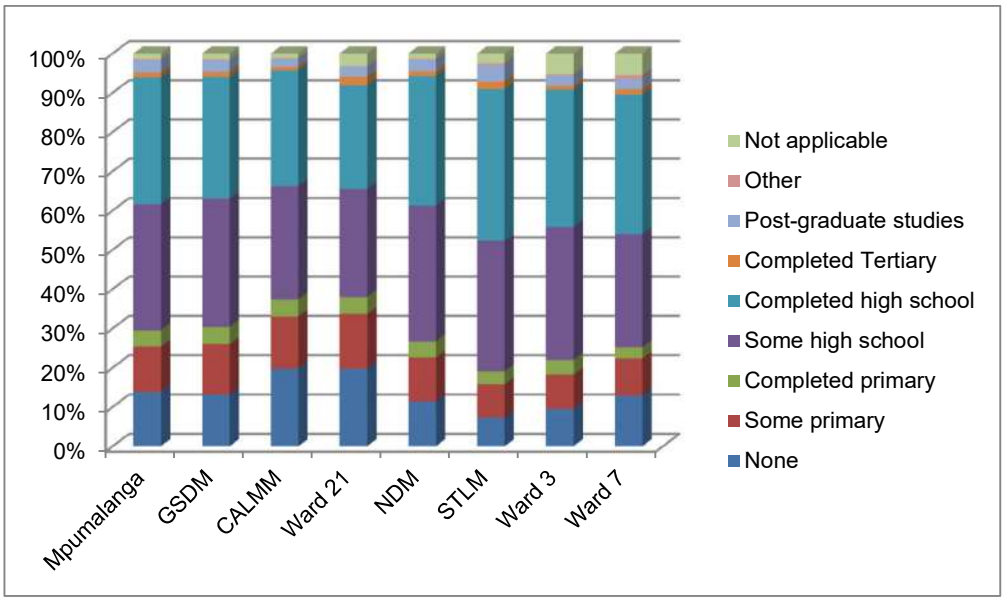


Figure 10-37: Highest Level of Education Completed

Adapted from Wazimap (2017)

10.15.4 Economy, Labour Force and Employment

Figure 10-38 below presents an overview of the employment status of the population. In this figure, 'not applicable' refers to those who are not considered to be of working age (i.e. individuals younger than 18 and older than 65 years of age). Discouraged work-seekers refers to individuals who are unemployed but who are not actively seeking work.

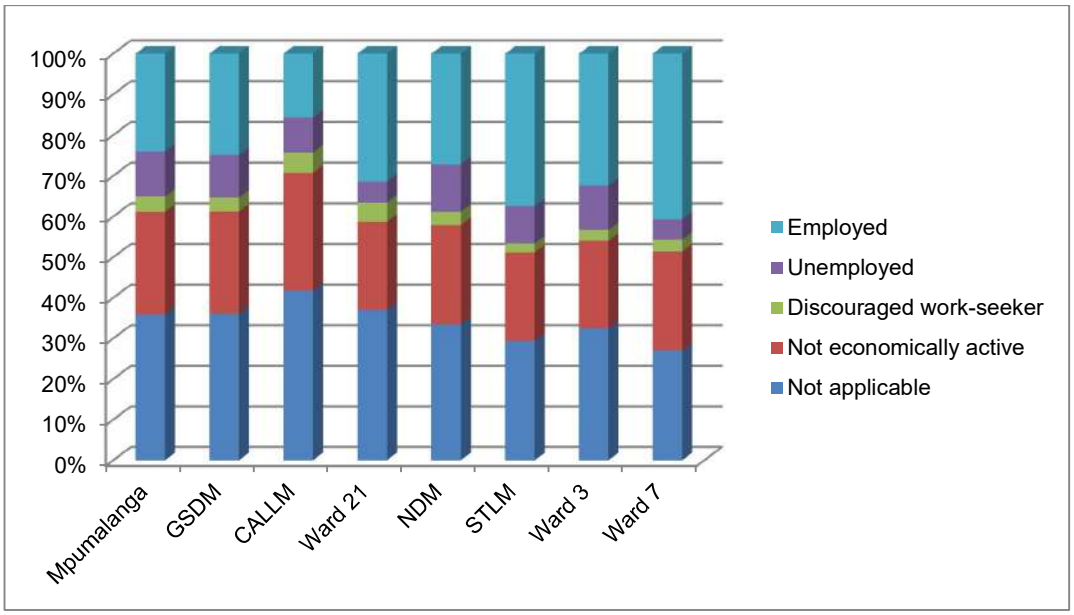


Figure 10-38: Employment Statistics within the Broader Study Area

Figure 10-39 provides an overview of the employment per sector within the broader study area. In this figure, "Not applicable" refers to individuals who are not employed (i.e. unemployed, not economically active, not of working age and discouraged work seekers).

GSDM reported an unemployment rate of 26.7% in 2017, which reflected an increase from 26.0% from 2014 (GSDM, 2020). In 2017, GSDM reported the lowest unemployment rate of the three districts within Mpumalanga. The unemployment rate for females in the district was 31.7% and males was 22.9%. As of the 2016 Community Survey, the youth unemployment rate was reported at 38.4%. The CALLM reported an unemployment rate of 31.3% in 2017, which was almost equal with the reported unemployment rate in 2014 (31.2%).

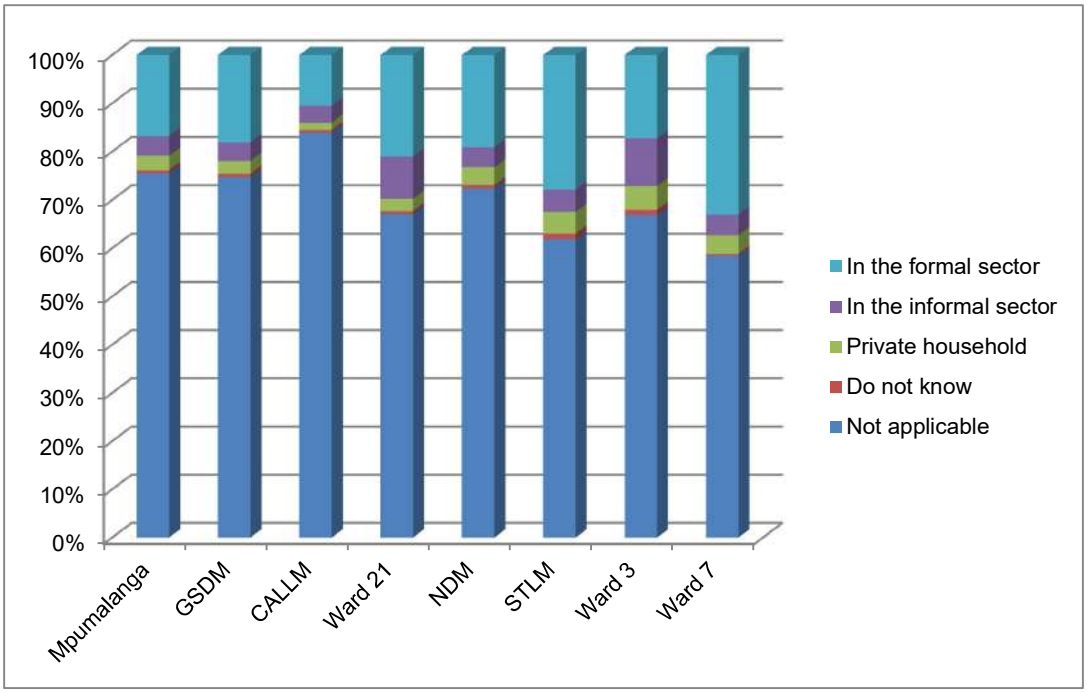


Figure 10-39: Employment by Sector within the Broader Study Area

Adapted from Wazimap (2017)

Within South Africa, the five main Job Drivers include the following:

- Infrastructure: Public Investment including energy, transport, water and communication infrastructure as well as housing;
- Main economic sectors: including agricultural smallholder schemes, agro-processing, mining, manufacturing, business and tourism;
- The Potential of new economies: including the Green Economy; the manufacture, construction and maintenance of new environmentally friendly infrastructure; and knowledge-intensive Information and Communication Technologies (ICT), higher education, healthcare, mining-related technologies, pharmaceutical and biotechnology sectors;
- Investing in social and public services: including co-operations, Stockvels, education, health and policing; and
- Spatial development and regional integration: job creation through exports within the Southern African Development Community (SADC) region (GSDM, 2020; NDM 2020).

The Mpumalanga Growth and Development Plan aims to foster economic growth to create jobs as well as reducing poverty and inequality within the province (GSDM, 2020; NDM, 2020). The following economic sectors have been identified as key sectors to encourage this economic growth and create employment opportunities:

- Agriculture and forestry;

- Mining and energy;
- Tourism and cultural industries;
- The Green Economy and ICT; and
- Manufacturing and beneficiation.

In 2016, the NDM contributed 36.8% to the Mpumalanga Gross Domestic Product (GDP) (NDM 2020). This is the largest contribution of all the districts within the Province, although it does reflect an overall decrease in the contribution, down from 37.1% in 2006. The NDM contributed 2.8% to the South African GDP, which is an increase compared to 2006 (at which time the NDM contributed 2.5% to the national GDP). This is lower than the peak contribution in 2012, where the NDM contributed 3.1% to the national GDP.

Within the NDM, the economies contributing the largest portion to the NDM economy were mining (41.2%), manufacturing (11.8%) and community services (11.6%) in 2016 (NDM 2020). Within the GSDM (2020), the sectors contributing the most to the 2017 district economy were mining (26.8%), manufacturing (18.8%) and community services (13.7%).

The economies employing the largest portions[7] of the labour force in the NDM in 2016 were trade (18.0%), community services (17.4%) and mining (13.7%) (NDM 2020). Within the GSDM, the three economies employing the largest portions of the labour force in 2017 include trade (21.6%), community services (19.2%) and finance (12.5%) (GSDM, 2020).

10.15.5 Income Levels

Figure 10-40 summarises the annual income for employed individuals. These figures are as per the 2011 census and have not been updated to consider inflation. A family of four with a monthly household income of R 1 600.00 or less would be considered to live in poverty, as this income would leave the family unable to meet their food needs with no money left for non-food items. This would equate to an annual income of R 19 200.00 or less. If all the individuals earning an income represent a single breadwinner for a family, then between 18% (STLM) and 41% (Ward 21) of households are living below the poverty line.

In 2016, 753 000 households within the NDM were living in poverty (as per the higher-bound poverty line), which equates to approximately 52.9% of the population within the municipality (NDM 2020). This is a decrease from 57.4% of the population living in poverty in 2006.

Within the GSDM, 45.1% of the population lived below the lower-bound poverty line in 2017 (GSDM, 2020). This represents 496 921 people living below this line.

[7] The figures indicating the employment by the agriculture and transport sectors were not visible in the graph for either 2011 or 2016 in this version of the NDM IDP.

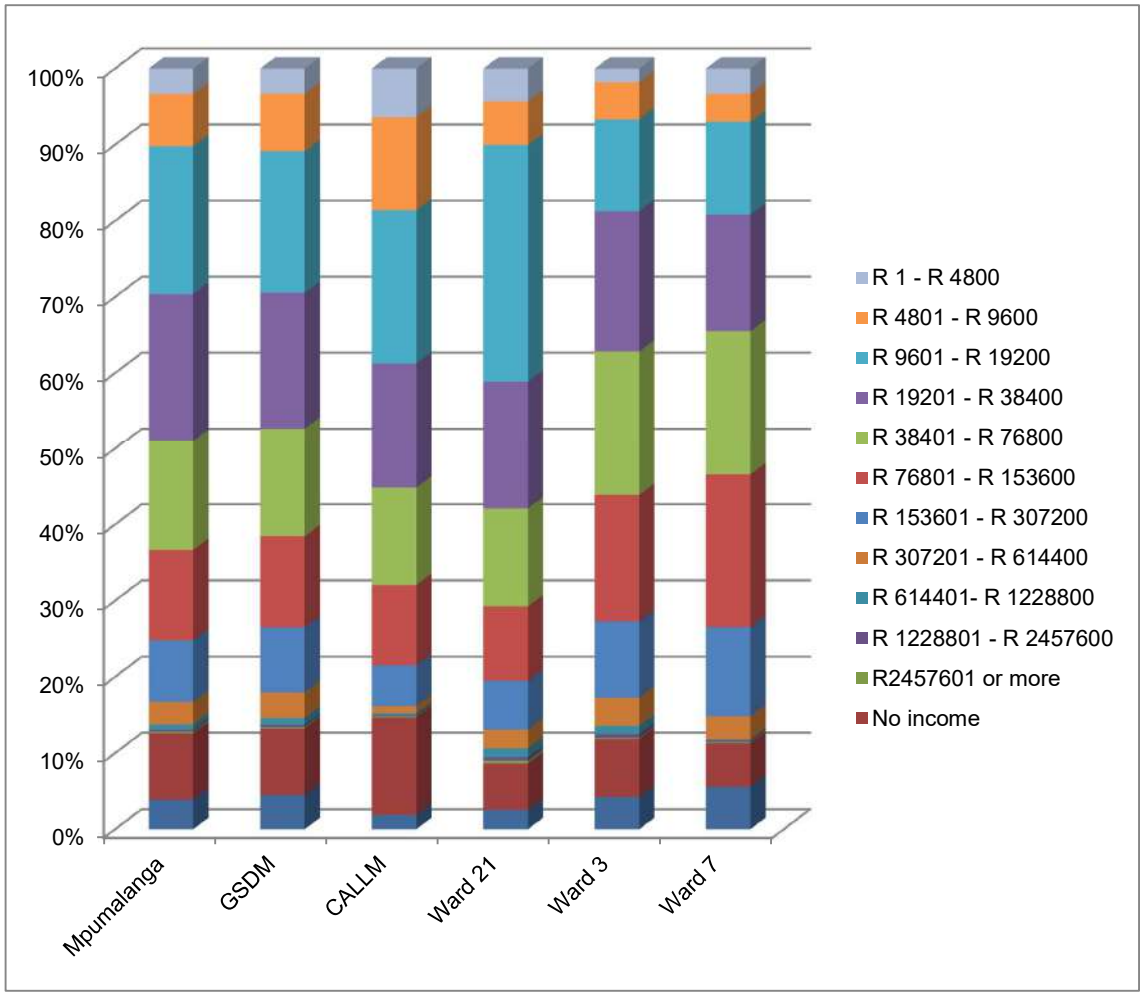


Figure 10-40: Annual Income for Employed Individuals within the Broader Study Area

Adapted from Wazimap (2017)

10.15.6 Household Services

This section provides a brief overview of the level of households' access to basic public services and infrastructure namely: the supply of water, sanitation, and waste management.

10.15.6.1 *Sources of Water*

Table 10-26 presents the most and least common sources of water for the population in the various areas under investigation. In this table, "water scheme" refers to a regional or local water scheme that is operated by a municipality or other water services provider.

Table 10-26: Most and Least Common Sources of Water within the Study Areas

Water Supply	MP	NDM	STLM	Ward 3	Ward 7	GSDM	CALLM	Ward 21
Most Common	Water Scheme	Water Scheme	Water Scheme	Water Scheme	Water Scheme	Water Scheme	Water Scheme	Borehole
Second	Borehole	Borehole	Borehole	Borehole	Borehole	Borehole	River / stream	Water Scheme
Third	Water Tanker	Water Tanker	Other	Water Tanker	Other	Water Tanker	Water Tanker	Water Tanker
Least	Rain water tank	Spring	Rain water tank	River / stream	Rain water tank	Rain water tank	Rain water tank	Rain water tank

Adapted from Wazimap (2017)

10.15.6.2 *Sanitation Resources*

Table 10-27 presents the sanitation resources employed by the population of the areas under investigation. This table differentiates between flush toilets connected to the sewage system and flush toilets with a septic tank. Additionally, the table differentiates between pit toilets with and without ventilation.

Table 10-27: Most and Least Common Sanitation Resources within the Study Areas

Water Supply	MP	NDM	STLM	Ward 3	Ward 7	GSDM	CALLM	Ward 21
Most Common	Flush	Flush	Flush	Flush	Flush	Flush	Pit latrine (vent)	Flush
Second	Pit latrine (no vent)	Pit latrine (no vent)	Pit latrine (no vent)	Pit latrine (no vent)	Pit latrine (no vent)	Pit latrine (no vent)	Pit latrine (no vent)	Pit latrine (no vent)
Third	Pit latrine (vent)	Pit latrine (vent)	Pit latrine (vent)	Pit latrine (vent)	Pit latrine (vent)	Pit latrine (vent)	Flush	Flush (tank)
Least	Bucket latrine	Chemical toilet	Other	Chemical toilet	Other	Bucket latrine	Bucket latrine	Bucket latrine

Adapted from Wazimap (2017)

10.15.6.3 *Waste Management*

Table 10-28 summarises the waste management strategies employed within the areas of interest. This table differentiates between communal and own refuse dumps and waste that is removed by a local authority or private company at least once a week or less often.

