
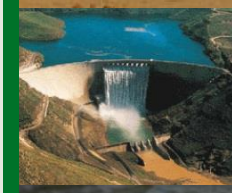









ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

Scoping Report

MOTUOANE HENNEMAN EXPLORATION RIGHT APPLICATION

EIMS Ref: 1133

PASA Ref: 12/3/315 ER

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20 YEARS 1993 - 2013

Leaders in Environmental Management

MOTUOANE HENNEMAN EXPLORATION RIGHT APPLICATION

SCOPING REPORT

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REVISION AND AMENDMENTS

Date	No.	Description Of Revision Or Amendment
2016/07/09	0	Scoping Report for Public Review

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ABBREVIATIONS

AIA	:	Archaeological Impact Assessment
ASAPA	:	Association of South African Professional Archaeologists
BH	:	Borehole
CMA	:	Catchment Management Agency
CMAs	:	Catchment Management Agencies
CRM	:	Cultural Resources Management
DEA	:	Department of Environmental Affairs
DMR	:	Department of Mineral Resources
DWA	:	Department: Water Affairs
DWS	:	Department of Water Affairs and Sanitation
EC	:	Electrical Conductivity
EIA	:	Environmental Impact Assessment
ELWU	:	Existing Lawful Water Use
EMPR	:	Environmental Management Programme Report
ESA	:	Early Stone Age
GA	:	General Authorisation
GN	:	Government Notice
GPS	:	Global Positioning System
HIA	:	Heritage Impact Assessment
HIR	:	Heritage Impact Report
HSR	:	Heritage Scoping Report
I&AP	:	Interested & Affected Party
IBA	:	Important Bird Area
LIA	:	Late Iron Age
LSA	:	Later Stone Age
MAE	:	Mean Annual Evaporation
mamsl	:	metres above mean sea level
MAP	:	Mean Annual Precipitation

MAR : Mean Annual Runoff

MCM : Million cubic metres

MIA : Middle Iron Age

MPRDA: Minerals and Petroleum Resources Development Act, 2002

MSA : Middle Stone Age

NEM:WA: National Environmental Management: Waste Amendment Act, 2008

NEMA : National Environmental Management Act, 2002

NEMA : National Environmental Management Act

NGDB : National Groundwater Database

NHRA : National Heritage Resources Act

NWA : National Water Act, 1998

PASA : Petroleum Agency South Africa

PHRA : Provincial Heritage Resources Authority

PSSA : Palaeontological Society of South Africa

RoD : Record of Decision

SADC : Southern African Development Community

SAHRA : South African Heritage Resources Agency

SWL : Static Water Level

TDS : Total Dissolved Solids

WMA : Water Management Area

WUL : Water Use Licence

EXECUTIVE SUMMARY

Motuoane Energy (Pty) Ltd (hereafter referred to as Motuoane – the applicant) compiled and submitted an application for an exploration right for hydrocarbons, in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA, as amended) to the Petroleum Agency South Africa (PASA) in 2016. The proposed Motuoane Hennenman project is located over an area of approximately 149 377 hectares (ha), covering various farms near the town of Hennenman, within the Free State Province, extending north from approximately Theunissen, north east towards Kroonstad, and east of Virginia and Hennenman. The local municipalities in which the proposed exploration area is located includes, Matjhabeng and Masilonyana, which are part of the Lejweleputswa District Municipality, and Moqhaka which is part of the Fezile Dabi District Municipality.

In terms of the MPRDA an exploration right must be issued prior to the commencement of the proposed exploration activities. A requirement of obtaining an exploration right is that Scoping and Environmental Impact Assessment (EIA) Reports must be compiled and submitted to PASA in terms of Regulation 21 and 23 of the NEMA regulations.

The EA application to PASA was submitted on the 30th of June 2016. This report and associated appendices constitutes the scoping report for the proposed Motuoane Hennenman Exploration Right Project application and is due for submission to the PASA for adjudication by the 15th of August 2016 (NEMA 44 day legislated timeframe).

The proposed Motuoane Hennenman Exploration Right project, if approved, will allow Motuoane to determine if there is an economically viable resource (oil, gas and condensate) available in the area. The exploration right will not provide the required authorisation for production activities to be undertaken. Any future intention to undertake production of hydrocarbons within the exploration right area would require a further application, investigation and public consultation process. A significant proportion of the comments/objections received to date involved the concern regarding “fracking” and associated water pollution and attempts were made to clarify and confirm that this application for exploration does not include any form of well stimulation which includes hydraulic fracking (“fracking”).

The proposed exploration programme will be completed within 3 years and will entail background data collection and data management; geological mapping, geochemical soil sampling and diamond core drilling.

The alternatives considered and discussed in this scoping report, including location, technology, activity and exploration placement alternatives have culminated into the identification of three feasible development alternatives.

The Public Participation Process (PPP) for the proposed project has been undertaken in accordance with the requirements of the MPRDA, and NEMA in line with the principles of Integrated Environmental Management (IEM). The PPP commenced on the 27th May 2016 with an initial notification and call to register, ending on the 30th of June 2016. This scoping report will be made available for public review and comment for a period of 30 days, from the 11th of July 2016 to the 11th of August 2016. The comments received from I&AP’s during these

commenting periods will be captured in an Issues and Response summary table included in the scoping report to be submitted to the competent authority (The Petroleum Agency South Africa) for consideration and decision making purposes. The comments received from I&APs during these commenting periods will be captured in an Issues and Response summary table included in the scoping report to be submitted to the competent authority (The Petroleum Agency South Africa) for consideration and decision making purposes.

On acceptance of the scoping report from the PASA, an EIA Report, including an Environmental management Programme (EMPR), will also be compiled and presented for public comment as part of this EIA process during which time further stakeholder engagement will take place.

An EIA Report, including an EMPR, will also be compiled and presented for public comment as a step of this EIA process during which time further stakeholder engagement will take place.