Table 10-28: Most and Least Common Waste Management Strategies within the Study Areas

Water Supply	MP	NDM	STLM	Ward 3	Ward 7	GSDM	CALLM	Ward 21
Most Common	Own dump	Removal (weekly)	Removal (weekly)	Removal (weekly)	Removal (weekly)	Removal (weekly)	Own dump	Own dump
Second	Removal (weekly)	Own dump	Own dump	Own dump	Own dump	Own dump	Removal (weekly)	Removal (weekly)
Third	No disposal	No disposal	No disposal	No disposal	No disposal	No disposal	No disposal	No disposal
Least	Removal (less often)	Other	Other	Communal dump	Communal dump	Other	Removal (less often)	Other

Adapted from Wazimap (2017)

11 Item 2(j): Impacts identified

Potential impacts resulting from the proposed Arnot South Project identified during the Scoping Report include the following;

- Potential increase in ambient noise levels;
- Potential increase in ambient dust levels;
- Loss of agricultural land where the shaft position has been located;
- Soil erosion and compaction;
- Positive impact on job creation;
- Potential increase of traffic within the study area and nearby roads;
- Habitat loss and impact on biodiversity;
- Possible contamination of ground and surface water;
- Potential loss of wetland integrity and functionality;
- Potential visual disturbances;
- Potential loss of or damage to heritage and cultural aspects; and
- Increase in waste generation.

Refer to Table 12-6 for the preliminarily identified impacts per Project activity and the proposed mitigation measures.

11.1 Item 2(g)(vi): Methodology used in determining the significance of the environmental impacts

The methodology to identify, determine and assess the potential impacts is provided in this section and will be utilised by the relevant Specialists during the EIA Phase.

11.1.1 Impact rating

The impact assessment methodology that will be utilised during the EIA Phase for the Project consists of two phases namely impact identification and impact significance rating.

Impacts and risks have been identified based on a description of the activities to be undertaken. Once impacts have been identified, a numerical environmental significance rating process will be undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of a particular environmental impact.

The severity of an impact is determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact is then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances.

Following the identification and significance ratings of potential impacts, mitigation and management measures were incorporated into the EMP.

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 11-2. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of seven categories (The descriptions of the significance ratings are presented in Table 11-3).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table 11-1: Impact Assessment Parameter Ratings

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	Irreplaceable loss or damage to biological or physical resources or **highly** sensitive environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
5	Serious loss and/or damage to physical or biological resources or **highly** sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or **moderately** sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources of **low to moderately** sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	**Minor loss and/or effects** to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

Rating	Intensity/Replaceability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	**Minimal to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited/Isolated Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 11-2: Probability / Consequence Matrix

Significance																																						
-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Consequence																																						

Table 11-3: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

11.2 Item 2(g)(vii): The positive and negative impacts that the proposed activity and alternatives will have on the environment and the community that may be affected

All potential negative and positive impacts will be identified, ranked and mitigation measures prescribed during the EIA Phase. The assumed impacts (to be confirmed during the EIA Phase) are listed in Table 12-6 below.

11.3 Item 2(g)(viii): The possible mitigation measures that could be applied and the level of risk

Possible mitigation measures that could be applied to risks regarding the site layout will be considered and discussed as part of the EIA Phase. This will also take into consideration the comments received from I&APs during the public participation phase as well as the findings of the specialist investigations. The proposed mitigation measures for the assumed risks (to be confirmed during the EIA Phase) are also listed in Table 12-6 below.

11.4 Item 2(g)(ix): The outcome of the site selection matrix

The preliminary layout for this application process has been predominantly determined by the position of the economically mineable coal reserve (No. 2 seam). The EIA Phase will consider how the layout can be altered to reduce or avoid impacts.

11.5 Item 2(g)(x): Motivation where no alternatives sites were considered

The selection of the preferred site is predominantly determined by the Prospecting Right ownership that has been awarded to Exxaro and the known presence of coal seams in the area. For this reason, no site alternatives have been considered. Should any area within the Mining Right be deemed unsuitable for the proposed mining activities, this will be stated in the EIA.

The alternatives considered in this report include the mining method, technology, and the “No-Go” alternative. Refer to section 9.1 above.

11.6 Item 2(g)(xi): Statement motivating the preferred alternatives and site

As stated above, Exxaro has obtained a Prospecting Right, and therefore have been granted access to the preferred site. The preferred site locations are mostly determined by the location of the coal resource (and the optimal extraction thereof) and the financial viability to access the resource through underground mining methods. The current layouts for mine access and related infrastructure have taken the depth of the No. 2 coal seam as a major technical consideration. The basis of the selected position of the boxcut is on the most practical underground mining layout with the least conveyor belt transfer points. The mine access area

and mining area will be further assessed in the EIA Phase to determine the viability of mining each area in relation to the surface occupiers and their activities.

12 Item 2(k): Plan of Study for the EIA process

The purpose of the EIA Phase is to investigate the potential negative and positive impacts of a proposed project activities on the environment. The potential impacts will then be quantified to assess the significance that an impact may pose on the receiving environment. The objectives of the EIA process are to:

- Ensure that the potential biophysical and socio-economic impacts of the proposed Project, including those as a result of blasting and potential traffic impacts, are taken into consideration during the decision-making process;
- Ensure that the Project activities undertaken do not have a substantial detrimental impact on the environment by presenting management and mitigation measures that will avoid and/or reduce those impacts;
- Ensure that I&APs are informed about the proposed Project and the public participation process to be followed;
- Ensure that I&APs are given an opportunity to raise concerns; and
- Provide a process aimed at enabling authorities to make an informed decision, especially in respect of their obligation to take environmental and social considerations into account when making those decisions.

12.1 Item 2(k)(i): Description of the alternatives considered and assessed

The alternatives including the “No-Go” alternatives considered and assessed are presented in Section 9.1 above. These will be further investigated during the EIA Phase.

12.2 Item 2(k)(ii): Description of aspects to be assessed as part of the EIA process

The EIA Phase will assess the overall aspects affected by the proposed Project in relation to Listed Project activities. The identified Listed and specified Activities for the Project are included in Section 5.1 above, and the affected environmental aspects, which will also form part of the EIA Phase are contained in section 12.3 below.

12.3 Item 2(k)(iii): Aspects to be assessed by specialists

The following Specialist Impact Assessments will be undertaken as part of the EIA Phase:

- Surface Water Impact Assessment;
- Groundwater Impact Assessment;
- Hydropedology Study;

- Soil, Land Use and Land Capability;
- Fauna and Flora Impact Assessment;
- Wetlands Impact Assessment;
- Aquatic Ecology Impact Assessment;
- Air Quality Impact Assessment;
- Noise Impact Assessment;
- Blasting and Vibrations Impact Assessment;
- Heritage Impact Assessment;
- Social Impact Assessment;
- Traffic Impact Assessment;
- Geochemistry (Waste Classification Study);
- Acid Mine Drainage (AMD) Strategy;
- Climate Change;
- Topography and Visual Assessment
- Closure and Rehabilitation; and
- Public Participation Process.

The specialist reports will be included as part of the Draft EIA and will be made available for public review before submission to the decision-making authorities.

12.4 Item 2(k)(iv): Description of the proposed method of assessing the environmental aspects

The full Impact Assessment methodology is included in Section 11.1.1 above and the methodologies to be used by the relevant Specialists are described below.

12.4.1 Surface Water

A detailed surface water assessment will be conducted to assess and identify potential impacts that may arise from the proposed development at the Arnot South Project site. This section provides the scope of work and methodology that will be undertaken during the EIA Phase of this project.

12.4.1.1 *Site Assessment and Sampling*

A site visit will be undertaken to physically assess and verify the hydrological characteristics of the affected area and the surrounds. During the site visit, eight water samples for laboratory analysis will be collected from the Vaalrivierspruit, Klein Olifants River and their tributaries

upstream and downstream of the Project area in order to determine upstream and downstream water quality for the site prior to the commencement of the proposed Project.

12.4.1.2 *Floodline Modelling*

Floodline modelling will be conducted for the Vaalrivierspruit and three of its tributaries, the Klein Olifants River and four of its tributaries which flow close to or pass through the Arnot South Project area. The following will be undertaken to model the floodlines:

- Catchment delineations will be conducted in Global Mapper 21 using a digital Elevation Model (DEM) derived from surveyed topographic data;
- Peak flows will be calculated for the 1:50-year and 1:100-year flood events. The Rational Method (Alternative 3), Standard Design Flood (SDF) and the Midgley and Pitman (MIPI) method will be used to calculate the peak flows (SANRAL, 2013).
- Floodline modelling and post-processing will be undertaken prior to mapping in ArcGIS 10.3.

12.4.1.3 *Stormwater Management Plan*

A Stormwater Management Plan (SWMP) will be compiled in accordance with the GN 704 best practice guidelines to include:

- Separation of clean and dirty areas or catchments;
- Storm water catchment delineations;
- Modelling runoff rates and runoff volumes resulting from the 1:50-year design rainfall event; and
- Conceptual placement and sizing of storm water structures including channels, berms and PCDs.

The Personal Computer Stormwater Management Model (PCSWMM) program will be utilised for stormflow modelling and for conceptual sizing of infrastructure such as drain/channels and PCDs.

12.4.1.4 *Water Balance*

A water balance will be calculated to determine inflows, transfers and outflows within the mine water system. This will provide an understanding of the mine water system and provides explanation of the drivers and controls of water within the system and how these can be managed.

12.4.1.5 *Surface Water Impact Assessment*

Detailed surface water impacts (quality and quantity) that may result from the proposed Project activities, based on the established baseline conditions, will be identified. A numerical environmental significance rating methodology that utilises the impact's probability of occurrence and its severity as factors to determine the significance of an environmental risk

will be utilised. Mitigation and management measures will be recommended, and a monitoring programme will be developed.

12.4.2 Groundwater

The proposed plan of study for the hydrogeological assessment is discussed below.

12.4.2.1 *A hydrocensus Survey and Groundwater Sampling (Site Assessment)*

A hydrocensus survey will be carried out in a 3 km radius around the site to determine third party groundwater users that may be at risk in future. Groundwater levels will be taken and groundwater from the sources will be sampled, if accessible. Water quality samples (assumed is 10 samples) will be submitted to a laboratory for analysis. This will also serve as input into the conceptual model.

12.4.2.2 *Geophysical Survey*

A ground geophysical survey will be conducted to delineate weathered zones and geological structures underlying the proposed project area. The geophysical survey will be used to more accurately position the proposed new groundwater drilling sites, in combination with remote sensing lineament analysis and review of all existing geological exploration data. A ground geophysical survey (electromagnetic and/or magnetic) would be employed to delineate weathered zones and identify possible linear structures that could act as preferred groundwater flow paths or barriers. The magnetic and electromagnetic method will be used to identify linear geological features, especially geological structures such as intrusive dykes and fractured fault zones.

12.4.2.3 *Aquifer Characterisation*

Based on the targets identified during the geophysical survey and desktop study, boreholes will be drilled for aquifer characterisation and groundwater monitoring. Aquifer characterisation will be undertaken to determine the hydrodynamics of the local aquifer as this will determine the aquifer responses from mining activities. The drilling programme will be performed using the rotary air percussion method with initial drilling and construction rounded of at a diameter of 165 mm inner diameter (ID) and reamed or enlarged to 203 mm if high yielding boreholes (yielding more than 6.0 L/s) are intercepted. The depth for characterisation boreholes is recommended to be approximately 30 m below the depth at which mining is targeted.

12.4.2.4 *Geochemical Assessment and Waste Characterisation*

Geochemical assessment and waste characterisation will be conducted based on the results obtained from 15 material samples. Geochemical and waste classification will be undertaken in line with the NEM: WA. As a standard, X-Ray Fluorescence (XRF), X-Ray Diffraction (XRD), sulphur speciation, Acid Base Accounting (ABA) and Net Acid Generation (NAG) tests will be performed. Aqua regia acid digestion will also be performed for each sample to determine the Total Concentration (TC) as detailed in the NEM: WA guidelines to be compared and classified against the Total Concentration Threshold (TCT). Leachate tests will be done to simulate the

heavy metal and anion leachate potential of sampled material that is disposed on the facilities, with the solution type and pH determined based on guidelines or the expected conditions on site. These tests will simulate and evaluate the potential of any heavy metal or ion contamination from the waste material that will be produced;

12.4.2.5 *Conceptual Modelling*

A conceptual model will be developed for the mine; the model aims to describe the groundwater environment in terms of the source-pathway-receptor dynamics.

12.4.2.6 *Numerical Modelling*

This task will entail developing a numerical model based on the conceptual model and data collected during the desktop review and field investigations. The conceptual model will be encoded into the numerical model. The model will be calibrated to the latest water levels (steady state), as well as historic water level monitoring if available (transient). Once calibrated, the model will be utilised to run the required scenarios to determine the likely impacts associated with the project activities. The scenario modelling will cover the operational phase and a period of 100 years post closure.

12.4.2.7 *Groundwater Impact Assessment*

An impact assessment will be provided based on the outcome of the numerical model with recommended mitigation measures that may be required to address the groundwater impacts associated with the Project. A groundwater risk assessment will be conducted based on the potential impacts identified during the numerical modelling.

12.4.3 Hydropedology

A detailed hydropedological assessment will be conducted to assess and identify potential impacts that may arise from the proposed mining activities. This section provides the methodology that will be undertaken during the EIA Phase of this project.

12.4.3.1 *Desktop Assessment and Literature Review*

The following reports will be reviewed for better understanding of hydropedological processes in the study area:

- Soil Classification Report;
- Wetlands Report; and
- Hydrogeological Report.

12.4.3.2 *Site Assessment*

A site assessment will be undertaken to understand and verify hillslope hydrology which determines the dominant water flow paths within the demarcated landscape units. Soil characteristics which indicate water residence times, leaching effects and reactions with acids

will be assessed during the site visit. Any signs which indicate groundwater-surface water interaction will be identified such as hillslope seeps, springs and wetlands.

12.4.3.3 *Conceptual Hydropedological Responses*

Hydrological soil types will be delineated according to methods described by Le Roux (Le Roux *et al*., 2011) and the conceptual hillslope hydrological behaviour determined. The hydrological behaviour will be based on identified hydrological soil types. The hydrological behaviour is based on identified hydrological soil types as described in Table 12-1 below.

Based on the identified land types and dominant soil forms within the Project area, the dominant hydrological soil types are likely to be recharge and interflow soils. However, this will be verified during the site visit by observations made in the soil profile. For recharge soils, a structureless, freely draining profile is expected, while textural discontinuity is anticipated for the interflow soils. Furthermore, observations of soil characteristics indicating prolonged saturation of the subsoil in a fluctuating water table, such as high chroma mottles and concretions are expected in the interflow soils.

Table 12-1: Hydrological Soil Types of the Hillslopes (Adapted from (Le Roux *et al.*, 2011))

Hydrological Soil Type	Description	Symbol
Recharge	Soils without any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow direction. These soils can either be shallow on fractured rock with limited contribution to evapotranspiration or deep freely drained soils with significant contribution to evapotranspiration (ET).	
Interflow (A/B)	Duplex soils where the textural discontinuity facilitates build-up of water in the topsoil. The duration of drainable water depends on rate of ET, position in the hillslope (lateral addition/release) and slope (discharge in a predominantly lateral direction).	
Interflow (Soil/Bedrock)	Soils overlying relatively impermeable bedrock. Hydromorphic properties signify temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction.	
Responsive (Shallow)	Shallow soils overlying relatively impermeable bedrock. Limited storage capacity results in the generation of overland flow after rain events.	
Responsive (Saturated)	Soils with morphological evidence of long periods of saturation. These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation excess.	

12.4.4 Soils, Land Capability and Use

This section describes the methodology after the completion of the Impact Assessment report, indicated in Figure 12-1.

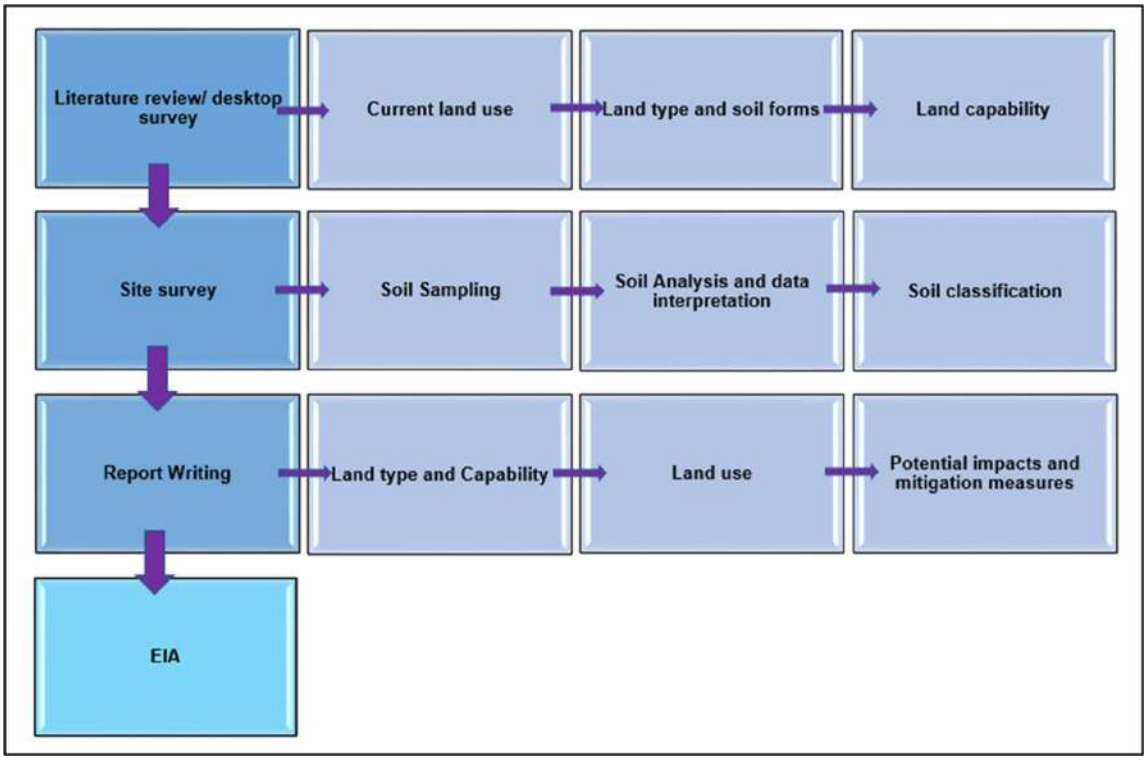


Figure 12-1: Soils, Land Capability and Use Assessment and Report Process

12.4.4.1 *Site Assessment*

The soil survey will determine the soil properties (position in landscape, soil depth, texture, structure and underlying material) and the potential nature, severity and extent of impacts the proposed infrastructure will have on the environment (e.g. erosion damage and/or potential for erosion, extent of basal cover, general ecosystem functionality, and possible soil contamination sources). The soil forms found will be identified using the South African Soil Classification System (Soil Classification Working Group, 1991). Representative soil samples will be taken at each of the predetermined focus areas. Five soil samples will be collected during the site visit for soil chemical and physical analysis at a South African National Accreditation System (SANAS) accredited laboratory.

12.4.4.2 *Soil Classification*

A hand soil auger will be used to determine the soil type and depth. Soils will be investigated using a Bucket and Cradle auger to a maximum depth of 1.2 m or to the first restricting layer. Survey positions will be recorded as waypoints using a handheld Global Positioning System (GPS). Other features such as existing open trenches and diggings will be used to determine soil form and depth. Mapping unit boundaries will be determined by changes in topography

with subsidiary indications from vegetation and parent material. The soils will be classified using the Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991).

12.4.4.3 *Soil Physical and Chemical Analysis*

In accordance with the methodology given in the Handbook of Standard Soil Testing Methods for Advisory Purposes (Soil Science Society of South Africa, 1990), five samples will be analysed for soil fertility and soil texture. Potential harmful elements will be tested in three of the five samples that will be collected.

12.4.4.4 *Land Use*

The current land use was identified by aerial imagery during the desktop assessment of the Scoping Phase and will be verified by on-site inspection during the EIA Phase. The maps indicate delineated areas of similar land use (Land Type Survey Staff, 1972 - 2006). Land use categories are split into:

- Plantations;
- Natural;
- Waterbodies;
- Mines;
- Urban built-up; and
- Agriculture.

12.4.4.5 *Land Capability*

Land capability and suitability (agricultural potential) mapping, which highlight the capability (what could be practised) of the various soils identified at a site, and the suitability (what should be practised considering various restrictions), respectively, were undertaken for the Project area at desktop level and will be ground truthed during the site visit.

Land capability mapping is based on identifying soil forms during the site visit. The land capability mapping involves dividing land into one of eight potential classes (Table 12-2) of soil capability, whereby Classes I-IV represent arable land and Classes V-VIII represent non-arable land according to the guidelines ((Soil Conservation Service: U.S. Department of Agriculture, 1973; Schoeman *et al*., 2000)).

Table 12-2: Land Capability Classes

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	**Arable Land**
II	W	F	LG	MG	IG	LC	MC	IC	-	
III	W	F	LG	MG	IG	LC	MC	-	-	
IV	W	F	LG	MG	IG	LC	-	-	-	
V	W		LG	MG	-	-	-	-	-	**Grazing Land**
VI	W	F	LG	MG	-	-	-	-	-	
VII	W	F	LG	-	-	-	-	-	-	**Wildlife**
VIII	W	-	-	-	-	-	-	-	-	

W - Wildlife	MG - Moderate Grazing	MC - Moderate Cultivation
F- Forestry	IG - Intensive Grazing	IC - Intensive Cultivation
LG - Light Grazing	LC - Light Cultivation	VIC - Very Intensive Cultivation

12.4.4.6 *Land Suitability*

Soil agricultural potential or suitability mapping will be determined by considering the soil forms, land capability classes, soil chemistry results, the hydrology of the site and the current land use. The process involves allocating terrain factors (such as slope) and soil factors (such as depth, texture, internal drainage and mechanical limitations (which affect soil-water processes) which define soil forms, to an area of land. The soil chemistry, which includes pH, cation and anion concentrations as well as nitrogen compositions, which are affected by the site hydrology, will be considered in determining the final suitability of the soil. The suitability guidelines according to the U.S. Department of Agriculture (1973) and Schoeman *et al*. (2000) will be used to determine the Land Capability.

The soil impacts will be assessed based on the impact's magnitude as well as the receiving environment's sensitivity, resulting in an impact significance rating which identifies the most important impacts that require management.

12.4.4.7 *Soil Impact Assessment*

The soil impacts will be assessed based on the impact's magnitude as well as the receiving environment's sensitivity, resulting in an impact significance rating which identified the most important impacts that require management. Based on national guidelines and legislation, the following criteria will be taken into consideration when potentially significant impacts will be examined relating to Soil, Land Use and Land Capability:

- Nature of impacts (direct/indirect and positive/negative);
- Duration (short/medium/long-term; permanent (irreversible)/temporary (reversible) and frequent/seldom);
- Extent (geographical area and size of affected population/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Measures to mitigate avoid or offset significant adverse impacts.

12.4.5 Fauna and Flora

12.4.5.1 *Site Assessment*

A single site survey (during the wet / summer season) will be undertaken, which will include the following:

- Linear transects constructed with the use of geo-referenced imagery that will be evaluated on foot to record the presence of any terrestrial faunal and floral species within the study area, as well as any habitat that may support the presence of SCC;
- Defining the Project's area of influence based on impacts; and
- Describing habitats and delineate their extent on a map.

12.4.5.1.1 *Flora*

Plant species present on the site will be identified and listed. The following plants will be investigated:

- Those with Red Data status (individual co-ordinates will be taken);
- Those with Medicinal uses; and
- Those declared Alien Invasive Plants (AIPs).

This will allow for the classification of the different vegetation units present. Species composition and habitat diversity will be assessed. The identification of these units will lead to the recognition of potentially important habitat types for discussion in the faunal survey. Potential areas of importance (sensitive areas), such as those areas where Red Data species of both flora and fauna could occur, will be identified, assessed and marked. This study will

indicate the extent and distribution of potential Red Data habitat and the probability that Red Data species actually occur in these habitats.

The impacts of the construction and operation of the proposed mine on the vegetation will be investigated and discussed. This will include the impacts on the presence of certain important species as well as the impacts on habitat diversity. The influence on the ecosystems in the area and their interactions will be assessed and discussed. This will include an assessment of ecosystem services.

This Scoping Report comprises some initial observations of the site, as well as a desktop study of the site and the impacts that are likely to occur. The EIA specialist report will define the vegetation communities (including habitats), species found on site and the sensitivity of each vegetation community found on site with reference to the proposed mining operation in order to identify and assess impacts and where possible, prescribe mitigation measures.

12.4.5.1.2 *Fauna*

The presence of mammals, birds, reptiles, amphibians and terrestrial invertebrates will be investigated, with emphasis on those with Red Data status in the databases. The presence of these species will be correlated to the vegetation units (habitats) classified during the floral survey. The influence of habitat diversity on species composition will be investigated. The surveys will assess the potential Red Data habitats and indicate the probability that Red Data species occur in these habitats. The current method of sampling for each category of species is described below:

Mammal sampling methods include Sherman traps that are used to sample small mammals. Additionally, any signs of animals or animal scats and spoor are recorded within the study area. Camera traps are used to capture any large mammals. Both the Sherman and camera traps are placed where signs of animal movement are present.

Birds are sampled using sampling points and line transects that are conducted via walks or drives. Opportunistic sightings are recorded, and nests and calls are noted. Point sampling is done at one or several points for a predetermined length of time each day during the sampling method.

Reptiles are sampled using pitfall traps together with active searches such as turning over rocks, looking in trees and termite mounds. Opportunistic sightings are recorded. Amphibians are sampled in the same manner as reptiles, with regular walks around pans within the study area.

Only certain invertebrate groups are sampled and used as indicators, as doing a full invertebrate survey is extremely time-consuming. Butterflies are used as an invertebrate indicator and are caught with an insect net. Baboon spiders are used as an indicator (many are nationally protected). Spider sampling is done by active searching for burrows along transects and identification is achieved by luring the spider out of its burrow (if required and if possible). Baboon spiders (*Idiothele* sp.) have been found on site and could potentially be Red Data species (species of concern). Each butterfly and spider will be identified to at least family level and where possible to genus and species level.

The impacts of the construction and operation of the proposed mine on the animal life will be investigated and discussed. This will include the impacts on the presence of certain important species as well as the impacts relating to habitat diversity. The influence on the animal life in the ecosystems and their interactions will be assessed and discussed.

12.4.5.2 *Fauna and Flora Impact Assessment*

A standardised impact assessment methodology will be applied to each of the perceived potential impacts expected to arise from the proposed Project. A specialist opinion will be provided in terms of the state of the available habitat located within the Project area. Measures will be designed and planned to assess the standard impacts and others of particular relevance to the project design such as habitat loss, habitat fragmentation, loss of biodiversity (SCC), proliferation of alien invasive species and impacts on conservation areas.

12.4.6 Wetlands

12.4.6.1 *Wetland Identification and Classification*

The wetland delineations will be verified according to the accepted methodology from the Department of Water and Sanitation 'A practical field procedure for identification and delineation of wetlands and riparian areas' (Department of Water Affairs and Forestry, 2005) as well as the "Updated manual for identification and delineation of wetlands and riparian areas" (Department of Water Affairs and Forestry (DWAF), 2008). These methodologies use the:

- **Terrain Unit Indicator**: Identifies those parts of the landscape where wetlands are more likely to occur;
- **Soil Form Indicator**: Identifies the soil forms, which are associated with prolonged and frequent saturation;
- **Soil Wetness Indicator**: Identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- **Vegetation Indicator**: Identifies hydrophilic vegetation associated with frequently saturated soils.

12.4.6.2 *Wetland Functionality, Status and Sensitivity*

The wetland functionality, status and sensitivity will form part of the main wetland report and is not discussed in the scoping report. The methodology of the aforementioned is summarised here. The wetland functionality, status and sensitivity consist of the following:

- Present Ecological Status (PES) – WET-Health;
- Ecological Importance and Sensitivity (EIS); and
- Provision of Goods and Services - WET-Ecoservices.

Wetland functionality is defined as a measure of the deviation of wetland structure and function from its natural reference condition. The natural reference condition is based on a theoretical undisturbed state extrapolated from an understanding of undisturbed regional vegetation and hydrological conditions. In the current assessment the hydrological, geomorphological and vegetation integrity was assessed for the wetland unit associated with the study site, to provide a PES score (Macfarlane *et al.*, 2007) and an EIS (DWAF, 1999).

The allocations of scores in the functional and integrity assessment are subjective and are thus vulnerable to the interpretation of the specialist. Collection of empirical data is precluded at this level of investigation due to project constraints including time and budget. Water quality values, species richness and abundance indices, surface and groundwater volumes, amongst others, should ideally be used rather than a subjective scoring system such as is presented here.

The functional assessment methodologies presented below take into consideration subjective recorded impacts to determine the scores attributed to each functional HGM wetland unit. The aspect of wetland functionality and integrity that are predominantly addressed include hydrological and geomorphological function (subjective observations) and the integrity of the biodiversity component (mainly based on the theoretical intactness of natural vegetation) as directed by the assessment methodology. In the current study the wetland was assessed using, WET-Health (Macfarlane *et al.*, 2007), EIS (DWAF, 1999) and WetEcoServices, (Kotze *et al.*, 2006).

12.4.6.3 *PES – WET-Health*

A summary of the components of the WET-Health (i.e. Hydrological; Geomorphological and Vegetation Health assessment for wetlands) is described in Table 12-3.

Table 12-3: Health categories used by WET-Health for describing the integrity of wetlands (Macfarlane *et al.*, 2007)

Impact Category	Description	Combined Impact Score	PES Category
None	Unmodified, natural.	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota has taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	D

Impact Category	Description	Combined Impact Score	PES Category
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Critical	Modifications have reached a critical level and ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

12.4.6.4 *Ecological Importance and Sensitivity*

The Ecological Importance and Sensitivity (EIS) tool was derived to assess the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred. Ecological importance is an expression of a wetland's importance to the maintenance of ecological diversity and functioning on local and wider spatial scales. Ecological sensitivity refers to the system's ability to tolerate disturbance and its capacity to recover from disturbance once it has occurred (DWAF, 1999). This classification of water resources allows for an appropriate management class to be allocated to the water resource and includes the following:

- Ecological Importance in terms of ecosystems and biodiversity such as species diversity and abundance;
- Ecological functions including groundwater recharge, provision of specialised habitat and dispersal corridors; and
- Basic human needs including subsistence farming and water use.

The EIS of the wetlands is expressed on a scale rating from Very High to Low/Marginal.

12.4.6.5 *Wetland Impact Assessment*

This will involve the collation of all information, including desktop, statistical analysis of historic data (where available) and field survey findings. This information will be used to develop management plans and recommendations along with associated maps describing the findings and recommended actions.

12.4.7 Aquatics

Descriptions of the various approaches for the determination of the aquatic ecology baseline are detailed in the respective sections below.

12.4.7.1 *Water Quality*

Selected *in situ* water quality variables will be measured using water quality meters manufactured by YSI, namely the EcoSense EC300A, EcoSense ODO200 and EcoSense

pH100A handheld meters. Temperature, pH, electrical conductivity and dissolved oxygen will be recorded prior to additional biological sampling.

12.4.7.2 *Habitat Quality*

The availability and diversity of aquatic habitat is important to consider in assessments due to the reliance and adaptations of aquatic biota to specific habitats types (Barbour *et al.*, 1998; Barbour *et al.*, 2013). Habitat quality and availability assessments are usually conducted alongside biological assessments that utilise fish and macroinvertebrates. Aquatic habitat will be assessed through visual observations on each river system considered.

12.4.7.3 *Index for Habitat Integrity*

The Index for Habitat integrity (IHI) (Version 2, Kleynhans, C.J., pers. comm., 2015) aims to assess the number and severity of anthropogenic perturbations along a river/stream/wetland and the potential inflictions of damage toward the habitat integrity of the system (Dallas, 2005). Various abiotic (e.g. water abstraction, weirs, dams, pollution, dumping of rubble, etc.) and biotic (e.g. presence of alien plants and aquatic animals, etc.) factors are assessed, which represent some of the most important and easily quantifiable, anthropogenic impacts upon the system.

In accordance with the magnitude of the impact created by the abovementioned criteria, the assessment of the severity of the modifications is based on six descriptive categories ranging between a rating of 0 (no impact), 1 to 5 (small impact), 6 to 10 (moderate impact), 11 to 15 (large impact), 16 to 20 (serious impact) and 21 to 25. Based on available knowledge of the site and/or adjacent catchment, a confidence level (high, medium, low) is assigned to each of the scored metrics.

Each of the allocated scores will then be moderated by a weighting system, which is based on the relative threat of the impact to the habitat integrity of the riverine system. The total score for each impact is equal to the assigned score multiplied by the weight of that impact. The estimated impacts (assigned score / maximum score [25] X allocated weighting) of all criteria are then summed together, expressed as a percentage and subtracted from 100 to determine the PES score (PES; or Ecological Category) for the instream and riparian components, respectively.

However, in cases where selected instream component criteria (i.e. water abstraction, flow, bed and channel modification, water quality and inundation) and/or any of the riparian component criteria exceeded ratings of large, serious or critical, an additional negative weight is applied. The aim of this is to accommodate the possible cumulative effect (and integrated) negative effects of such impacts (Kemper, 1999).

Subsequently, the negative weights will be added for both facets of the assessment and the total additional negative weight subtracted from the provisionally determined integrity to arrive at a final habitat integrity estimate (Kemper, 1999). The eventual total scores for the instream and riparian zone components are then used to place the habitat integrity in a specific habitat integrity ecological category (Table 12-4).

Table 12-4: Ecological Categories for the Habitat Integrity scores

Ecological Category	Description	Score (% of Total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and there has been an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 - 19

12.4.7.4 *Aquatic Macroinvertebrate Assessment*

Macroinvertebrate assemblages are good indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour *et al*. 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour *et al*. 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem, which includes:

- Integrated Habitat Assessment System;
- South African Scoring System Version 5 (SASS5); and
- Macroinvertebrate Response Assessment Index (MIRAI).

12.4.7.5 *Ichthyofaunal Assessment*

Fish is considered to be a very important river health indicator whereby their responses to environmental change can be measured utilising the Fish Response Assessment Index (Kleynhans 1999; Kleynhans *et al*., 2005) through sampling.

12.4.7.6 *Fish Response Assessment Index*

The number of recorded fish species from sampling and their Frequency of Occurrence (FROC) will be used to supplement data in the Fish Response Assessment Index (FRAI). The information gained using the FRAI provides an indication of the PES of the river based on the

fish assemblage structures observed. This allows for the determination of potential driver/changes to the aquatic ecosystem of concern based on fish species expected in the system in comparison to actual species present.