The compilation of the Scoping Report for the proposed Motuoane Hennenman project required the input and contribution from several specialists, namely:

- Ecology and Wetlands;
- Geohydrology; and
- Heritage.

The specialist studies undertaken assisted in the determination of the baseline receiving environment, the identification of site specific sensitivities, identification and preliminary assessment of impacts for all project phases and the provision of suitable technical management/mitigation measures to be implemented.

The positive implication of the proposed Motuoane Hennenman Exploration Right project is the potential discovery of an economically viable hydrocarbon resource. Due to the limited extent (3 exploration wells) and duration of the proposed exploration activities (3 years), at this stage the project is not anticipated to have significant negative environmental impacts. Preliminary impact assessment results are such that only one potential impact (disturbance/ destruction of graves and cemeteries) was calculated to be of High impact significance without mitigation. However, the impact can be reduced to Medium impact significance by implementing the proposed mitigation measures. Furthermore, the remaining preliminary impacts resulted in post-mitigation impacts scores that were either Medium or Low.

The negative impacts of the proposed exploration activities, most of which are of Medium or Low significance before the proposed mitigation and mostly Low after the implementation of proposed mitigations, will be further assessed during the EIA phase of the project. Potential mitigation measures have been identified and will be refined based on input from the EAP, public consultation, and specialist assessments during the EIA phase of the project. The EMPR will, identify appropriate mechanisms for avoidance and mitigation of the negative impacts and enhancing the positive

1. INTRODUCTION

Motuoane Energy (Pty) Ltd (hereafter referred to as Motuoane – the applicant) compiled and submitted an application for an exploration right for hydrocarbons/petroleum, in terms of Section 79 of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA) as amended, to the Petroleum Agency South Africa (PASA). The proposed exploration right application area is located within the Matjhabeng-, Masilonyana-, and Moqhaka Local Municipalities, Free State Province, extending north from approximately Theunissen, north east towards Kroonstad, east of Virginia and Henneman.

In terms of the MPRDA, an Exploration Right must be issued prior to the commencement of the proposed exploration activities. The PASA accepted the application (reference number: 12/3/315ER) and subsequently requested that in accordance with Regulation 16 of the Environmental Impact Assessment (EIA) Regulations (2014) under the National Environmental Management Act (Act 107 of 1998 – NEMA) as amended, an application for Environmental Authorisation (EA) be submitted to the PASA in support of the application for the Exploration Right.

In order for an EA application to be considered by the PASA, an Environmental Impact Assessment (EIA) Process must be followed, consisting of Scoping and EIA Phases. Each of these phases culminates in a compilation and submission of Scoping and EIA Reports, respectively to the PASA in terms of Regulation 21 of the NEMA. Additionally, Interested and Affected Parties (I&APs) must be notified and consulted throughout the EIA as per Chapter 6 of the NEMA.

This report and associated appendices constitutes the Scoping Report for the proposed Motuoane Henneman Exploration Right application (the project). As stated above, the Scoping Report has been compiled in terms of Section 79 of the MPRDA and Section 21 of the NEMA. The PPP commenced on the 27th May 2016 with an initial notification and call to register, ending on the 30th June 2016. This Scoping Report was made available for public review and comment for a total period of 30 days, from the 11th of July 2016 to the 11th of August 2016. The EA application to PASA was submitted on the 30th of June 2016 and, therefore this report has been available for review for a period of 30 days after the submission of the EA application as per Section 40 of the NEMA.

1.1. PROJECT OVERVIEW

The proposed project covers an area of approximately 149 377 hectares (ha) covering various farms within the Free State Province. The total area to be disturbed by exploration activities will be minimal based on the relatively non-invasive exploration techniques. The project includes the drilling of 3 core exploration boreholes (3x30mx30m drill sites = 0.27ha with associated access roads).

The proposed gas exploration programme will be completed within 3 years and will entail the following activities, based on information presented in the Exploration Works Programme (EWP):

- Background data collection and management;

- Geological mapping;
- Geochemical soil sampling; and
- Diamond core drilling.

The proposed project, if approved, will allow Motuoane to determine if there is an economically viable resource available in the area.

1.2. PURPOSE OF SCOPING REPORT

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

- Identify the policies and legislation that are relevant to the activity;
- To motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- To identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking;
- To identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process including 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;
- To identify the key issues to be addressed in the assessment phase;
- To 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
- To 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.

1.3. DETAILS OF EAP

1.3.1. EXPERTISE OF THE EAP

Environmental Impact Management Services (Pty) Ltd (EIMS) has been appointed by Motuoane to act as the Independent Environmental Assessment Practitioner (EAP) and to assist in preparing and submitting the EA application, Scoping and EIA Reports, and undertaking a Public Participation Process (PPP) in support of the Motuoane Exploration Right application.

1.3.2. SUMMARY OF EAP CURRICULUM VITAE

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS has in excess of 20 years' experience in conducting EIAs, including many EIA's for mines and mining related projects as well as gas exploration and production applications. The EAP's responsible for preparing this Scoping Report are Ms. Nobuhle Hughes (Senior Consultant) and Mr Bongani Khupe (Project Manager). Brief details of Ms. Nobuhle Hughes and Mr Bongani Khupe's expertise and experience are presented below.

Mr. Bongani Khupe is a registered Professional Natural Scientist who holds a Bachelor of Science Honours degree and has more than 9 years' experience in the environmental field. His key focus is on environmental impact assessments, environmental permitting, public participation, environmental management plans and programmes, strategic environmental advice, rehabilitation advice and monitoring, environmental compliance advice and monitoring as well as providing technical input for projects in the environmental management field. He has been involved as an EAP in several infrastructure projects and other EIAs across the country. He is a trained Environmental Auditor and his training included all aspects of Environmental Auditing as well as EMS auditing in terms of ISO14001. Mr Khupe is therefore registered as an Associate Environmental Auditor with the Institute of Environmental Management and Assessment (IEMA).