12.4.8 Air Quality

12.4.8.1 *Emission Inventory*

An emission inventory will be undertaken by taking into cognisance the proposed mine infrastructure and planned activities within the footprint. Emissions rates generated will serve as input parameter into the dispersion modelling software: American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD). The emissions equations from United States Environment Protection Agency (US EPA) and the Australian National Pollutant Inventory (NPI) will be used to calculate the emissions from various sources.

12.4.8.2 *Air Quality Dispersion Modelling*

The United States Environmental Protection Agency's Preferred/Recommended Models: AERMOD modelling system will be utilised to simulate all emission scenarios for the different pollutants. The model simulation will assess the emissions from the various sources within the mine boundary and determine the potential contributions from the mine to the ambient air quality of the area. The results will be contour plots (maps) representing the zone of influence.

The predicted zone of influence for each pollutant simulated will be used to assess operational phase impacts and, in some instances, cumulative impacts of the operation on the ambient air quality as it applies to the South African Air Quality standards for compliance.

12.4.9 Noise

An inventory of noise generating machinery and their sound power levels will be conducted. This will be followed by noise modelling to determine the propagation of noise from mine related activities to the surrounding receivers.

The outcome of the model will be compared with the SANS 10103:2008 day and night-time guideline limit values. It is worth mentioning that the results are not a true reflection of the significance of the impact. To specifically determine the significance of the impact the baseline levels are compared to the outcome of the model. An impact assessment will be drafted, which will rate impacts and recommend mitigation measures and management measures.

12.4.10 Cultural Heritage

12.4.10.1 *Secondary Data Collection Methodology*

Data collection informs the cultural heritage baseline profile of the study area under consideration. Data was collected through a desktop literature review, which comprised the South African Heritage Resources Information System (SAHRIS) database as well as online electronic journal articles, reference books and select internet sources.

12.4.10.2 *Historical layering*

Digby Wells will undertake a historical layering exercise in the Impact Assessment phase. This technique will assist in the identification of historical structures afforded general protection under Section 34 of the NHRA. Historical layering is a process whereby diverse cartographic sources from various time periods are layered chronologically using Geographic Information Systems (GIS). The rationale behind historical layering is threefold, as it:

- Enables a virtual representation of changes in the land use of a particular area over time;
- Provides relative dates based on the presence or absence of visible features; and
- Identified potential locations where heritage resources may exist within an area.

12.4.10.3 *Primary Data Collection*

Digby Wells will undertake the in-field assessments in the Impact Assessment phase and this will include the following in-field assessments:

- A pre-disturbance survey aimed at identifying physical heritage resources that may be present within the site-specific area to inform the Heritage Impact Assessment (HIA); and
- A site inspection aimed at identifying outcrops of potentially fossil-bearing rock and palaeontologically-sensitive layers to inform the PIA report.

Depending on the conditions on site, these surveys may be a combination of vehicular and pedestrian surveys and will be non-intrusive (i.e. no samples will be taken). Digby Wells will record the tracks of the survey and any heritage resources identified in the field as waypoints through a handheld GPS device. These results will be mapped as plans to be included in the final HIA report.

12.4.10.4 *Site Naming Convention*

Heritage resources identified by Digby Wells during the field survey are prefixed by the SAHRIS case identification generated for this Project. Information on the relevant period or feature code and site number follows (e.g. 11829/BGG-001).

The site name may be shortened on plans or figures to the period/feature code and site number (e.g. BGG-001). Table 12-5 presents a list of the relevant period and feature codes.

Table 12-5: Relevant NHRA Section Codes

Feature or Period Code	Reference
S.34	Historical Built Environment
S.35	Archaeological or palaeontological resource
S.36	Burial grounds and graves

Heritage resources identified through secondary data collection are prefixed by the relevant SAHRIS case or map identification number (where applicable) and the original site name as used by the author of that assessment (e.g. 1668/Site 1). Once the impacts are identified, Digby Wells' rating system that takes into consideration the intensity, duration, spatial scale and probability will be used to determine the significance of the identified impacts.

12.4.11 Social Assessment

Digby Wells defined the primary and secondary study areas as described in Section 10.15 in terms of the likely areas of impact – direct, indirect and induced.

12.4.11.1 *Secondary Data*

Secondary data informed the compilation of the social baseline description. Digby Wells reviewed the following data sources:

- Databases from Statistics South Africa and Wazimap;
- Provincial, District and Municipal development planning reports;
- Other EIAs and other Social Development reports and documents for the study areas deemed as relevant to this Project; and
- Available maps and satellite imagery.

12.4.11.2 *Primary Data Collection*

Digby Wells did not collect any primary data to inform the socio-economic baseline but will collect the data to inform the Social Impact Assessment (SIA) report. Primary data collection will consist of:

- One-to-one meetings with government and local leaders; as well as with community gatekeepers.
- Focus group discussions will be held with Ward Committee members; community members – in groups of men, women, youths and elders (if applicable).
- Ad hoc meetings will also be held with stakeholders referred to the specialist by community members or leaders.
- General site observations and pictorial representation of the study areas will also be attained.

The proposed Project will have both positive and negative impacts within the Project area. Digby Wells will assess these impacts in more detail in the impact assessment phase of the EIA process and will present the findings in a specialist SIA report.

12.5 Item 2(k)(v): Description of proposed method of assessing duration and significance

The Impact Assessment methodology is contained in Table 11-3 above. For cumulative analysis, the following will be considered:

- Existing operations in the areas that could contribute, inter alia, to air pollution, groundwater contamination, surface water contamination, noise and wetland health degradation;
- Potential of blast impacts on surrounding historical resources, communities and mining operations;
- AMD is considered a factor in the general Project area, and will further considered in the EIA Phase; and
- Loss of heritage resources.

12.6 Item 2(k)(vi): An indication of the stages at which the competent authority will be consulted

The competent authority for this Project is the DMRE who will be informed throughout the Environmental Authorisation Application processes. The DMRE has also been identified as a Key Stakeholder and will be provided all notifications provided to I&APS, throughout the process. The DMRE will also be invited to attend a site inspection and any/all public engagements. The following proposed project dates apply to the Project Schedule:

- Submission of the Application Form: 14 December 2020;
- Assumed submission of the Draft Scoping Report for Public Review: January/February 2021;
- Assumed submission of Final Scoping Report: March 2021;
- Assumed submission of the Draft EIA: August 2021; and
- Assumed submission of Final EIA: December 2021.

12.7 Item 2(k)(vii): Details of the Public Participation Process to be followed during the EIA process

The public participation process will be aligned with the regulatory requirements in terms of Chapter 6 of the EIA Regulations, 2014 (as amended) in accordance with the NEMA. Stakeholder comments gathered during the Scoping Phase and outcomes from the public meetings will be closely considered for further Public Participation activities and inclusion for specialist studies (where applicable). The main emphasis of stakeholder meetings as part of this phase will be to share results of the specialist impact studies completed and the associated suggested mitigation measures and recommendations.

It is anticipated that the Stakeholder Engagement process to be implemented for the EIA Phase will be similar to the process undertaken for the Scoping phase. The premise of activities is to adhere to various legislative requirements for Public Participation and that a single, integrated process is followed. This will limit stakeholder fatigue and ensure that stakeholders are presented with a single view of the Project. A public meeting will be held during the EIA Phase to present the findings of the EIA process.

12.8 Item 2(k)(viii): Tasks which will be undertaken as part of the EIA process

The following tasks will be undertaken during the EIA Phase:

- Further define the project activities;
- Further assess the project alternatives based on technical, economic, social and environmental criteria;
- Supplement the legal review of the project;
- Undertake detailed specialist investigations and impact assessment;
- Confirm sewage generation volume, treatment technology;
- Confirm water requirements for the different phases of the mine and water resource;
- Identification of possible fatal flaws;
- Assess potential impacts using the methodology provided herein;
- Provide detailed and feasible mitigation and management measures in an EMPr; and
- Public participation activities, including public and key stakeholder meetings.

12.9 Item 2(k)(ix): Measures to avoid, reverse, mitigate, or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored

Table 12-6 provides the proposed project activities, potential impact associated with each activity and proposed preliminary mitigation and residual risk, per environmental aspects.

Table 12-6: Environmental Aspects Preliminary Impacts and Mitigation Measures

Activities	Potential impacts	Mitigation type	Potential for residual risk
Surface Water			
• Removal of vegetation / topsoil for establishment of mining and linear infrastructure; and • Stockpiling of soils, rock dump and discard dump establishment.	• Sedimentation and siltation of water resources reducing flow regime within the Vaalrivierspruit, Klein Olifants River and their tributaries	• Control fluvial erosion and sedimentation by establishing a stormwater management plan	Medium
• Construction of access road and haul roads across rivers and streams.	• Alteration of channel geometry at crossings resulting in fluvial erosion and reduced flow regime.	• Remedy through re-profiling disturbed channel geometry to allow free drainage at river crossings.	Medium
• Handling of hydrocarbons and general waste; and • Diesel storage and explosives magazine.	• Surface water contamination leading to deteriorated water quality within the Vaalrivierspruit, Klein Olifants River and their tributaries.	• Control through use of spill kits and accredited vendors for waste disposal; • Control by training of personnel in proper hydrocarbon and chemical handling methods; and • Control by bunding hydrocarbon and other waste storage facilities.	High
• Construction of additional infrastructure, and ventilation shafts.	• Interception of rainfall, runoff and subsurface flow leading to reduced downstream runoff yield.	• Remedy through rehabilitation of areas previously occupied by ventilation fans and other infrastructure, post-closure.	Medium
• Areas containing topsoil stockpiles, overburden and discard dumps	• Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein Olifants River and their tributaries.	• Control by implementing a comprehensive storm water management plan which addresses fluvial erosion control.	Medium
• Effluent/process water as a result of operations and use of water for mining operations; and • Handling of hydrocarbons and general waste.	• Contamination of water resources and deterioration of water quality.	• Control through implementation of a SWMP for dirty water management; and • Control through water quality and quantity monitoring and updating the mine-wide water balance.	High
• Concurrent rehabilitation as mining progresses.	• Restoration of free drainage and runoff yield at least to a certain extent.	• Remedy through re-profiling and rehabilitation of previously disturbed landscapes.	High positive
• Demolition and removal of infrastructure	• Sedimentation and siltation of nearby watercourses including Vaalrivierspruit, Klein Olifants River and their tributaries.	• Control through limiting disturbance of soils to where demolition will be taking place.	Medium
• Spillages and leakages from vehicles and machinery during demolition of infrastructure.	• Contamination of water resources and deterioration of water quality.	• Control through water quality monitoring.	Minor
• Post-closure monitoring and rehabilitation; and • Closure of the underground mine.	• Restoration of free drainage and runoff yield at least to a certain extent.	• Remedy through re-profiling and rehabilitation of previously disturbed landscapes.	High positive
Groundwater			
• Removal of vegetation / topsoil for establishment of mining and linear infrastructure.	• Groundwater quality deterioration.	• Control through extent of excavation and management measures in place should the extent of excavation not allow for alternative extent.	Low
• Diesel storage and explosives magazine.	• Groundwater quality deterioration.	• Stop through constructing storage and handling areas accordingly.	Medium

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Underground blasting and mining.	• Groundwater quality deterioration.	• Remedy though handling underground water appropriately and using environmentally friendly products.	Medium
• Dewatering from underground mine voids.	• Groundwater quantity deterioration.	• Modify through dewatering according to specifications by numerical model.	Medium
• Subsidence	• Groundwater quality deterioration and surface water quality deterioration.	• Control through mining method.	Medium
• Potentially contaminating stockpiles on surface.	• Groundwater quality deterioration.	• Stop through constructing storage area accordingly.	Low
• Contamination generation within underground mine (shaft).	• Groundwater quality deterioration.	• Remedy through limiting contamination during operation.	Medium
• Potential decant.	• Groundwater quality deterioration.	• Control through decant management.	Medium
Hydropedology			
• Removal of vegetation / topsoil for establishment of mining and linear infrastructure.	• Sedimentation and siltation of surface water resources resulting from soil erosion.	• Control by minimizing the area to be disturbed and remedy through rehabilitation (re-vegetation).	Low
• Diesel storage and explosives magazine.	• Surface water contamination as a result of leaks and spillages of hydrocarbons and other potentially hazardous chemicals.	• Control by preventing mixing of potentially dirty water into the receiving natural water resources.	Low
• Construction of additional infrastructure, and ventilation shafts.	• Alteration of natural flow paths due to an increase in impervious areas and a reduction in infiltration and recharge and potential contamination of receiving waterbodies.	• Remedy through rehabilitation (backfilling, reprofiling and re-vegetation).	Medium
• Construction of access and haul roads.	• Alteration of natural flow paths due to an increase in impervious areas and a reduction in infiltration and recharge and potential contamination of receiving waterbodies; and • Alteration of river channel geometry at river crossings.	• Control by implementing the SWMP and river channel re-profiling at affected crossings post-closure.	Low
• Stockpiling of soils, rock dump and discard dump establishment.	• Potential leaching of acid generating material into groundwater resources; and • Sedimentation and siltation of water resources from eroded soils from stockpiles and softs/hards dumps.	• Control by undertaking waste classification of the rock dump and discard dump material and handling accordingly, remedy by implementing the rehabilitation plan.	High
• Underground blasting; and • Removal of rock (blasting).	• Alteration of the dominant flow paths in the study area may have implications in the quantity of water reporting to downstream/downslope receptors; and • Disturbance in the flow path in the study area will impact on the natural surface-groundwater interactions, which may have impacts on both the quality and quantity of water reporting into the receiving environment.	• Remedy through rehabilitation (backfilling and reprofiling).	Medium
• Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	• Surface water contamination as a result of leaks and spillages of hydrocarbons and other potentially hazardous chemicals.	• Control by preventing mixing of potentially dirty water into the receiving natural water resources through use of spill kits, drip trays proper SWMP.	Low
• Concurrent rehabilitation as mining progresses.	• Restoration of hydrological processes to sustainable and practically fit-for-purpose post-mining land use conditions as much as possible. The main objective is to understand impacts of land use change post mining, to reduce contamination of water resources, and for the protection of wetlands; and • Positive impacts are envisaged as this may cause the hydropedological functions of the site to satisfy the needs of interested and affected parties who are beneficiaries of the land and water resources in the area.	• N/A	Low

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Demolition and removal of infrastructure.	• Deterioration of water quality of receiving waterbodies caused by spillage and leakage of hydrocarbon waste (fuels, oils & grease) from heavy machinery and vehicles; and • Sedimentation and siltation of water resources due to disturbed soils during demolition of infrastructure.	• Control by proper handling of hydrocarbon waste and implementation of SWM infrastructure such as silt fences to control sediments; • Decommissioning activities should be prioritized during dry months of the year (May to October) where practical, though disturbed footprints should not be left un-rehabilitated for extended periods of time; • Use of accredited contractors for removal or demolition of infrastructure is recommended; this will reduce the risk of waste generation and accidental spillages; and • An appointed Environmental Control Officer (ECO) must always be available to ensure implementation of the recommended mitigation/management measures during all phases of the Project.	Low
• Post-closure monitoring and rehabilitation.	• Post closure monitoring will allow for early detection of potential contaminants that may cause unforeseen negative impacts on the receiving environment. • Positive impacts are envisaged from rehabilitation as this is likely to cause the hydropedological functions of the site to satisfy the needs of interested and affected parties who are beneficiaries of the land and water resources in the area. Furthermore, the potential source of contaminants will be managed or removed, and this will improve water quality.	• N/A	Low
• Closure of the underground mine.	• Contamination of soil and water resources due to the potential decant of AMD due to movement of contamination and pollution plumes.	• Control by considering the findings of the hydrogeological report which will indicate whether any AMD is anticipated post closure and implementation of recommendations to mitigate or prevent AMD.	Medium
Soils			
• Removal of vegetation and topsoil for the establishment of mining and linear infrastructure.	• Decrease in soil depth and area for agricultural activities; • Soil erosion caused by wind and water movement over the exposed soil surface; • Increasing sedimentation within the lower lying areas; and • Loss of soil fertility.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	Very High
• Construction, operation and maintenance of diesel storage and explosives magazine.	• Major disturbance to the functionality and productivity of the soil which may result in a loss of topsoil, erosion, organic material depletion in the topsoil; • Hardened surfaces resulting in increased runoff, erosion potential and sedimentation; and • Chemical soil pollution, loss of basal cover, organic matter and soil fertility, and soil contamination.	• Control through design, management, maintenance and mitigation; • Remedy through concurrent rehabilitation and monitoring • Remediate using commercially available emergency clean up kits.	Medium
• Construction, operation and maintenance of additional infrastructure, such as haul roads and ventilation shafts.	• Soil compaction, low vegetation growth, high runoff potential, increased erosion; and • Land capability of the soils will decrease as well as changing the land use from agricultural practices to mining activities. Should the area not be rehabilitated to pre-mining land capability after mining operations, the land capability may be reduced to wilderness.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	Medium

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Stockpiling of soils, rock dump and discard dump establishment.	• Major disturbance to the functionality and productivity of the soil which may result in a loss of topsoil, erosion, organic material depletion (fertility) in the topsoil; • Erosion and sedimentation of stockpiles, impacting the low-lying areas such as wetlands and vegetation; and • Water contamination.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation, re-vegetation and monitoring.	High
• Underground blasting and removal of rock.	• Movement of the soil strata; • Dewatering of soil profiles; and • Changes to the landscape, causing ponding, and undulating topographies.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	High
• Maintenance of haul roads, pipelines, machinery, water-, effluent- and stormwater.	• Hydrocarbon leaks from vehicles and machinery or hazardous materials such as oil and fuel spills. • Soil contamination; • Loss of utilisable soil as a resource; and • Erosion, soil contamination, compaction, loss of land capability and land use.	• Control through design, management, maintenance and mitigation; • Remedy through cleaning all spills up immediately, and removal of contaminated soils. • Remediate using commercially available emergency clean up kits.	High
• Concurrent rehabilitation as mining progresses.	• Rehabilitation of the disturbed mined areas causes mechanical compaction and soil contamination; • The impacts will be negative and mostly of a permanent nature. The disturbance of the soil layers will be a problem, even after the area has been rehabilitated; • Recovery of the soil quality is dependent on the quality of rehabilitation; and • Fertility may be improved through soil amelioration, but soil depth and compaction are not easily alleviated.	• Control through design, management, maintenance and mitigation; • Remedy through continuous monitoring and maintenance; and • Control through restricting vehicles in the newly rehabilitated areas and maintenance on vehicles.	Low
• Demolition and removal of infrastructure.	• Disturbance of soils, and subsequent erosion by wind, and water; • Increased vehicle movement in the area, increasing soil compaction, and runoff potential; • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of the soils; • Unexpected changes in the depth, and the nature of the soil; and • Ponding of water, and creation of drainage channels.	• Control through maintenance and monitoring to ensure no erosion, incision and canalisation takes place; • Control through implementation of erosion berms downstream of areas to be re-profiled and contoured to prevent gully formation; • Remedy erosion by immediate action and included as part of an ongoing rehabilitation plan; and • Remediate all soils compacted as a result of rehabilitation activities by ripping/scarifying (<300 mm) and re-profile.	Medium
• Post-closure monitoring and rehabilitation.	• Exposure of soils, and subsequent compaction, erosion, and sedimentation; • Soil compaction, and increased runoff potential due to vehicle movement during rehabilitation programs; • Loss of organic material, and vegetation cover; and • Potential spillage of hydrocarbons such as oils, fuels, and grease, thus contamination of soil.	• Control waste or discard that may be have occurred by classifying it and dispose of in an appropriate landfill facility; • Control through monitoring the rehabilitation, and mitigation; • Control through a rehabilitation and monitoring plan for at least three years after decommissioning to ensure no unexpected, and undulated impacts on the environment, Soil, Land Use, and Land Capability.	Low
• Closure of the underground mine.	• Possible subsidence; and • Possible decanting and soil and water contamination.	• Control through design, management, maintenance and mitigation; and • Remedy through rehabilitation and monitoring.	High
Fauna and Flora			

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Removal of vegetation / topsoil for establishment of mining and linear infrastructure; and • Construction of access road, haul roads. and additional infrastructure.	• Loss of plant communities/ floral diversity; • Loss of general biodiversity; • Loss of habitat; • Fragmentation and degradation to the ecosystem; • Loss of floral and faunal SCC; • AIP proliferation; • Increase in dust pollution; • Compaction of soils; and • Increase in faunal casualties.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	High
• Stockpiling of soils, rock dump and discard dump establishment.	• Compaction of soils; • Low vegetation growth; and • Increased run off and erosion.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	Medium
• Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas.	• Hazardous spills can occur that lead to contamination of the surrounding area; • Increased erosion potential; and • Continual habitat fragmentation.	• Control through design, management, maintenance and mitigation; and • Remediate using commercially available emergency clean up kits.	Medium
• Removal of rock (blasting)	• Habitat removal; and • Faunal casualties (limited).	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	Medium
• Demolition and removal of infrastructure.	• Loss of biodiversity and sensitive fauna and flora; and • Loss of habitat integrity and ecosystem services.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	High
Wetlands			
• Site clearing, including the removal of vegetation and topsoil.	• Habitat fragmentation; • Spread of alien and invasive species; • Soil disturbance and/or compaction; • Increased incidence of erosion; • Sedimentation from erosion; • Potential water quality deterioration; and • Disturbance to avifauna and other fauna utilising the freshwater resources thus resulting in an overall loss of biodiversity.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	High
• Stripping topsoil and soft overburden; • Loading, hauling and stockpiling; and • Construction of mine related infrastructure including roads (excluding pits).	• Increased potential for erosion, sedimentation and deposition impacts; • Loss of water quality; • Loss of habitat and biodiversity; • Fragmentation of the wetland resources as a result of road crossings; • Loss of wetland habitat (soils and vegetation) due to both direct and indirect impacts; • Potential loss of wetland ecosystems or part thereof; and • Loss of ecological services at the local and catchment scale.	• Control through design, management, maintenance and mitigation; • Remedy through concurrent rehabilitation and monitoring; and • Remediate using commercially available emergency clean up kits.	Medium

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Construction of underground mine in wetland and aquatic areas.	• Loss of wetland habitat; • Potential habitat fragmentation; • Increased erosion potential; • Potential impacts as a result of sedimentation; • Loss of water supply; • Impacts to natural flow regimes; • Potential loss of water quality further downstream; • Loss of biodiversity; • Alterations to natural river channels; and • Alterations to water distribution and volume.	• No mitigation potential for this activity.	High
• Use and maintenance of haul roads for the transportation of coal.	• Fragmentation of the wetland resources as a result of road crossings; • Contamination of wetland resources; • Impacts to water quality as a result of spills; • Compaction of soils; • Loss of habitat and biodiversity; • Increased potential for sheet runoff from paved/cleared surfaces; and • Increased potential for erosion.	• Control through design, management, maintenance and mitigation; • Remedy through concurrent rehabilitation and monitoring; and • Remediate using commercially available emergency clean up kits.	Medium
• Operational activities, including excavation and dewatering.	• Erosion and sedimentation; • Impacts to the water quality of the groundwater, local and downstream resources; • Potential loss of water supply from adjacent soils; • Surface water runoff, ultimately resulting in a loss of catchment yield; • Dewatering activities are likely to result in the loss of water supply to the wetland systems present and in turn, moisture stress to the surrounding riparian and wetland vegetation; and • Disturbed soils may give rise to the spread and proliferation of alien and invasive species.	• Control through design, management, maintenance and mitigation; • Remedy through concurrent rehabilitation and monitoring; and • Remediate using commercially available emergency clean up kits.	High
• Rehabilitation of site and dismantling of infrastructure.	• Erosion onset; • Sedimentation; and • Establishment of alien plants.	• Control through design, management, maintenance and mitigation; • Remedy through concurrent rehabilitation and monitoring; and • Remediate using commercially available emergency clean up kits.	Medium
• Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring.	• Improper infilling and profiling, resulting in the creation of preferential flow paths and thus increasing the potential for erosion; • Improper rehabilitation of compacted soils, resulting in poor vegetation cover; and • Increased potential for the spread; and establishment of alien and invasive species.	• Control through design, management, maintenance and mitigation; • Remedy through concurrent rehabilitation and monitoring; and • Remediate using commercially available emergency clean up kits.	Low
• Post-mining decants into freshwater resources.	• Contamination of wetland systems; • Loss of habitat integrity and ecosystem services such as toxicant removal and water for human use; • Loss of water quality to downstream freshwater resources; and • Loss of biodiversity and sensitive fauna and flora.	• If post-mining decant takes place within proximity to, or within wetland areas, this water should be treated prior to release into the environment; and • Investigation into the water quality and the most appropriate treatment measures must be conducted.	High

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Subsidence.	• Potential habitat fragmentation, most notable in the high-risk subsidence areas • Potential loss of water quality further downstream; • Increased erosion potential; • Potential impacts as a result of sedimentation; • Loss of water supply; • Impacts to natural flow regimes; • Loss of biodiversity; • Alterations to natural river channels; and • Alterations to water distribution and volume.	• Control through design, management, maintenance and mitigation; and • Remedy through concurrent rehabilitation and monitoring.	High
Aquatics			
• Site clearing, including the removal of vegetation and topsoil.	• Spread of alien and invasive species; • Change in hydrology; • Increased incidence of erosion; • Sedimentation from erosion; • Potential water quality deterioration; and • Loss of biodiversity.	Control through: • Preventing unnecessary clearing of extensive areas not part of the direct footprint area; • Demarcating non-directly affected freshwater resources as no-go zones; • Monitoring freshwater resources during the construction phase; • Management and monitoring of alien and invasive plant species; and • Carrying out the Storm Water Management Plan.	Medium
• Construction of mine related infrastructure including access and haul roads; diesel storage and explosives magazine; topsoil stockpiling.	• Increased incidence of erosion; • Sedimentation from erosion; • Potential water quality deterioration as a result of diesel spills; and • Loss of biodiversity.	Control through: • The construction of clean and dirty water separation systems; • Implementing a soil management programme; • Implementing an alien vegetation management programme; • Installation of erosion berms; • Allowing only essential personnel within the buffer areas for all freshwater features; • Demarcating all areas of increased ecological sensitivity as “No-Go” areas; • Restricting construction activities to the drier months; • Disallowing the dumping of material within freshwater resources; • Inspecting vehicles for leaks regularly; • Re-fuelling on a sealed surface area away from aquatic areas; and • Providing appropriate sanitary facilities for the duration of the construction activities. Remedy through: • Actively re-vegetating disturbed areas; • Installing vegetation covers on all topsoil stockpiles; and • Cleaning up leaks immediately.	Medium

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Removal of rock (blasting); water use and storage; storage and handling of hazardous products including fuel, explosives, oil and waste.	• Potential impacts as a result of sedimentation; • Loss of water supply; • Impacts to natural flow regimes; • Potential loss of water quality further downstream; • Loss of biodiversity; and • Alterations to water distribution and volume.	Control through: • A soil management programme; • Restricting construction activities to the drier months; and • Disallowing the dumping of material within freshwater resources.	High
• Stripping topsoil and soft overburden; loading, hauling and stockpiling; and • Use and maintenance of haul roads for the transportation of coal.	• Fragmentation of the freshwater resources as a result of road crossings; • Contamination of freshwater resources; • Impacts to water quality as a result of spills; • Loss of habitat and biodiversity; • Increased potential for sheet runoff from paved/cleared surfaces; and • Increased potential for erosion.	Control through: • Preventing unnecessary clearing of extensive areas not part of the direct footprint area; • Demarcation as no-go zones; • Monitoring freshwater resources; • Implementing a soil management programme; • Installation of erosion berms; • Control the edge of the non-directly impacted freshwater resources through demarcation as no-go zones; • Implementing an alien vegetation management programme; • Installing vegetation covers on all topsoil stockpiles; • Disallowing the dumping of material within freshwater resources; • Disallowing vehicles or heavy machinery within any aquatic areas; • Inspecting vehicles for leaks regularly; • Re-fuelling on a sealed surface area; and • Providing appropriate sanitary facilities. Remedy through: • Actively re-vegetating disturbed areas; and • Cleaning up oil spills immediately.	Low

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Underground mine activities, including excavation and dewatering; operating sewage treatment plant.	• Erosion and sedimentation; • Impacts to the water quality of the groundwater, local and downstream resources; • Surface water runoff, ultimately resulting in a loss of catchment yield; and • Disturbed soils may give rise to the spread and proliferation of alien and invasive species.	Control through • Implementing a soil management programme; • Allowing only essential personnel within the buffer areas for all freshwater features; • Demarcating all “No-Go” areas; • Disallowing the dumping of material within any freshwater resources; • Managing and maintaining the sewage treatment plant; • Inspecting vehicles for leaks regularly; • Re-fuelling on a sealed surface; and • Providing appropriate sanitary facilities for the duration of the construction activities. Remedy through • Backfilling pit areas on an ongoing basis for the life of the proposed operation; and • Cleaning up leaks immediately.	Low
• Rehabilitation of site and dismantling of infrastructure; and • Rehabilitation, including spreading of soil, re-vegetation and profiling or contouring.	• Erosion onset; • Sedimentation; • Establishment of alien plants; and • Surface water runoff, ultimately resulting in a loss of catchment yield.	Control through • Demarcating “No-Go” zones; • Implementing and maintaining an alien vegetation management programme; • Disallowing the dumping of material within freshwater resources; • Disallowing vehicles or heavy machinery to drive within aquatic areas or their buffer areas; • Inspecting vehicles for leaks regularly; • Re-fuelling on a sealed surface area; • Installation of erosion berms; • Providing appropriate sanitary facilities; and • Removing all waste to an appropriate waste facility. Remedy through • Cleaning up leaks immediately; • Implementing and maintaining an alien vegetation management programme; and • Actively re-vegetating disturbed areas after decommissioning.	Low
• Post-mining decant into freshwater resources.	• Loss of habitat integrity and ecosystem services such as toxicant removal and water for human use; • Loss of water quality to downstream freshwater resources; and • Loss of biodiversity and sensitive fauna and flora.	Control through • Considering passive water treatment options. Remedy through • through treating and post-mining decant prior to release into the environment.	Low

Activities	Potential impacts	Mitigation type	Potential for residual risk
Air Quality			
• Removal of vegetation/Removal of topsoil/Establishment of mining and linear infrastructure; • Construction of additional infrastructure, and ventilation shafts; • Construction of access road and haul roads; • Stockpiling of soils, rock dump, and discard dump establishment; and • Demolition and removal of infrastructure; • Post-closure monitoring and rehabilitation; and • Closure of the underground mine.	• Poor air quality due to airborne dust from activities associated with this phase and the release of gaseous pollutants from off-road machinery; and • Poor air quality due to airborne dust and the release of gaseous pollutants due to activities associated with this the decommissioning and post-closure phase.	• Minimise the area of disturbance at all times; • Where necessary, wetting agents, dust suppressants, or binders will be applied to the exposed areas (including excavated material and open areas); • Speed limits will be adhered to at all times. Mine vehicles to be fitted with a GPS that alerts management when a vehicle is going over the speed limit; • Construction should be conducted in phases; • The drop heights when tipping and loading materials will be minimised as far as practicable; and • Monitoring of criteria air quality pollutants to ascertain the effectiveness of the mitigation measures in place.	Low
• Diesel storage and explosive magazine.	• Poor air quality due to spilling and vapourisation of gases via vents.	• Internal floating roofs and seal to minimize evaporation from a diesel storage tank; • Vapour recovery – collects emissions from storage tanks and converts to liquid product; and • Secondary containment will be provided for all storage tanks for leaks and fire spread control and environmental protection in accordance with good engineering.	Low
• Ventilation fans and infrastructure area containing stockpile areas; • Underground blasting; • Maintenance of haul roads, management infrastructure, and stockpile areas; • Removal of rock(blasting); and • Concurrent rehabilitation as mining progresses.	• Poor air quality due to airborne dust and the release of gaseous pollutants due to activities associated with this phase.	• Minimise the area of disturbance at all times; • Where necessary, wetting agents, dust suppressants or binders will be applied to the exposed areas (including excavated material and open areas); • Speed limits will be adhered to at all times. Mine vehicles to be fitted with a GPS that alerts management when a vehicle is going over the speed limit; and • The drop heights when tipping and loading materials will be minimised as far as practicable.	High
Noise			
• Removal of vegetation/Removal of topsoil/Establishment of mining and linear infrastructure; • Construction of additional infrastructure, and ventilation shafts; • Construction of access road and haul roads; • Diesel storage and explosives magazine; and • Stockpiling of soils, rock dump, and discard dump establishment.	• Noise emanating from machinery while conducting these activities can impact the surrounding sensitive receptors.	• Noise control measures; • Design measures; and • Control through management and monitoring.	Low

Activities	Potential impacts	Mitigation type	Potential for residual risk
• Ventilation fans and infrastructure area containing stockpile areas; • Maintenance of haul roads, management infrastructure, and stockpile areas. • Removal of rock(blasting); and • Concurrent rehabilitation as mining progresses	• Noise emanating from machinery while conducting these activities can impact the surrounding sensitive receptors.	• Noise control measures; • Design measures; and • Control through management and monitoring.	High
• Demolition and removal of infrastructure; • Post-closure monitoring and rehabilitation; and • Closure of the underground mine.	• Noise emanating from machinery while conducting these activities can impact the surrounding sensitive receptors.	• Noise control measures; • Design measures; and • Control through management and monitoring.	Low
Cultural Heritage			
• Surface clearing and establishment of infrastructure.	• Damage to or destruction of heritage resources generally protected under Sections 34, 35 and 36 of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) (i.e. previously unidentified historical structures, archaeological and fossiliferous material or burial grounds and graves respectively).	• Reactive – mitigate impacts.	Low to Medium
Socio-Economic			
• Removal of vegetation / topsoil for establishment of mining and linear infrastructure; • Establishing the box cut; • Diesel storage and explosives magazine; • Construction of infrastructure, and ventilation Shafts; • Construction of access road and haul roads; and • Stockpiling of soils, rock dump and discard dump establishment.	• Loss of existing livelihoods / economic displacement.	• Remedy or control through livelihood restoration measures.	High

Activities	Potential impacts	Mitigation type	Potential for residual risk
Construction activities: • Removal of vegetation / topsoil for establishment of mining and linear infrastructure; • Establishing the box cut; • Diesel storage and explosives magazine; • Construction of infrastructure, and ventilation Shafts; • Construction of access road and haul roads; and • Stockpiling of soils, rock dump and discard dump establishment. Operational activities: • Ventilation fans and infrastructure area, including stockpile areas and the discard dump • Underground blasting and operation of the underground workings; • Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas; • Removal of rock (blasting); • Operating washing plant; • Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; • Operating sewage treatment plant; • Stockpiling and dumping (rock dumps, soils, ROM, discard dump) establishment and operation; and • Maintenance activities.	• Creation of temporary or long-term employment and business opportunities; and • Knock-on or multiplier effects on local and regional economy.	• Enhance positive impacts.	Medium

Activities	Potential impacts	Mitigation type	Potential for residual risk
Construction activities: • Removal of vegetation / topsoil for establishment of mining and linear infrastructure; • Establishing the box cut; • Diesel storage and explosives magazine; • Construction of infrastructure, and ventilation Shafts; • Construction of access road and haul roads; and • Stockpiling of soils, rock dump and discard dump establishment. Operational activities: • Ventilation fans and infrastructure area, including stockpile areas and the discard dump • Underground blasting and operation of the underground workings; • Maintenance of haul roads, pipelines, machinery, water, effluent and stormwater management infrastructure and stockpile areas; • Removal of rock (blasting); • Operating washing plant; • Storage, handling and treatment of hazardous products (including fuel, explosives and oil) and waste; • Operating sewage treatment plant; • Stockpiling and dumping (rock dumps, soils, ROM, discard dump) establishment and operation; and • Maintenance activities.	• Potential negative impacts to community health, safety and security (through population influx, increased dust and noise, traffic, blasting) and degraded sense of place.	• Control or remedy through individual management plans for these components.	Low
• Demolition and removal of infrastructure; • Post-closure monitoring and rehabilitation; and • Closure of the underground mine.	• Loss of employment opportunities and knock-on or multiplier effects on local and regional economy.	• Control through implementation of sustainable measures to enhance positive impacts.	Low

13 Item 2(l): Other information required by the competent authority

In accordance with the provisions of Regulation 23(3) of the EIA 2014 Regulations (as amended) the EIA should include all information required as set out in Appendix 3 and in terms of Regulation 23(4) the Environmental Management Plan (EMP) should contain all information required as set out in Appendix4. The Competent Authority has not requested any other information. The EIA report must include the following:

- Details of the EAP who prepared the report and the expertise of the EAP, including a curriculum vitae;
- A plan, which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale;
- A description of the scope of the proposed activity;
- A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;
- A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;
- A full public participation process including a CRR in the EIA report;
- Impact Assessment, including methodology, of the necessary environmental aspects, including the nature, significance, extent, duration and probability of the impacts occurring, positive and negative impacts, including mitigation and monitoring measures;
- An assessment of the proposed alternatives;
- A complete EMPr;
- An impact statement from the EAP, specific information the Competent Authority may require, and conditions for approval; and
- An EAP oath regarding the correctness of information provided in the report.