Ms Nobuhle Hughes is a senior consultant at EIMS and has been involved in numerous significant projects over the past 6 years that she has been with the firm. She has experience in Project Management, small to large scale Environmental Impact Assessments, Public Participation, as well as Report Writing.

The declaration of independence of the EAP and the Curriculum Vitae (indicating the experience with EIAs and relevant application processes) of the consultant that was involved in the Scoping and EIA process and the compilation of this report are attached as Appendix A.

1.4. SPECIALIST CONSULTANTS

Three specialist studies were undertaken to address the key issues that required further investigation, namely the impact on ecology, geohydrology (ground water), and heritage resources.

The specialist studies involved the gathering of data relevant to identifying and assessing environmental impacts that may occur as a result of the proposed project. These impacts were then assessed according to pre-defined rating scales (see Section 7 for the impact rating methodology). Specialists also recommended appropriate mitigation/management measures to minimise potential negative impacts or enhance potential benefits, respectively. The specialists appointed for the proposed Motuoane Henneman project are indicated in Table 1 below.

TABLE 1: LIST OF SPECIALISTS APPOINTED TO THE PROJECT

Component	Company Responsible
Ecology and Wetlands	David Hoare Consulting cc
Geohydrology	Exigo Sustainability (Pty) Ltd
Heritage	PGS Heritage

1.5. DETAILS OF THE APPLICANT

The details of the applicant are given in Table 2 below.

TABLE 2: DETAILS OF THE APPLICANT

Project Applicant	Motuoane Energy (Pty) Ltd
Registration no:	2012/044973/07
Responsible Person:	Director
Contact Person	Mr Peter Price
Physical address	38 Fouche Terrace, Morning Hill, Bedfordview, 2007
Postal address:	38 Fouche Terrace, Morning Hill, Bedfordview, 2007

2. PROJECT DESCRIPTION

2.1 LOCATION

2.1.1 REGIONAL SETTING

The proposed Motuoane Henneman project is located over an area of approximately 149 377 hectares (ha), covering various farms near the town of Henneman, within the Free State Province, extending north from approximately Theunissen, north east towards Kroonstad, and east of Virginia and Henneman. The approximate centre point of the proposed study area is located at: 28° 5'1.67"S; 27° 8'0.66"E in Ventersburg. The local municipalities in which the proposed exploration area is located includes, Matjhabeng and Masilonyana which are part of the Lejweleputswa District Municipality, and Moqhaka which is part of the Fezile Dabi District Municipality.

The exploration activities will not take place across the entire study area. The total area to be disturbed by exploration activities will be minimal based on the relatively non-invasive exploration techniques to be undertaken. The project includes the drilling of 3 (30m x 30m) core exploration wells whereby the drill sites will be 0.27 ha in total, as well as associated access roads. It is necessary at this early phase, to apply for a large area in order to secure the right to assess the existence of petroleum resources and to gain access to existing data.

2.1.2 PROPERTY DESCRIPTION

The proposed exploration right application area is located within the Matjhabeng- and Masilonyana Local Municipalities within the Lejweleputswa District Municipality, and the Moqhaka Local Municipality which is part of the Fezile Dabi District Municipality, in the Free State Province. Details of the properties which make up the exploration right application area is attached as Appendix B.

2.1.3 LOCALITY MAP

Figure 1 overleaf indicates the locality of the proposed Motuoane Henneman project.