13.1 Impact on the socio-economic conditions of any directly affected person

The positive impacts of the proposed Project can be summarised as follows:

The Arnot South Project is expected to be operational for approximately 30 years (depending on the confirmation and viability of the additional resources (i.e. No. 2 and No.4 coal seams)). Thus, positive impacts relate to the creation of jobs, business opportunities and skills development. Employment as well as the additional infrastructure will contribute to the overall socio-economic profile of the region.

The negative impacts of the proposed Project can be summarised as follows:

The Project will impact on surrounding landowners who utilise their farms for various agricultural activities from which they source their income and maintain their livelihoods. Also, the negative impacts are associated with population influx as job seekers move into the area. The population influx may result in increased demand on health and emergency services, conflict and xenophobia between residents and job seekers, increase in crime and other social issues.

A socio-economic study will be undertaken as part of the specialist studies to be conducted.

13.2 Impact on any National Estate referred to in Section 3(2) of the National Heritage Resources Act

A full Heritage Impact Assessment will be undertaken during the EIA Phase in compliance with Section 38 of the NHRA. Any resources identified on site will be recorded, labelled and the appropriate mitigations applied.

14 Item 2(m): Other matters required in terms of Sections 24(4)(a) and (b) of the Act

Section 24(4)(b)(i) of the NEMA provides that an investigation must be undertaken of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity. Refer to Section 9.1 for alternatives assessed. These alternatives will be further assessed during the EIA Phase. Refer to section10.14 above for the cultural heritage baseline.

15 Item 2(n): Undertaking regarding correctness of information

I, Xan Taylor, herewith undertake that the information provided in the foregoing report is correct, and that the comments and inputs from stakeholders and Interested and Affected parties has been correctly recorded in the report.

Signature of the EAP: _____

Date: _____

16 Item 2(o): Undertaking regarding level of agreement

I, Xan Taylor, herewith undertake that the information provided in the foregoing report is correct, and that the level of agreement with interested and Affected Parties and stakeholders has been correctly recorded and reported herein.

Signature of the EAP: _____

Date: _____

References

Behrens, J. & Swanepoel, N., 2008. Historical archaeologies of southern Africa: precedents and prospects. In: N. Swanepoel, A. Esterhuysen & P. Bonner, eds. Five Hundred Years Rediscovered: South African precedents and prospects. Johannesburg: Wits University Press, pp. 23-39.

Birkholtz, P., 2011. Proposed development of the Kriel Ash Dam Facility: Kriel (Ga-Nala), Emalahleni Local Municipality, Mpumalanga Province, PGS Heritage & Grave Relocation Consultants: Unpublished report prepared for Aurecon. SAHRIS ID: 466.

Birkholtz, P., 2013. Proposed coal mining on sections of the Farms Blesbokfontein 31 IS, Klippoortje 32 IS, Nooitgedacht 37 IS, Blesbokfontein 38 IS, Hartebeesfontein 39 IS, Roodepoort 40 IS, Frischgewaagd 60 IS and Vierfontein 61 IS, Emalahleni Local Municipality, Mpumalanga, PGS Heritage & Grave Relocations Consultants: Unpublished report prepared for Xstrata Coal (Pty) Ltd. SAHRIS ID: 2261.

Brodie, N., 2008. The Joburg Book: A guide to the city's history, people and places. Johannesburg: Sharp Sharp Media.

Clark, J., 1982. The cultures of the Middle Palaeolithic/Middle Stone Age. In: J. Clark, ed. The Cambridge History of Africa, Volume 1: From the Earliest Times to c. 500 BC. Cambridge: Cambridge University Press, pp. 248-341.

Coetzee, F. P. & Behrens, J. P., 2015. Cultural Heritage Project of the Farm Rietvley 320 IS, Sasol Fine Ash Dam (FAD) 6, Phase II, Mpumalanga, Department of Anthropology and Archaeology, UNISA: Unpublished report prepared for Sasol Synfuels (Pty) Ltd and SRK Consulting (Pty) Ltd. SAHRIS Case ID 7592.

Coetzee, F. P. & Fivaz, H., 2017. Cutural Heritage Impact Assessment: Phase 1 Investigation for a proposed Extension of Pit 1 and Pipeline from Dorstfontein West to Dorstfontein East and the disposal of Discard into the Opencast Pit, northeast of Kriel, Mpumalanga, Francois P Coetzee: Unpublished report prepared for Exxaro Coal (Pty) Ltd and SRK Consulting (South Africa) (Pty) Ltd. SAHRIS Case ID 11743.

Darwall, W. R. T., Smith, K. G., Tweddle, D., & Skelton, P., 2009. *The status and distribution of freshwater biodiversity in southern Africa*.

Department of Environmental Affairs (DEA), Department of Mineral Resources (DMR), Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute., 2013. *Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector.* Pretoria.

de Jong, R., 2007. Archaeological and Heritage Impact Assessment Report: proposed new Goedgevonden Colliery expansion project on the Farms Goedgevonden 10 IS, Zaaiwater 11 IS and Kleinzuikerboschplaat 5 IS near Ogies, Emalahleni Local Municipality, Mpumalanga, Cultmatrix CC: Unpublished report. SAHRIS ID: 01123.

de Jong, R. C., 2006. Archaeological and Heritage Assessment Report Version 3: Optimum Mine EMP Amendment, North of Hendrina, Mpumalanga, Cultmatrix cc: Unpublished report prepared for Jones & Wagener. SAHRIS ID: 01121.

Deacon, H. & Deacon, J., 1999. Human Beginnings in South Africa. Cape Town: David Phillip.

Delius, P. & Cope, R., 2007. Hard-fought frontiers: 1845 - 1883. In: Mpumalanga: History and Heritage. Pietermaritzburg: University of KwaZulu-Natal Press, pp. 137-199.

Delius, P., Maggs, T. & Schoeman, A., 2014. Forgotten World: The Stone-Walled Settlements of the Mpumalanga Escarpment. First ed. Johannesburg: Wits University Press.

Digby Wells, 2013. Heritage Impact Assessment for the Consbrey Colliery Project, 2629BB and 2629BD, Mpumalanga Province, Digby Wells Environmental: Unpublished report prepared for Mosobo Coal (Pty) Ltd. SAHRIS ID: 1722.

Driver, A., Nel, J., Snaddon, K., Murray, K., Roux, D., & Hill, L., 2011. *Implementation Manual for Freshwater Ecosystem Priority Areas. Draft Report for the Water Research Commission.* Retrieved from http://www.wrc.org.za/Knowledge Hub D

du Piesanie, J. & Nel, J., 2016a. Proposed Development of an Underground Coal Mine and Associated Infrastructure near Hendrina, Mpumalanga, Digby Wells Environmental: Unpublished report prepared for Umcebo Mining (Pty) Ltd. SAHRIS ID: 9404.

du Piesanie, J. & Nel, J., 2016b. Environmental Authorisation for the Proposed Imvula Coal Mine: Heritage Impact Assessment Report, Digby Wells Environmental: Unpublished report prepared for Ixia Coal (Pty) Ltd. SAHRIS ID: 8831.

Department of Water and Sanitation (DWS)., 2014. *A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa*.

Eastwood, E., Van Schalkwyk, J. & Smith, B., 2002. Archaeological and rock art survey of the Makgabeng Plateau, Limpopo Basin. The Digging Stick, 19(1), pp. 1-3.

Esterhuysen, A. & Smith, J., 2007. Stories in stone. In: P. Delius, ed. Mpumalanga: History and Heritage: reclaiming the past, defining the future. Pietermaritzburg: University of KwaZulu-Natal Press, pp. 41-67.

Fourie, W., 2007. Proposed Coal Mining on Portions of the farm Op Goedenhoop 205 IS, Hendrina, Mpumalanga Province, Matakoma - ARM Heritage Contracts Unit: Unpublished report prepared for Digby Wells & Associates. SAHRIS ID: 01025.

Fourie, W., 2008. Zondagsfontein substation, telecommunication tower and 2X7.5km 132kV powerling, Ogies, Mpumalanga Province, Matakoma ARM (Heritage Contracts Unit): Unpublished report prepared for Wandima Environmental Services.

Fourie, W., 2009. Heritage Assessment: the Kwagga North Project, Optimum Coal, Arnot, Mpumalanga, Professional Grave Solutions - Heritage Unit: Unpublished report prepared for Consecion Creek Consulting.

Fourie, W., 2012. ATCOM East Expansion of the Impunzi Colliery, on portions of the Farms Steenkoolspruit 18 IS, Van Dyskdrift 19 IS and Kromfontein 30 IS, Emalahleni, Mpumalanga Province, PGS Heritage & Grave Relocation Consultants: Unpublished report prepared for Jones and Wagener Consulting Engineers.

Fourie, W. & Hutton, M., 2012. Ramp 9 Expansion Project, Lilliput 83 IT, Breyten, Mpumalanga, PGS Heritage and Grave Relocation Consultants: Unpublished report prepared for Tselentis Colliery. SAHRIS ID: 138.

Fourie, W., Steyn, H., Birkholtz, P. & Salomon, A., 2000. Phase 1 Archaeological Survey of the Impunzi Division of Duiker Mining - Witbank/Ogies Area, Matakoma & CRM Africa: Unpublished report. SAHRIS ID: 01164.

Fourie, W., Steyn, H. & Hutton, M., 2012. ATCOM East Expansion of the Impunzi Colliery, on Portions of the Farms Steenkoolspruit 18 IS, Van Dyksdrift 19 IS and Kromfontein 30 IS, Emalahleni, Mpumalanga Province, PGS Professional Heritage and Grave Relocation Consultants: Unpubllished report prepared for Jones and Wagener Consulting Engineers. SAHRIS Case ID 6391.

Gerlanc, N. M., 2005. Habitat origin and changes in water chemistry influence developemnt of Westren Chorus Frogs. *Journal of Herpatology 39(2)*, 254-265.

Groenewald, G. & Groenewald, D., 2014. Palaeontological Heritage of Mpumalanga, Unpublished report: SAHRA Palaeotechnical Report.

GSDM, 2020. GSDM Final Draft IDP: 2019-2020. Ermelo: Unpublished Government Planning Document.

Hardwick, S. & du Piesanie, J., 2018. Heritage Impact Assessment: Heritage Resources Management Process for the Exxaro Matla Mine, Digby Wells Environmental: Unpublished report prepared for Exxaro Coal Mpumalanga (Pty) Ltd. SAHRIS Case ID 11829.

Higgit, N., Karodia Khan, S., du Piesanie, J. & Nel, J., 2014. Environmental Impact Assessment for the Weltevreden Open Cast Coal Mine, Weltevreden 381 JT, Belfast, Mpumalanga: Heritage Impact Assessment, Digby Wells Environmental: Unpublished report prepared for Northern Coal (Pty) Ltd. SAHRIS ID: 5472.

Hodgson, F.D.I. and Krantz, RM., 1998. Groundwater Quality Deterioration in the Olifants River Catchment above the Loskop Dam with Specialised Investigations in the Witbank Dam Sub-catchment. WRC Report No.29/1/98.

Huffman, T., 1999. Archaeological Survey for the Rossouw Dam, Middelburg, Archaeological Resources Management: Unpublished report prepared for Strategic Environmental Focus. SAHRIS Map ID 2895.

Huffman, T. N. & Calabrese, J. A., 1996. Archaeological survey of Dorstfontein Coal Mines, Archaeological Resources Management: Unpublished report.

Johnson, M. R., Anhauesser, C. R. & Thomas, R. J., 2006. The Geology of South Africa. 2009 Reprint (with minor corrections) ed. Johannesburg: Council for Geosciences.

Karodia, S., Higgit, N., du Piesanie, J. & Nel, J., 2013. Heritage Impact Assessment for the Harwar Colliery, 2630AA and 2630AC, Mpumalanga Province, Digby Wells Environmental: Unpublished report prepared for Msobo Coal (Pty) Ltd. Case ID 1724.

Karodia, S. & Nel, J., 2014. Heritage Statement for the Basic Assessment undertaken for a Powerline Upgrade, Syferfontein Mine, Secunda, Mpumalanga Province, Digby Wells Environmental: Unpublished report prepared for Sasol Mining (Pty) Ltd. SAHRIS ID: 4919.

Kleynhans, C. J., 1999. The development of a fish index to assess the biological integrity of South African rivers. *Water SA*, *25*(3), 265–278.

Kleynhans, C., Thirion, C., & Moolman, J., 2005. A Level I River Ecoregion classification System for South Africa, Lesotho and Swaziland. In *Water*.

Landau, P. S., 2010. Popular Politics in the History of South Africa, 1400-1948. Cambridge: Cambridge University Press.

Land Type Survey Staff. (1972 - 2006). *Land Types of South Africa: Digital Map (1:250 000) and Soil Inventory Databases. .* Pretoria: Agricultural Research Council - Institue for Soil, Climate and Water.

Lötter, M. C., 2015. *Technical Reort for the Mpumalanga Biodiversity Sector Plan - MBSP.* Nelspruit: Mpumalanga Tourism & Parks Agency.

Magoma, M., 2013. Phase 1 Archaeological Impact Assessment Specialist Study Report for the Proposed Township Establishment of 5760 stands on Portion 6 of farm Rietspruit 437-IS in Ermelo Region, Msukaligwa Local Municipality, Mpumalanga Province, Vhubvo Archaeo-Heritage Consultants CC: Unpublished report prepared for Dynamic Integrated Geo-Environmental Services. SAHRIS ID: 3907.

Makhura, T., 2007. Early Inhabitants. In: Mpumalanga: History and Heritage. Pietermaritzburg: The University of KwaZulu-Natal Press, pp. 91-135.

Miller, S., 2010. Cultural Heritage Resources Impact Assessment for Harmony Gold Mine, Evander, African Heritage Consultants CC: Unpublished report prepared for Harmony Gold. SAHRIS ID: 10237.

Mitchell, P., 2002. The Archaeology of Southern Africa. Cambridge: Cambridge University Press.

Mucina, L., & Rutherford, M. C., 2012. *The Vegetation of South Africa, Lesotho and Swaziland.* Pretoria: South African National Biodiversity Institute.

NDM., 2020. Integrated Development Plan: Second Review 2019-2020. Middelburg: Unpublished Government Planning Document.

Nel, J., Murray, K., Maherry, A., Petersen, C., Roux, D., Driver, A.,Nienaber, S., 2011. *Technical Report for the National Freshwater Priority Areas project.* WRC: 1801/2/11.

Pakenham, T., 1979. The Boer War. Johannesburg: Johnathon Ball Publishers.

Pateman, T., 2011. Rural and Urban Areas: Comparing Lives Using Rural/Urban Classifications. Reg Trends 43, 11–86.

Pelser, A. J., 2013a. A Revision of Phase 1 HIA for the Proposed Wonderfontein Colliery near Belfast in Mpumalanga, Apelser Archaeological Consulting: Unpublished report prepared for Usimbithi Mining (Pty) Ltd. SAHRIS ID: 1487.