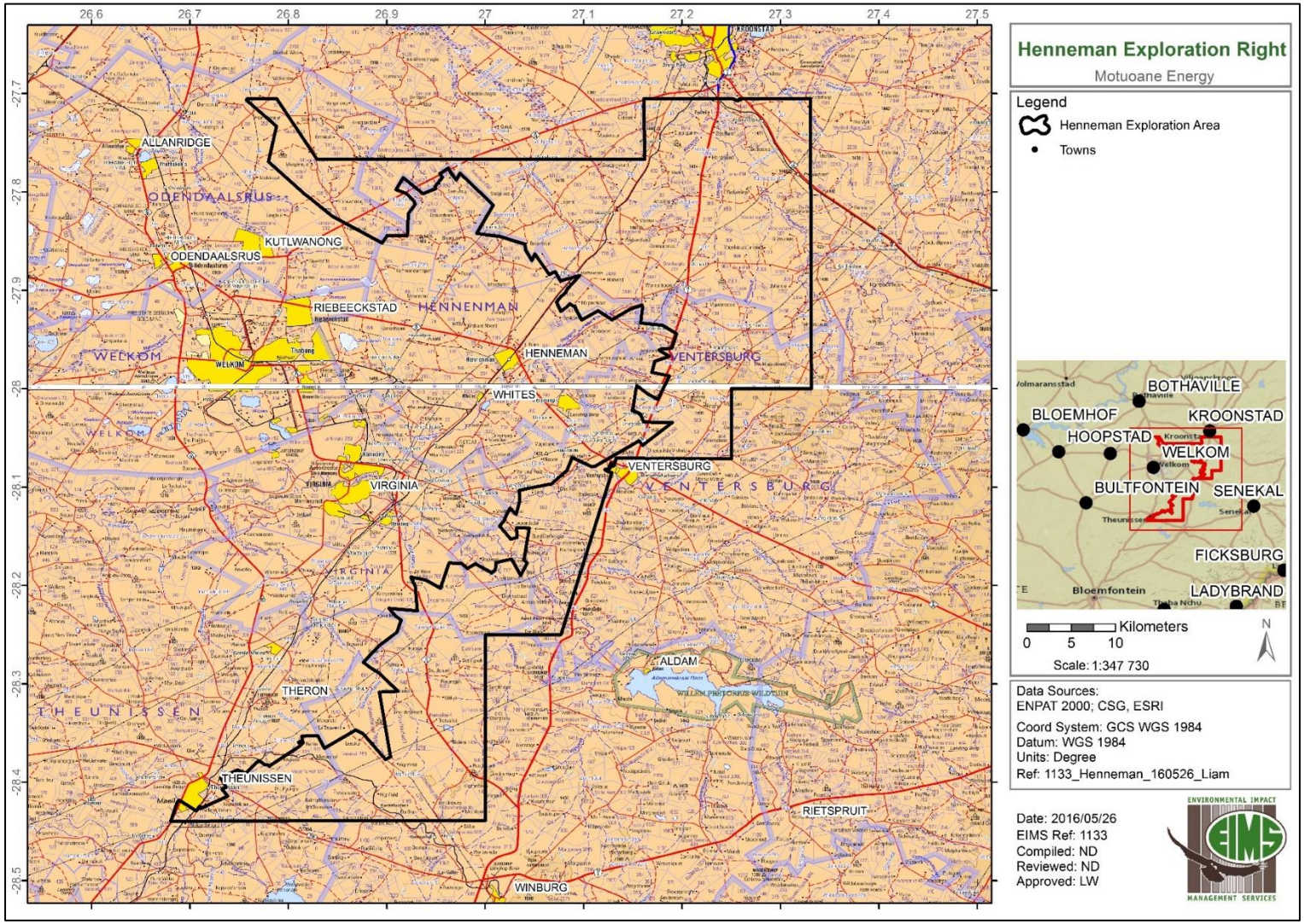

FIGURE 1: LOCALITY MAP

2.2 DESCRIPTION OF ACTIVITY

2.2.1 NEED AND DESIRABILITY OF THE PROJECT

The proposed Motuoane Henneman Exploration Right project, if approved, will allow Motuoane to determine if there is an economically viable resource (relevant hydrocarbons) available within the application area. It is important to note that the Exploration Right will not provide the required authorisation for production activities to be undertaken. As such, any future intention to undertake production of hydrocarbons/petroleum within the Exploration Right area would require a further application, investigation, and public consultation process.

The White Paper on the Energy Policy (1998) is the overarching policy document that guides future policy and planning in the energy sector. It states that the government will, *inter alia*, "*promote the development of South Africa's oil and gas resources…*" and "*ensure private sector investment and expertise in the exploitation and development of the country's oil and as resources*". The successful exploitation of the hydrocarbon natural resources would contribute to the growth of the economy and relieve pressure on the balance of payments.

The National Development Plan (NDP) (2012) provides the context for all development in South Africa, with the overarching aim of eradicating poverty and inequality between people in South Africa. The NDP identifies the need to diversify the current energy mix and to reduce carbon emissions. Gas will play a more significant role in the energy mix and the exploration of gas as an alternative to coal for energy production has been recognised as a planning priority. The position of the NDP is reiterated in the Draft Integrated Energy Plan (IEP) (2013), which seeks to determine how current and future energy needs can be addressed efficiently. Main objectives outlined in the plan include security of supply, increased access to energy, diversity in supply sources and primary sources of energy and minimising emissions. The plan indicates that projected demand for natural gas between 2010 and 2050 would be second only to petroleum products, primarily due to increased growth in the industrial sector. It also identifies significant potential for natural gas in terms of power generation and direct thermal uses.

An increase in domestic natural gas reserves would also contribute to security of supply in the gas-to-liquids industry, which relies on feedstock from coal, oil and gas reserves. The Draft IEP points out the vulnerability of the liquid fuels industry and its economy to fluctuations in the global oil market, given that South Africa is a net importer of oil. Furthermore, existing gas stocks in the domestic offshore are declining, and new sources of feedstock are required to support and increase production in the gas-to-liquids industry (NDP, 2012).

As such, exploration for additional domestic hydrocarbon and petroleum reserves is considered important and any discoveries would be well received by the local market. The Department of Energy's Integrated Resource Plan (2010 - 2030) supports this view, stating that regional and domestic gas options should be pursued. The government's official position is that exploration and development of oil and gas fields should be encouraged.

The identification of potential geological structures or "prospects" within the proposed exploration licence area for future exploration and possible well-drilling provides an opportunity to develop a South African oil and gas industry resulting in long-term benefits consisting of access to new energy sources, improved security of supply, major in-country investments in a development project and reduced dependence on the importation of

hydrocarbons. There is also potential in the long-term for local economic stimulation through direct employment, future business opportunities, royalties and tax revenues.

In summary, exploration success would result in long-term benefits for South Africa consisting of access to new energy sources, improved security of supply, major in-country investments in a development project and reduced dependence on the importation of hydrocarbons.

2.2.2 DESCRIPTION OF PROPOSED PROJECT

The proposed gas exploration programme will be completed within three years and in summary will entail activities as detailed in Table 3 below, based on information presented in the Exploration Works Programme (EWP):

TABLE 3: EXPLORATION ACTIVITIES

Main Activity/Action/Process	Ancillary Activity
Non-invasive exploration	Background data collection and data management
	Geological and geophysical mapping
Invasive exploration	Geochemical soil sampling
	Diamond core drilling

Each of the above mentioned activities presented in Table 3 are described in more detail in the subsequent subsections.

2.2.2.1. NON-INVASIVE EXPLORATION ACTIVITIES

BACKGROUND DATA COLLECTION AND MANAGEMENT

A project database will be established for the collection, collating, and integration of all the data gathered for all exploration efforts. This will be updated as and when new data is available or generated from the existing data set. Data including geological maps, gravity and magnetic geophysical data for basin analysis, and information on previously drilled wells will be acquired. This phase will include the interpretation and processing of the data.

In order to acquire information on existing wells, wellhead control and measurement equipment will be designed for gas emitting wells and installed to measure pressure, flow rate and collect gas samples from the wells if physical conditions permit. These activities will be undertaken within the first year of exploration.