Pelser, A. J., 2013b. A Report on a Heritage Impact Assessment for the Proposed Vaalbult Mining Project on Portions of the farm Vaalbult 3 IT, Gert Sibande District Municipality, West of Carolina, Mpumalanga Province, Apelser Archaeological Consulting: Unpublished report prepared for Vaalbult Mining Company (Pty) Ltd. SAHRIS ID: 4309.

Pelser, A. J., 2015. Phase 1 HIA for the Vosbreet Boerdery proposed new Pig Farm on Portions 6 and 10 of the farm Rensburgshoop 74 IS near Bethal, Mpumalanga, Apelser Archaeological Consulting: Unpublished report prepared for Shangoni Management Services (Pty) Ltd. SAHRIS ID: 9087.

Pelser, A. J. & van Vollenhoven, A. C., 2008. A Report on a Cultural Respurces Survey on the farms Kleinkopje 15 IS and Steenkoolspruit 18 IS, Douglas Collieries, Emahlaleni District, Mpumalanga Province, Archaetnos Culture & Cultural Resource Consultants: Unpublished report prepared for DMO Projects, BHP Billiton, Energy Coals SA. SAHRIS ID: 02179.

Pistorious, J., 2008. Phase 1 Heritage Impact Assessment (HIA) Study for the Total Coal South Africa's (TCSA) Proposed New Expansion of the Dorsfontein Coal Mine (DCM) near Kriel on the Eastern Highveld in the Mpumalanga Province of South Africa,, Pretoria: Unpublished report prepared for Total Coal Ground Water Consulting Services.

Pistorius, J., 2004b. A Heritage Impact Assessment (HIA) Study for the EMP Ammendment for Douglas Colliery in the Mpumalanga Province of South Africa, Dr Julius C.C. Pistorius: Unpublished report prepared for Pulled Howard and De Lange. SAHRIS ID: 01153.

Pistorius, J., 2008b. Phase 1 Heritage Impact Assessment (HIA) Study for Sasols proposed new shaft complex on Strybult 542 and for the North Block on the Eastern Highveld in the Mpumalanga Province of South Africa,, Pretoria: Unpublished Report prepared for Clean Stream Environmental and Sasol Secunda.

Pistorius, J., 2012. A Phase 1 Heritage Impact Assessment (HIA) study for a proposed 600MW Power Plant and associated infrastructure for Kipower (Pty) Ltd near Delmas on the eastern Highveld in the Mpumalanga Province of South Africa, Dr Julius C.C. Pistorius: Unpublished report prepared for Jones and Wagener Consulting, Civil Engineers (Pty) Ltd and Kuyasa Mining. SAHRIS ID: 174.

Pistorius, J., 2014. A Phase 1 Heritage Impact Assessment (HIA) study for Anglo Operations Limited Greenside Colliery's new discard facility near Emalahleni on the eastern

Highveld in the Mpumalanga Province, Dr Julius C.C. Pistorius: Unpublished report prepared for Shangoni Management Services (Pty) Ltd. SAHRIS ID: 4249.

Pistorius, J., 2015. A Phase 1 Heritage Impact Assessment (HIA) study for the South 32 CSA proposed extension of opencast operations and associated closure of a section of the D253 provincial road at the Klipfontein Section of the Middelburg Mine, Mpumalanga, Dr Julius C.C. Pistorius: Unpublished report prepared for Jones & Wagener Engineering & Environmental Consultants. SAHRIS ID: 6492.

Pistorius, J., 2016. A Phase 1 Heritage Impact Assessment (HIA) study for the proposed Kipower 400kV Loop-in and Loop-out transmission lines to connect the Kipower independent power station with the national grid on the eastern Highveld in the Mpumalanga Province, Dr Julius C.C. Pistorius: Unpublished report prepared for Jones & Wagener Environmental and Engineering Consultants. SAHRIS ID: 9599.

Pistorius, J. C. C., 2004a. A Heritage Impact Assessment (HIA) study for the Proposed New Optimim Colliery on the farm Schoonoord 164 IS in the Mpumalanga Province of South Africa, Dr Julius CC Pistorius: Unpublished report prepared for African EPA. SAHRIS ID: 00687.

Pistorius, J. C. C., 2007. A Phase 1 Heritage Impact Assessment (HIA) Study for the Proposed new 88kV Power Line running from the Majuba Power Station near Amersfoort to the Camden Power Station near Ermelo in the Mpumalanga Province of South Africa, Dr Julius CC Pistorius: Unpublished report prepared for Eskom. SAHRIS ID: 01147.

Pistorius, J. C. C., 2011. A Phase 1 Heritage Impact Assessment (HIA) Study for the Consolidated Environmental Management Programme Report (Consolidated EMPr) for Arnot Coal on the Eastern Highveld in the Mpumalanga Province, Dr Julius CC Pistorius: Unpublished report prepared for Golder Associates Africa (Pty) Ltd and Exxaro Arnot Coal. SAHRIS ID: 6251.

Pistorius, J. C. C., 2013. A Phase 1 Heritage Impact Assessment (HIA) Study for Sasol Mining's Proposed Borrow Pits on the Eastern Highveld in the Mpumalanga Province, Dr Julius CC Pistorius: Unpublished report prepared for JMA Consulting (Pty) Ltd. SAHRIS ID:10337.

Schoeman, J., van der Walt, M., Monnik, K., Thackrah, A., Malherbe, J., & Le Roux, R., 2000. *The Development and Application of Land Capability Classification System for South Africa.* . Pretoria: ARC - ISCW Report No. GW/A/2000/57: ARC - Institute for Soil, Climate and Water .

Seliane, M., 2013. Paardekop Coal Mine: Phase 1 Cultural Heritage Impact Assessment, Strategic Environmental Focus (Pty) Ltd: Unpublished report prepared for xstrata Coal. SAHRIS ID: 3135.

Skelton, P. H., 2001. *A Complete Guide to the Freshwater Fishes of southern Africa*. Struik Publishers.

Smith, B. & Ouzman, S., 2004. Taking Stock: identifying Khoekhoen Herder Rock Art in southern Africa. Current Anthropology, 45(4), pp. 499-526.

Smith, B. & Zubieta, L., 2007. The power of ancient art. In: P. Delius, ed. Mpumalanga: History and Heritage. Pietermaritzburg: University of KwaZulu-Natal Press, pp. 69-90.

Soil Conservation Service: U.S. Department of Agriculture., 1973. *Land-Capability Classification.* Agriculture Handbook No. 210.

Swanepoel, N., Esterhuysen, A. & Bonner, P., 2008. Five Hundred Years Rediscovered: Southern African Precedents and Prospects. Johannesburg: Wits University Press.

USEPA., 2016. Revision of Emission Factors for AP-42. Chapter 13: Miscellaneous Source. Section 13.2.4: Aggregate Handling and Storage Piles (Fugitive Dust Sources). http://www.epa.gov/ttn/chief/ap42/index.html. [Accessed 2 June].

Van der Walt, S., 2015. Intended relocation of the remains of 104 graves that are older than 60 years from the farms Klipplaat 14 IS and Boschmansfontein 12 IS, Mpumalanga, PGS Heritage and Grave Relocation Consultants: Letter submitted to the South African Heritage Resources Agency.

van Schalkwyk, J., 1997a. A Survey of Cultural Resources in the Pit 5 and 6 Mining Areas, Kriel Colliery, Kriel Distruct, Mpumalanga Province, National Cultural History Museum: Unpublished report prepared for Kriel Colliery. SAHRIS ID: 00654.

van Schalkwyk, J., 1997b. A Survey of Cultural Resources in the Proposed Kleinfontein Mining Area, Mpumalanga Province, National Cultural History Museum: Unpublished report prepared for Amcoal: Goedehoop Colliery. SAHRIS ID: 02418.

Van Schalkwyk, J., 2002a. A survey of cultural resources for the Koornfontein Mining Development, Middelburg District, Mpumalanga District, National Cultural History Museum: Unpublished report prepared for Jones & Wagener.

van Schalkwyk, J., 2002b. A survey of cultural resources in the proposed Klipspruit Mining Area, Witbank District, Mpumalanga, National Cultural History Museum: Unpublished report prepared for Oryx Environmental. SAHRIS ID: 01165.

van Schalkwyk, J., 2003a. Archaeological Survey of a Section of the Secunda-Mozambique Gas Pipeline, Carolina District, Mpumalanga, National Cultural History Museum: Unpublished report prepared for GLMC Joint Venture. SAHRIS ID: 00659.

van Schalkwyk, J., 2003b. Archaeological Survey of a Section of the Secunda-Mozambique Gas Pipeline, Ermelo and Bethal Districts, Mpumalanga, National Cultural History Museum: Unpublished report prepared for GLMC Joint Venture. SAHRIS ID: 00662.

van Schalkwyk, J., 2003c. Archaeological Survey of a Section of the Secunda-Mozambique Gas Pipeline, Bethal and Highveld Ridge Districts, Mpulamanga, National Cultural History Museum: Unpublished report prepared for GLMC Joint Venture. SAHRIS ID: 00672.

van Schalkwyk, J., 2007. Heritage Impact Scoping Report for the Planned Hendrina-Marathon Powerline, Mpumalanga Province, National Cultural History Museum: Unpublished report prepared for Strategic Environmental Focus. SAHRIS ID: 01179.

van Schalkwyk, J. A., 2013. Cultural Heritage Impact Scoping Assessment Report for the Underground Coal Gasification Project and Associated Infrastructure in support of Co-Firing of Gas at the Majuba Power Station, Amersfoort, Mpumalanga, J.A. van Schalkwyk: Unpublished report prepared for Royal Haskoning DHV. SAHRIS Case ID 756.

Van Schalkwyk, J. & Moifatswane, S., 2003. Goedehoop Mine, Mpumalanga: Archaeological and cultural historical survey and impact assessment, National Cultural History Museum: Unpublished report prepared for Oryx Environmental. SAHRIS ID: 00719.

Van Schalkwyk, J., Naude, M. & Smith, S., 1996. A Survey of Cultural Resources in the Proposed Sigma Colliery North West Strip Mine, Sasolburg District, Free State Province, National Cultural History Musuem: Unpublished report prepared for Walmsley Environmental Consultants. SAHRIS Map ID: 02335.

Van Vollenhoven, A., 2012a. A report on the Heritage Impact Assessment related to the Exxaro Matla Project near Kriel in the Mpumalanga Province, Archaetnos Culture & Cultural Resource Consultants: Unpublished report prepared for GCS. SAHRIS ID: 102.

van Vollenhoven, A., 2012b. A report on a Heritage Impact Assessment for the proposed Beneficiation Plant at Kriel Colliery, Mpumalanga Province, Archaetnos Culture and Cultural Resource Consultants: Unpublished report prepared for SRK. SAHRIS ID: 166.

Van Vollenhoven, A., 2014. A report on the Heritage Impact Assessment related to the Exxaro Matla Project near Kriel in the Mpumalanga Province (updated), Archaetnos Culture and Cultural Resource Consultants: Unpublished report.

van Vollenhoven, A., 2015a. A report on a Cultural Heritage Impact Assessment for the proposed Hope No. 4 Seam Mining Project, clode to Kriel, Mpumalanga Province, Archaetnos Culture and Cultural Resource Consultants: Unpublished report prepared for Geivicon. SAHRIS ID: 8410.

van Vollenhoven, A., 2015b. A report on an Archaeological Heritage Impact Assessment for the proposed Kudu-Halfgewonnen South Traction 88kV LILO Eskom Line and Kromklip Tee-Van Dyks Tee, Mpumalanga Province, Archaetnos Culture and Cultural Resources Consultants: Unpublished report prepared for Texture Environmental Consultants. SAHRIS ID: 7332.

van Vollenhoven, A., 2017b. A report on a Cultural Heritage Impact Assessment for a proposed underground mine on different portions of the Farm Schurvekop 227 ID, close to Bethal, Mpumalanga Province, Archaetnos Culture and Cultural Resources Consultants: Unpublished report prepared for Cabanga Environmental. SAHRIS ID: 10490.

van Vollenhoven, A. C., 2017a. A Report on a Cultural Heritage Impact Assessment for Additional Infrastructure at the Evander Gold Mine, Mpumalanga Province, Archaetnos Culture & Cultural Resource Consultants: Unpublished report prepared for Cabanga Environmental. SAHRIS ID: 10237.

van Vollenhoven, A. C. & du Bruyn, C., 2014. A Report on a Cultural Heritage Impact Assessment for the Proposed Isibonelo Colliery Block Z Opencast Mine, close to Kriel, Mpumalanga Province, Archaetnos Culture & Cultural Resource Consultants: Unpublished report prepared for WSP Environmental (Pty) Ltd. SAHRIS ID: 5914.

van Vollenhoven, A. C. & Pelser, A. J., 2011. Report on the Heritage Impact Assessment for the Proposed Development at the Exxaro Eerstelingfontein NDC Coal Mine near Belfast in Mpumalanga Province, Archaetnos Culture and Cultural Resource Consultants: Unpublished report prepared for WSP Environmental (Pty) Ltd. SAHRIS ID: 6357.

van Wyk Rowe, C., 2014. Phase 1 Archaeological / Heritage Impact Assessment for the proposed Bahlanhene Residential TOwnship Establishment on Portion 2 of the Farm Langverwacht 293, Ermelo, Mpumalanga, Adansonia Heritage Consultants: Unpublished report prepared for Wandima Environmental Services CC. SAHRIS Case ID 6810.

von der Heyde, N., 2013. Field Guide to the Battlefields of South Africa. Cape Town: Random House Struik.

Voortrekkers, T., 2014. The Great Trek - South Africa 1835 - 1845. [Online]

Available at: http://www.voortrekker-history.co.za/index.php#.VOBq3a8cTIU [Accessed 25 October 2017].

Waddle, J. H., 2006. *Use of amphibians as ecosystem indicator species. Dissertation.* University of Florida.

Wessels, A., 2010. The Anglo-Boer War 1889-1902: White Man's War, Black Man's War, Traumatic War. Stellenbosch: African Sun Media.

Willsworth, C., 2006. Bakenlaagte - the Story. Durban: Just Done Productions.

Woodford, A.C and Chevallier, L., 2002. Hydrogeology of the Main Karoo Basin: Current Knowledge and Future Research Needs. Pretoria, South Africa: Water Research Commission.

Woodhall, S., 2005. Field Guide to Butterflies of South Africa. Cape Town: Struik Publishers.

WRC., 2015. Water Resources of South Africa Study Report WR2012. Pretoria: Water Research Commission

DIGBY WELLS
ENVIRONMENTAL

Appendix A: EAPs CV and Qualifications

DIGBY WELLS
ENVIRONMENTAL

Appendix B: 21-digit Surveyor General Code for Each Farm Portion

Appendix C: Plans

Plan 1: Land Tenure Map

Plan 2: Regional Setting

Plan 3: Locality Map

Plan 4: Infrastructure Layout Plan

Plan 5: Detailed Layout of Mining-Related Infrastructure

DIGBY WELLS
ENVIRONMENTAL

Appendix D: Fauna and Flora Species Expected to Occur within the Project Area

PLANT SPECIES EXPECTED TO OCCUR

Family	Species Name	IUCN Status
Lamiaceae	*Aeollanthus buchnerianus*	LC
Lamiaceae	*Ailanthus altissima*	LC
Orobanchaceae	*Alectra sessiliflora*	LC
Lythraceae	*Ammannia schinzii*	LC
Poaceae	*Aristida junciformis*	LC
Poaceae	*Brachiaria eruciformis*	LC
Bryaceae	*Bryum argenteum*	LC
Cyperaceae	*Bulbostylis densa subsp. afromontana*	LC
Cyperaceae	*Bulbostylis hispidula subsp. pyriformis*	LC
Poaceae	*Calamagrostis epigejos subsp. capensis*	LC
Compositae	*Cineraria parvifolia*	LC
Asteraceae	*Cirsium vulgare**	LC
Cucurbitaceae	*Citrullus lanatus*	LC
Commelinaceae	*Commelina africana var. krebsiana*	LC
Commelinaceae	*Commelina benghalensis*	LC
Commelinaceae	*Commelina subulata*	LC
Apocynaceae	*Cordylogyne argillicola*	LC
Cyperaceae	*Cyperus congestus*	LC
Cyperaceae	*Cyperus esculentus var. esculentus*	LC
Cyperaceae	*Cyperus longus subsp. longus*	LC
Cyperaceae	*Cyperus rupestris*	LC
Cyperaceae	*Cyperus squarrosus*	LC
Poaceae	*Digitaria eriantha*	LC
Poaceae	*Digitaria sanguinalis*	LC
Poaceae	*Digitaria tricholaenoides*	LC
Orchidaceae	*Disa woodii*	LC
Poaceae	*Echinochloa jubata*	LC
Poaceae	*Echinochloa pyramidalis*	LC
Poaceae	*Eleocharis dregeana*	LC
Poaceae	*Eragrostis curvula*	LC