GEOLOGICAL AND GEOPHYSICAL MAPPING

Geological and Geophysical logging, utilizing the core samples obtained from the drilling programme as well as existing wells where conditions permit. The core samples will be analysed for the presence of hydrocarbons as

well as to determine the physical properties of the rocks. This analysis will allow for the determination of the lithology and associated properties as well as the presence of hydrocarbons. Geophysical logging and surface structures data will be integrated into maps. These activities will be undertaken within the second and third year of exploration

2.2.2.2. INVASIVE EXPLORATION ACTIVITIES

GEOCHEMICAL AND SOIL SAMPLING

Geochemical and soil sampling involves the removal of small sections of the soil profile using ether a shovel or a soil augur to a depth of between 6 and 12 inches. The number of samples to be collected will be determined by the results of the desktop study. These samples will then be submitted to a laboratory for geochemical analysis to determine the presence of hydrocarbon tracing.

DIAMOND CORE DRILLING

The project will involve the drilling of three (3) wells in locations still to be identified. The typical size of the diamond drill bit used to drill the exploration wells is 75.7 mm in diameter. Each borehole will be steel cased and cement grouted to prevent groundwater seepage.

The construction of each drill pad will disturb an area of up to 30 x 30 m. Within the disturbed area, the drill rig and drilling rods will be located. Impermeable, lined sumps will be used to circulate and store the drill fluid and mud. Core trays, hazardous and general storage, waste storage, chemical toilets, and any site offices required will also be placed inside the drill pad. The cores will be logged and each drill site will be suitably rehabilitated before drilling continues at the next drill site. Depending on the results of the core sampling, each borehole will either be grouted entirely or left as is for future analysis. Whichever of these options is chosen, the borehole will be capped with a steel cap that is engraved with the borehole number according to industry specifications.

2.2.2.3. SUPPORTING INFRASTRUCTURE

None of the proposed exploration activities require the establishment of any permanent infrastructure. Sites will be accessed from existing roads or farm tracks, as available. Existing accommodation in the area will utilised for staff and not on site.

INPUTS

Equipment for drilling will be provided by specialist contractors. The majority of equipment, consumables and even labour for these services is specialised. Contractors and suppliers will be encouraged to source locally as much as is feasible. Electricity, if required, will be provided by on-site generators.

Water required for the operation of the drilling rig, as well as potable water will be obtained locally, by agreement from a licensed source(s). The daily water requirements for operations (a maximum of 5000 litres per day) will fall within the water volumes permitted by the General Authorisation (No. 1191 in the Government Gazette No. 26187 published on 26 March 2004) issued by the Department of Water and Sanitation (DWS) for the taking of water from a water resource.

OUTPUTS

Chemical toilets will be provided for the personnel. The toilets will be supplied and managed by a specialist contractor and the sewage disposed of at the nearest wastewater management facility, or as required by the local authority.

All general and hazardous waste generated at the drilling site will be separated and stored in containers, before being removed from site and disposed at an appropriate waste disposal facility. The core recovered from the drilling will most likely be stored in a core shed for analysis and record keeping. Mineral residues produced during drilling practices will be managed in terms of the MPRDA and appropriate regulations, most notably Regulation 704 (4 June 1999) under the NWA and Regulation 632 on the Planning and Management of Residue Stockpiles and Residue Deposits (July 2015) under the National Environmental Management Waste Act (Act 59 of 2008) (NEMWA). Water from the drilling operations will be disposed of in accordance with the provisions of the National Waster Act and the National Environmental Management Waste Act (as applicable).

2.2.3 CLOSURE AND DECOMMISSIONING

A rehabilitation plan will be included in the Environmental Management Programme (EMP). The EMP shall outline the closure objectives that are aimed at re-instating the landform, land use and vegetation units to the same state as before exploration operations take place, unless a specific, reasonable alternate land use is requested by the landowner. As such, the intended end use for the disturbed exploration areas and the closure objectives will be defined in consultation with the relevant landowner. Proof of such consultation will be submitted together with the Application for Closure Certificate. The overall aim of the rehabilitation plan is to rehabilitate the environment to a condition as close as possible to that which existed prior to exploration. This shall be achieved with a number of specific objectives, as follows:

- **Making the area safe**. i.e.: Decommission exploration activities so as to ensure that the environment is safe for people and animals. This entails refilling excavations, sealing and grouting boreholes, etc.
- **Recreating a free draining landform**. This entails earthworks infilling, reshaping, levelling, etc. to recreate as close as possible the original topography and to ensure a free draining landscape.
- **Re-vegetation**. This involves either reseeding or allowing natural succession depending on the area, climate, etc.
- **Stormwater management and erosion control**. Management of stormwater and prevention of erosion during rehabilitation (e.g. cut off drains, berms, etc. and erosion control where required).
- **Verification of rehabilitation success**. Entails monitoring of rehabilitation.

Once exploration has been completed, all areas disturbed by exploration activities will be rehabilitated. This will be undertaken in accordance with the rehabilitation and closure plan to be developed during the Environmental Impact Assessment (EIA) process.

It is noted Activity 22 of GN R 983, Listing Notice 1, List of activities and competent authorities identified in terms of Sections 24(2) and 24D, dated 4 December 2014 will be triggered which pertains to the decommissioning of any activity and requiring –

- A closure certificate in terms of Section 43 of the MPRDA; or
- A prospecting right, mining permit, production right or exploration right, where the throughput of the activity has reduced by 90% or more over a period of 5 years excluding where the competent authority has in writing agreed that such reduction in throughput does not constitute closure.

2.2.4 PROPOSED PROJECT SCHEDULING

The proposed project schedule is indicated in the table below.

TABLE 4: PROPOSED PROJECT SCHEDULE

Exploration Program				
	Background data collection and data management	Geological mapping	Geochemical soil sampling	Diamond core drilling
Year 1	X			
Year 2	X	X	X	
Year 3	X	X	X	X

3. POLICY AND LEGISLATIVE REQUIREMENTS

3.1 APPLICABLE ENVIRONMENTAL LEGISLATION

A summary of the applicable legislation guiding the requirement to conduct this environmental application process is provided in **Table 5** below. The sections below furthermore provide an overview of the governing legislation identified which relate to the proposed project.

TABLE 5: APPLICABLE LEGISLATION

Applicable Legislation and Guidelines	Reference Where Applied	How does this Development Comply with and Respond to the Legislation and Policy Context
Minerals and Petroleum resources Development Act (MPRDA): In support of the application for an Exploration Right submitted by Motuoane, they are required to conduct a NEMA Scoping and EIA process in terms of Section 5A and Chapter 79 of the MPRDA.	This entire report is prepared as part of the Exploration Right Application under the MPRDA.	In terms of the MPRDA, an Exploration Right Application has been applied for.
National Environmental Management Act (NEMA): GNR 984 Activity 18: Any activity including the operation of that activity which requires an exploration right as contemplated in Section 79 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks.	This entire report is prepared as part of the Application for Environmental Authorisation under the NEMA.	In terms of the National Environmental Management Act an Application for Environmental Authorisation subject to a Scoping and EIA Process has been applied for.

3.2 APPLICABLE NATIONAL LEGISLATION

The legal framework within which the proposed exploration right application operates is governed by many acts, regulations, standards, guidelines and treaties on an international, national, provincial and local level. Legislation applicable to the project includes the following.

3.2.1. MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT

The Minerals and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA) governs the sustainable utilisation of South Africa's mineral resources. In the event that the proposed activities require material (e.g. sand, gravel, aggregate) for the purposes of construction then the provisions of the MPRDA may apply. The MPRDA aims to "make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources". The MPRDA outlines the procedural requirements that need to be met to acquire mineral and hydrocarbon rights in South Africa.

In terms of the MPRDA an Exploration Right must be issued prior to the commencement of any exploration activities. As per Section 79(4)(a) and (b) of the MPRDA, the Applicant is required to conduct an EIA and submit an EMPR for approval as well as to notify in writing and consult with Interested and Affected Parties (I&APs) within 120 days of acceptance of the Application. The MPRDA also requires adherence with related legislation, chief amongst them is the National Environmental Management Act (Act No. 107 of 1998, NEMA) and the National Water Act (Act No. 36 of 1998, NWA).

Several amendments have been made to the MPRDA. These include, but are not limited to, the amendment of Section 102, concerning amendment of rights, permits, programmes and plans, to requiring the written permission of the Minister for any amendment or alteration; and the section 5A(c) requirement that landowners or land occupiers receive twenty-one (21) days' written notice prior to any activities taking place on their properties. One of the most recent amendments requires all mining related activities to follow the full NEMA process as per the 2014 EIA Regulations, which came into effect on 4 December 2014.

An Exploration Right is exclusive, transferable, valid for 3 years, and renewable for a maximum of 3 periods of 2 years each. Exploration is very similar to prospecting, in that an Exploration Right only allows the holder of the right to conduct such activities as per the Exploration Works Programme to establish the presence of economically viable hydrocarbon resources. An exploration right does not grant the holder the right to conduct any production related activities.

On 3 June 2015, GNR 466 was published. The notice details amendments made to petroleum exploration and production relating, in particular, to the EIA process required, well design and construction, management and operations, water, waste, pollution incidents and air quality, and well suspension and decommissioning.

3.2.2. NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The National Environmental Management Act (Act No. 107 of 1998) as amended (NEMA), aims to protect the environment, and stipulates that developments must be socially, environmentally and economically sustainable, and that disturbances and pollution of the environment must be avoided, minimised and remedied. The Act also

provides for the equitable access to environmental resources, to meet basic human needs. Decisions on the environment must be taken in an open and transparent manner, and resources must be held in trust for the public and protected as such. NEMA also makes provision for the cost of remedying pollution, and all such costs shall be paid by the polluter.

Section 24 (2) in NEMA (1998) provides for activities which may have a detrimental effect on the environment and may not commence without environmental authorisation (EA) from the competent authority. In Section 24 (4 & 5) provision is made for the Regulations which stipulate the minimum procedures for the issuing of and monitoring compliance with EA's. Section 24 (8), states that authorisations or permits obtained under any other law for an activity listed or specified in terms of this Act does not absolve the applicant from obtaining authorisation under this Act.

In accordance with Section 24 of the NEMA, the Minister has published (in GN R. 983, 984, and 985) a list of activities that require EA prior to commencement of these activities. In this regard TABLE 6 provides a list of the specific activities extracted from the Regulations which the proposed project may potentially trigger, and which consequently have been applied for in this application for EA.

A Scoping and EIA process is reserved for activities which have the potential to result in significant impacts which are complex to assess. Scoping and EIA accordingly provides a mechanism for the comprehensive assessment of activities that are likely to have more significant environmental impacts.

TABLE 6: NEMA LISTED ACTIVITIES

Name of Activity	Aerial Extent of Activity (Ha or m^2)	Listed Activity	Applicable Listing Notice	Description of Listed Activity
Drill site; Drilling of approximately 3 boreholes will provide solid core samples that can be analysed for the presence of hydrocarbons and the physical properties of the rocks. Drilling requires the clearance of an area of 30m by 30m at each drill site for the placement of the drill rig with subsequent rehabilitation of the disturbed area following completion of the drilling operation. Depending on the need for access roads to the drill sites additional area may be cleared	0.27 ha	X	GNR 983 of 4 December 2014	Activity 27: The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for – ○ The undertaking of a linear activity; or Maintenance purposes undertaken in accordance with a maintenance management plan.
Exploration activities for hydrocarbons	149 377 ha	X	GNR 984 of 4 December 2014	Activity 18: Any activity including the operation of that activity which requires an exploration right as contemplated in section 79 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks.