Family	Species Name	IUCN Status
Poaceae	*Eragrostis lappula*	LC
Poaceae	*Eragrostis lehmanniana*	LC
Poaceae	*Eragrostis virescens*	LC
Ericaceae	*Erica drakensbergensis*	LC
Asteraceae	*Erigeron canadensis**	LC
Iridaceae	*Gladiolus crassifolius*	LC
Fabaceae	*Gleditsia triacanthos**	LC
Orchidaceae	*Habenaria epipactidea*	LC
Orchidaceae	*Habenaria filicornis*	LC
Orchidaceae	*Habenaria nyikana*	LC
Orchidaceae	*Habenaria schimperiana*	LC
Pedaliaceae	*Harpagophytum zeyheri subsp. zeyheri*	LC
Poaceae	*Harpochloa falx*	LC
Scrophulariaceae	*Hebenstretia angolensis*	LC
Asteraceae	*Helichrysum difficile*	LC
Asteraceae	*Helichrysum mixtum*	LC
Asteraceae	*Helichrysum rugulosum*	LC
Asteraceae	*Helichrysum stenopterum*	LC
Poaceae	*Heteropogon contortus*	LC
Poaceae	*Hyparrhenia anamesa*	LC
Asteraceae	*Hypochaeris radicata*	LC
Fabaceae	*Indigofera melanadenia*	LC
Cyperaceae	*Isolepis setacea*	LC
Juncaceae	*Juncus dregeanus subsp. dregeanus*	LC
Juncaceae	*Juncus lomatophyllus*	LC
Aiozazeae	*Khadia carolinensis*	**VU**
Asteraceae	*Lactuca inermis*	LC
Hyacinthaceae	*Ledebouria cooperi*	LC
Poaceae	*Leersia hexandra*	LC
Poaceae	*Leptochloa fusca*	LC
Hyacinthaceae	*Merwilla natalensis*	**NT**
Geraniaceae	*Monsonia angustifolia*	LC
Amaryllidaceae	*Nerine rehmannii*	LC

Family	Species Name	IUCN Status
Nymphaeaceae	*Nymphaea nouchali*	LC
Oleaceae	*Olea europaea**	LC
Ophioglossaceae	*Ophioglossum polyphyllum*	LC
Asteraceae	*Osteospermum muricatum subsp. muricatum*	LC
Geraniaceae	*Pelargonium luridum*	LC
Rubiaceae	*Pentanisia angustifolia*	LC
Caryophyllaceae	*Pollichia campestris*	LC
Polygalaceae	*Polygala africana*	LC
Polygalaceae	*Polygala hottentotta*	LC
Asteraceae	*Pseudognaphalium oligandrum*	LC
Asteraceae	*Pulicaria scabra*	LC
Ricciaceae	*Riccia stricta*	LC
Asteraceae	*Schistostephium crataegifolium*	LC
Gentianaceae	*Sebaea grandis*	LC
Scrophulariaceae	*Selago densiflora*	LC
Asteraceae	*Seriphium plumosum*	LC
Poaceae	*Setaria sphacelata var. torta*	LC
Solanaceae	*Solanum elaeagnifolium*	LC
Solanaceae	*Solanum lichtensteinii*	LC
Solanaceae	*Solanum nigrum*	LC
Solanaceae	*Solanum pseudocapsicum*	LC
Orobanchaceae	*Striga asiatica*	LC
Lamiaceae	*Syncolostemon pretoriae*	LC
Asteraceae	*Tagetes minuta**	LC
Asphodelaceae	*Trachyandra reflexipilosa*	LC
Poaceae	*Tristachya leucothrix*	LC
Fabaceae	*Vachellia tenuispina*	LC
Campanulaceae	*Wahlenbergia banksiana*	LC
Campanulaceae	*Wahlenbergia undulata*	LC
Leguminosae-Papilionoideae	*Zornia linearis*	LC

*Denotes Alien Invasive Species

MAMMALS EXPECTED TO OCCUR

Family	Scientific Name	Common Name	Red List Category
Bovidae	*Aepyceros melampus*	Impala	LC
Bovidae	*Connochaetes gnou*	Black Wildebeest	LC
Bovidae	*Damaliscus pygargus phillipsi*	Blesbok	LC
Bovidae	*Oryx gazella*	Gemsbok	LC
Bovidae	*Ourebia ourebi*	Oribi	**EN**
Bovidae	*Pelea capreolus*	Vaal Rhebok	**NT**
Bovidae	*Redunca arundinum*	Southern Reedbuck	LC
Bovidae	*Redunca fulvorufula*	Mountain Reedbuck	LC
Bovidae	*Sylvicapra grimmia*	Bush Duiker	LC
Bovidae	*Syncerus caffer*	African Buffalo	LC
Bovidae	*Taurotragus oryx*	Common Eland	LC
Bovidae	*Tragelaphus scriptus*	Bushbuck	LC
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	LC
Canidae	*Canis sp.*	Jackals and Wolves	
Canidae	*Canis mesomelas*	Black-backed Jackal	LC
Canidae	*Vulpes chama*	Cape Fox	LC
Equidae	*Equus quagga*	Plains Zebra	LC
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	**NT**
Felidae	*Caracal caracal*	Caracal	LC
Felidae	*Leptailurus serval*	Serval	**NT**
Felidae	*Panthera pardus*	Leopard	**VU**
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	LC
Hyaenidae	*Proteles cristata*	Aardwolf	LC
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	LC
Leporidae	*Lepus saxatilis*	Scrub Hare	LC
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	LC
Muridae	*Gerbilliscus brantsii*	Highveld Gerbil	LC
Muridae	*Lemniscomys rosalia*	Single-Striped Lemniscomys	LC

Family	Scientific Name	Common Name	Red List Category
Muridae	*Mastomys natalensis*	Natal Mastomys	LC
Muridae	*Otomys angoniensis*	Angoni Vlei Rat	LC
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	LC
Mustelidae	*Aonyx capensis*	African Clawless Otter	NT
Mustelidae	*Ictonyx striatus*	Striped Polecat	LC
Mustelidae	*Mellivora capensis*	Honey Badger	LC
Nesomyidae	*Dendromus mystacalis*	Chestnut African Climbing Mouse	LC
Orycteropodidae	*Orycteropus afer*	Aardvark	LC
Procaviidae	*Procavia capensis*	Cape Rock Hyrax	LC
Soricidae	*Crocidura flavescens*	Greater Red Musk Shrew	LC
Soricidae	*Myosorex varius*	Forest Shrew	LC
Suidae	*Phacochoerus africanus*	Common Warthog	LC
Viverridae	*Genetta tigrina*	Cape Genet (Cape Large-spotted Genet)	LC

REPTILES EXPECTED TO OCCUR

Family	Scientific Name	Common Name	Red List Category
Agamidae	*Agama atra*	Southern Rock Agama	LC
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	LC
Cordylidae	*Cordylus vittifer*	Common Girdled Lizard	LC
Cordylidae	*Pseudocordylus melanotus melanotus*	Common Crag Lizard	LC
Elapidae	*Hemachatus haemachatus*	Rinkhals	LC
Gekkonidae	*Pachydactylus affinis*	Transvaal Gecko	LC
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	LC
Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	LC
Lamprophiidae	*Homoroselaps lacteus*	Spotted Harlequin Snake	LC
Lamprophiidae	*Psammophis crucifer*	Cross-marked Grass Snake	LC
Lamprophiidae	*Psammophylax rhombeatus*	Spotted Grass Snake	LC
Lamprophiidae	*Pseudaspis cana*	Mole Snake	LC
Scincidae	*Acontias gracilicauda*	Thin-tailed Legless Skink	LC
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	LC
Typhlopidae	*Afrotyphlops bibronii*	Bibron's Blind Snake	LC

AMPHIBIANS EXPECTED TO OCCUR

Family	Species	Common Name	Red List Category
Bufonidae	*Sclerophrys capensis*	Raucous Toad	LC
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	LC
Bufonidae	*Sclerophrys pusilla*	Flatbacked Toad	LC
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	LC
Hyperoliidae	*Semnodactylus wealii*	Rattling Frog	LC
Phrynobatrachidae	*Phrynobatrachus natalensis*	Snoring Puddle Frog	LC
Ptychadenidae	*Ptychadena porosissima*	Striped Grass Frog	LC
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	LC
Pyxicephalidae	*Amietia fuscigula*	Cape River Frog	LC
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	LC
Pyxicephalidae	*Cacosternum nanum*	Bronze Caco	LC
Pyxicephalidae	*Strongylopus fasciatus*	Striped Stream Frog	LC
Pyxicephalidae	*Strongylopus grayii*	Clicking Stream Frog	LC
Pyxicephalidae	*Tomopterna sp.*		LC
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	LC
Pyxicephalidae	*Tomopterna natalensis*	Natal Sand Frog	LC
Pyxicephalidae	*Tomopterna tandyi*	Tandy's Sand Frog	LC
Hyperoliidae	*Afrixalus fornasinii*	Fornasini spiny reed frog	VU
Brevicipitidae	*Breviceps sopranus*	Whistling rain frog	VU
Heleophrynidae	*Heleophryne natalensis*	Natal Ghost Frog	VU
Hemisotidae	*Hemisus guttatus*	Spotted snout-burrower	VU
Hyperoliidae	*Hyperolius semidiscus*	Yellow-striped Reed Frog	VU
Pyxicephalidae	*Pyxicephalus adspersus*	Giant African Bullfrog	NT

LEPIDOPTERA (MOTHS AND BUTTERFLIES) EXPECTED TO OCCUR

Family	Species	Common Name	Red List Category
EREBIDAE	Grammodes euclidioides subsp euclidioides		Not listed
GEOMETRIDAE	Chiasmia simplicilinea	Oblique Peacock	LC
GEOMETRIDAE	Rhodometra sacraria		LC
HESPERIIDAE	Afrogegenes sp.		LC
HESPERIIDAE	Borbo borbonica borbonica	Olive-haired swift	LC
HESPERIIDAE	Coeliades pisistratus	Two-pip policeman	LC
HESPERIIDAE	Metisella meninx	Marsh sylph	LC
HESPERIIDAE	Pelopidas mathias	Black-branded swift	LC
LYCAENIDAE	Chilades trochylus	Grass jewel blue	LC
LYCAENIDAE	Lampides boeticus	Pea blue	LC
LYCAENIDAE	Leptotes sp.		LC
LYCAENIDAE	Zizeeria knysna knysna	African grass blue	LC
NOCTUIDAE	Acontia caffraria		Not listed
NYMPHALIDAE	Acraea natalica	Black-based acraea	LC
NYMPHALIDAE	Danaus chrysippus orientis	African plain tiger	LC
NYMPHALIDAE	Hypolimnas misippus	Common diadem	LC
NYMPHALIDAE	Junonia hierta cebrene	Yellow pansy	LC
NYMPHALIDAE	Junonia oenone oenone	Dark blue pansy	LC
NYMPHALIDAE	Junonia orithya madagascariensis	African blue pansy	LC
NYMPHALIDAE	Telchinia rahira rahira	Marsh telchinia	LC
NYMPHALIDAE	Telchinia serena	Dancing telchinia	LC
NYMPHALIDAE	Vanessa cardui	Painted lady	LC
PIERIDAE	Belenois aurota	Pioneer caper white	LC
PIERIDAE	Catopsilia florella	African migrant	LC
PIERIDAE	Eurema brigitta brigitta	Broad-bordered grass yellow	LC

Family	Species	Common Name	Red List Category
PIERIDAE	Pontia helice helice	Southern meadow white	LC
SPHINGIDAE	Cephonodes hylas virescens		Not listed
SPHINGIDAE	Macroglossum trochilus		Not listed

BIRDS EXPECTED TO OCCUR

Common Group	Common Name	Scientific Name	IUCN Status
Bishop	Southern Red	*Euplectes orix*	LC
Bishop	Yellow-crowned	*Euplectes afer*	LC
Bokmakierie	Bokmakierie	*Telophorus zeylonus*	LC
Bulbul	Dark-capped	*Pycnonotus tricolor*	LC
Buzzard	Jackal	*Buteo rufofuscus*	LC
Buzzard	Steppe	*Buteo vulpinus*	LC
Canary	Black-throated	*Crithagra atrogularis*	LC
Canary	Yellow-fronted	*Crithagra mozambicus*	LC
Chat	Anteating	*Myrmecocichla formicivora*	LC
Cisticola	Cloud	*Cisticola textrix*	LC
Cisticola	Levaillant's	*Cisticola tinniens*	LC
Cisticola	Wing-snapping	*Cisticola ayresii*	LC
Cisticola	Zitting	*Cisticola juncidis*	LC
Coot	Red-knobbed	*Fulica cristata*	LC
Cormorant	Reed	*Phalacrocorax africanus*	LC
Cormorant	White-breasted	*Phalacrocorax carbo*	LC
Crow	Pied	*Corvus albus*	LC
Cuckoo	Diderick	*Chrysococcyx caprius*	LC
Darter	African	*Anhinga rufa*	LC
Dove	Laughing	*Streptopelia senegalensis*	LC
Dove	Red-eyed	*Streptopelia semitorquata*	LC
Duck	African Black	*Anas sparsa*	LC

Common Group	Common Name	Scientific Name	IUCN Status
Duck	Maccoa	*Oxyura maccoa*	LC
Duck	White-backed	*Thalassornis leuconotus*	LC
Duck	Yellow-billed	*Anas undulata*	LC
Egret	Cattle	*Bubulcus ibis*	LC
Egret	Yellow-billed	*Egretta intermedia*	LC
Falcon	Amur	*Falco amurensis*	LC
Fiscal	Common (Southern)	*Lanius collaris*	LC
Francolin	Grey-winged	*Scleroptila africanus*	LC
Goose	Egyptian	*Alopochen aegyptiacus*	LC
Goose	Spur-winged	*Plectropterus gambensis*	LC
Grassbird	Cape	*Sphenoeacus afer*	LC
Grebe	Little	*Tachybaptus rucicollis*	LC
Guineafowl	Helmeted	*Numida meleagris*	LC
Hamerkop	Hamerkop	*Scopus umbretta*	LC
Heron	Black-headed	*Ardea melanocephala*	LC
Ibis	Glossy	*Plegadis falcinellus*	LC
Ibis	Hadeda	*Bostrychia hagedash*	LC
Ibis	Southern Bald	*Geronticus calvus*	VU
Kite	Black-shouldered	*Elanus caeruleus*	LC
Lapwing	Black-winged	*Vanellus melanopterus*	LC
Lapwing	Blacksmith	*Vanellus armatus*	LC
Lapwing	Crowned	*Vanellus coronatus*	LC
Lark	Red-capped	*Calandrella cinerea*	LC
Lark	Spike-heeled	*Chersomanes albofasciata*	LC
Longclaw	Cape	*Macronyx capensis*	LC
Martin	Banded	*Riparia cincta*	LC
Martin	Brown-throated	*Riparia paludicola*	LC
Martin	Rock	*Hirundo fuligula*	LC
Masked-weaver	Southern	*Ploceus velatus*	LC
Moorhen	Common	*Gallinula chloropus*	LC
Mousebird	Speckled	*Colius striatus*	LC

Common Group	Common Name	Scientific Name	IUCN Status
Myna	Common	*Acridotheres tristis*	LC
Pigeon	Speckled	*Columba guinea*	LC
Pipit	African	*Anthus cinnamomeus*	LC
Plover	Three-banded	*Charadrius tricollaris*	LC
Pochard	Southern	*Netta erythrophthalma*	LC
Quail	Common	*Coturnix coturnix*	LC
Quailfinch	African	*Ortygospiza atricollis*	LC
Quelea	Red-billed	*Quelea quelea*	LC
Reed-warbler	Great	*arundinaceus*	LC
Robin-chat	Cape	*Cossypha caffra*	LC
Sandpiper	Wood	*Tringa glareola*	LC
Secretarybird	Secretarybird	*Sagittarius serpentarius*	VU (NT) - MBSP
Seedeater	Streaky-headed	*Crithagra gularis*	LC
Shoveler	Cape	*Anas smithii*	LC
Sparrow	Cape	*Passer melanurus*	LC
Sparrow	House	*Passer domesticus*	LC
Sparrow	Southern Grey-headed	*Passer diffusus*	LC
Spurfowl	Swainson's	*Pternistis swainsonii*	LC
Starling	Pied	*Spreo bicolor*	LC
Stonechat	African	*Saxicola torquatus*	LC
Stork	White	*Ciconia ciconia*	LC
Sunbird	Amethyst	*Chalcomitra amethystina*	LC
Swallow	Barn	*Hirundo rustica*	LC
Swallow	Greater Striped	*Hirundo cucullata*	LC
Swallow	White-throated	*Hirundo albigularis*	LC
Swift	Common	*Apus apus*	LC
Swift	Little	*Apus affinis*	LC
Swift	White-rumped	*Apus caffer*	LC
Teal	Hottentot	*Anas hottentota*	LC
Teal	Red-billed	*Anas erythrorhyncha*	LC

Common Group	Common Name	Scientific Name	IUCN Status
Tern	Whiskered	*Chlidonias hybrida*	LC
Tern	White-winged	*Chlidonias leucopterus*	LC
Thick-knee	Spotted	*Burhinus capensis*	LC
Turtle-dove	Cape	*Streptopelia capicola*	LC
Wagtail	Cape	*Motacilla capensis*	LC
Warbler	Dark-capped Yellow	*Chloropeta natalensis*	LC
Warbler	Willow	*Phylloscopus trochilus*	LC
Waxbill	Common	*Estrilda astrild*	LC
Weaver	Cape	*Ploceus capensis*	LC
Wheatear	Mountain	*Oenanthe monticola*	LC
White-eye	Cape	*Zosterops virens*	LC
Whydah	Pin-tailed	*Vidua macroura*	LC
Widowbird	Fan-tailed	*Euplectes axillaris*	LC
Widowbird	Long-tailed	*Euplectes progne*	LC
Wryneck	Red-throated	*Jynx ruficollis*	LC

DIGBY WELLS
ENVIRONMENTAL

Appendix E: Public Participation Material