Drill site; Drilling of approximately 3 boreholes will provide solid core samples that can be analysed for the presence of hydrocarbons and the physical properties of the rocks. Drilling requires the clearance of an area of 30m by 30m at each drill site for the placement of the drill rig with subsequent rehabilitation of the disturbed area following completion of the drilling operation. Depending on the need for access roads to the drill sites additional area may be cleared. The exploration area includes areas which fall within the Eastern Free State Sandy Grasslands which are regarded as endangered.	0.27 ha	X	GNR 985 of 4 December 2014	Activity 12: The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. (b) In the Free State: i. Trans-frontier protected areas managed under international conventions; ii. Community Conservation Areas; iii. Biodiversity Stewardship Programme Biodiversity Agreement areas; iv. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; v. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; vi. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuarine functional zone, whichever distance is the greater,

				excluding where such removal will occur behind the development setback line on erven in urban areas; vii. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning; viii. A protected area identified in terms of NEMPAA, excluding conservancies; ix. World Heritage Sites; x. Sites or areas identified in terms of an International Convention; xi. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; xii. Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; or xiii. In an estuarine functional zone.

3.2.3. NATIONAL WATER ACT

The National Water Act, 1998 (Act 36 of 1998) (NWA) makes provision for two types of application for water use licences, namely individual applications and compulsory applications. The NWA also provides that the responsible authority may require an assessment by the applicant of the likely effect of the proposed licence on the resource quality, and that such assessment be subject to the EIA regulations. A person may use water, if the use is-

- permissible as a continuation of an existing lawful water use (ELWU);
- permissible in terms of a general authorisation (GA);
- permissible under Schedule 1; or
- authorised by a licence (i.e.: a Water Use Licence (WUL).

The NWA defines 11 water uses. A water use may only be undertaken if authorised. Water users are required to register certain water uses that actually took place on the date of registration, irrespective of whether the use was lawful or not.

Section 21 of the National Water Act 1998 lists the following 11 water uses which can only be legally undertaken through the water use authorisation issued by the Department of Water and Sanitation (DWS):

(a) taking water from a water resource ;

(b) storing water;

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

(d) engaging in a stream flow reduction activity contemplated in section 36;

(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);

(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduits;

(g) disposing of waste in a manner which may detrimentally impact on a water resource;

(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

(i) altering the bed, banks, course or characteristics of a watercourse;

(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

(k) using water for recreational purposes.

As part of the NWA, and with specific reference the GN704 of 1999 has been published. These regulations impose specific restrictions on activities in terms of its locality. One of these restrictions are in terms of Regulation 4(c) saying that no person in control of a mine or activity, may place or dispose of any residue or substance which causes or is likely to cause pollution of water resources, prospecting diggings, pit or any other excavation. If the waste classification results reflect pollution potential, an applicant will therefore have to apply

for exemption from GN704 in order to undertaken concurrent rehabilitation. If no pollution potential is revealed by the classification results, no exemption is required. GN704 also prescribes the design and construction of pollution control dams.

3.2.4. NATIONAL ENVIORNMENTAL MANAGEMENT: WASTE ACT

On 2 June 2014 the National Environmental Management: Waste Amendment Act came into force. Waste is accordingly no longer governed by the MPRDA, but is subject to all the provisions of the National Environmental Management: Waste Act, 2008 (NEMWA).

Section 16 of the NEMWA must also be considered which states as follows:

1. "A holder of waste must, within the holders power, take all reasonable measures to-
    a. avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;
    b. reduce, re-use, recycle and recover waste;
    c. where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
    d. manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour, or visual impacts;
    e. prevent any employee or any person under his or her supervision from contravening the Act; and
    f. prevent the waste from being used for unauthorised purposes."

These general principles of responsible waste management will be incorporated into the requirements of the EMPR to be implemented for this project.

3.2.5. NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT

The National Environmental Management: Air Quality Act (NEMAQA) is the main legislative tool for the management of air pollution and related activities. The Object of the Act is:

a) to protect the environment by providing reasonable measures for-
    i. the protection and enhancement of the quality of air in the republic;
    ii. the prevention of air pollution and ecological degradation; and
    iii. securing ecologically sustainable development while promoting justifiable economic and social development; and
b) Generally to give effect to Section 24(b) of the constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and wellbeing of people.

Section 21 of the NEMAQA allows that the Minister to publish a list of activities which may result in atmospheric emissions and which may have a significant detrimental effect on the environment. The NEMAQA further requires that no person may, without a provisional atmospheric emissions licence or an atmospheric emissions licence conduct an activity which is listed in accordance with Section 21.

3.2.6. NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT

The National Environmental Management: Biodiversity Act (Act 10 of 2004)(NEMBA), 'provides for: the management and conservation of South Africa's biodiversity within the framework of the NEMA; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous biological resources; the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute (SANBI); and for matters conducted therewith".

In terms of the Biodiversity Act, the applicant has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorization of the area (not just by listed activity as specified in the EIA regulations);
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity; and
- Limit further loss of biodiversity and conserve endangered ecosystems.

Regulations published under the NEMBA also provide a list of protected species, according to the Act (GN R. 151 dated 23 February 2007, as amended in GN R. 1187 dated 14 December 2007). Section 57 of NEMBA identifies restricted activities involving threatened or protected species. Restricted activities include the gathering, collecting, cutting, uprooting, damaging or destroy a listed species.

3.2.7. NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT

The National Environmental Management: Protected Areas Act (Act 57 of 2003) serves to: "provide for the protection and conservation of ecologically viable areas representative of South Africa's biological biodiversity and its natural landscapes and seascape; for the establishment of a national register of all national, provincial and local protected areas; for the management of those areas in accordance with national norms and standards; for intergovernmental co-operation and public consultation in matters concerning protected areas; for the continued existence, governance and functions of South African National Parks; and for matters in connection therewith.

The objectives of this Act are –

a) to provide, within the framework of the national legislation, including the National Environmental Management Act, for the declaration and management of protected areas;

b) to provide for co-operation governance in the declaration and management of protected areas;

c) to effect a national system of protected areas in South Africa as part of a strategy to manage and conserve its biodiversity;

d) to provide for a diverse and representative network of protected areas on state land, private land, communal land and marine water;

e) to promote sustainable utilisation of protected areas for the benefit of people, in a manner that would preserve the ecological character of such areas;

f) to promote participation of local communities in the management of protected areas, when appropriate; and

g) to provide for the continued existence of South African National Parks.

3.2.8. NATIONAL ENERGY ACT

The National Energy Act (Act 34 of 2008) provides to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors; to provide for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feedstock's and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure; to provide measures for the furnishing of certain data and information regarding energy demand, supply and generation; to establish an institution to be responsible for promotion of efficient generation and consumption of energy and energy research; and to provide for all matters connected therewith. Importantly, the DoE is mandated to provide for energy planning and measures for the furnishing of certain data and information regarding energy demand, supply and generation.

The objectives of this Act are to-

a) ensure uninterrupted supply of energy to the Republic;

b) promote diversity of supply of energy and its sources;

c) facilitate effective management of energy demand and its conservation;

d) promote energy research;

e) promote appropriate standards and specifications for the equipment, systems and processes used for producing, supplying and consuming energy;

f) ensure collection of data and information relating to energy supply, transportation and demand;

g) provide for optimal supply, transformation, transportation, storage and demand of energy that are planned, organised and implemented in accordance with a balanced consideration of security of supply, economics, consumer protection and a sustainable development;

h) provide for certain safety, health and environment matters that pertain to energy;

i) facilitate energy access for improvement of the quality of life of the people of Republic;

j) commercialise energy-related technologies;

k) ensure effective planning for energy supply, transportation and consumption; and

l) contribute to sustainable development of South Africa's economy.

The Act provides for the establishment of the South African National Energy Development Institution (SANEDI), whose functions include:

a. energy efficiency-
   i. undertake energy efficiency measures as directed by the Minister;
   ii. increase energy efficiency throughout the economy;
   iii. increase the gross domestic product per unit of energy consumed; and
   iv. optimise the utilisation of finite energy resources;

b. energy research and development-
   i. direct, monitor, conduct and implement energy research and technology development in all fields of energy, other than nuclear energy; and
   ii. promote energy research and technology innovation;
   iii. provide for-
      (aa) training and development in the field of energy research and technology development;
      (bb) establishment and expansion of industries in the field of energy; and
      (cc) commercialisation of energy technologies resulting from energy research and development programmes;
   iv. register patents and intellectual property in its name resulting from its activities;
   v. issue licences to other persons for the use of its patents and intellectual property;
   vi. publish information concerning its objects and functions;
   vii. establish facilities for the collection and dissemination of information in connection with research, development and innovation;
   viii. undertake any other energy technology development related activity as directed by the Minister, with the concurrence of the Minister of Science and Technology;
   ix. promote relevant energy research through cooperation with any entity, institution or person equipped with the relevant skills and expertise wit
   x. hin and outside the Republic;

xi. make grants to educational and scientific institutions in aid of research by their staff or for the establishment of facilities for such research;

xii. promote the training of research workers by granting bursaries or grants-in-aid for research;

xiii. undertake the investigations or research that the Minister, after consultation with the Minister of Science and Technology, may assign to it; and

xiv. advise the Minister and the Minister of Science and Technology on research in the field of energy technology.

3.2.9. NATIONAL GAS ACT

The Gas Act (Act 48 of 2001) aims to promote the orderly development of the piped gas industry; to establish a national regulatory framework; to establish a National Gas Regulator as the custodian and enforcer of the national regulatory framework; and to provide for matters connected therewith.

3.2.10. NATIONAL HERITAGE RESOURCE ACT

The National Heritage Resources Act (NHRA) stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, “no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…” The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA, MPRDA and the DFA legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Section of these Acts relevant to heritage (Fourie, 2008b):

The NEMA 23(2)(b) states that an integrated environmental management plan should, “…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage”.

A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken account of in the Regulations under NEMA is the Specialist Report requirements laid down in Section 33 (Fourie, 2008b).

MPRDA defines ‘environment’ as it is in the NEMA and therefore acknowledges cultural resources as part of the environment. Section 39(3)(b) of this Act specifically refers to the evaluation, assessment and identification of impacts on all heritage resources as identified in Section 3(2) of the National Heritage Resources Act that

are to be impacted on by activities governed by the MPRDA. Section 40 of the same Act requires the consultation with any State Department administering any law that has relevance on such an application through Section 39 of the MPRDA. This implies the evaluation of Heritage Assessment Reports in Environmental Management Plans or Programmes by the relevant heritage authorities (Fourie, 2008b).

In accordance with the legislative requirements and EIA rating criteria, the regulations of the South African Heritage Resources Agency (SAHRA) and Association of Southern African Professional Archaeologists (ASAPA) have also been incorporated to ensure that a comprehensive and legally compatible HSR report is compiled.

3.2.11. ENVIRONMENT CONSERVATION ACT

The Environment Conservation Act (Act 73 of 1989) (ECA) was, prior to the promulgation of the NEMA, the backbone of environmental legislation in South Africa. To date the majority of the ECA has been repealed by various other Acts, however Section 25 of the Act and the Noise Regulations (GN R. 154 of 1992) promulgated under this section are still in effect. These regulations serve to control noise and general prohibitions relating to noise impact and nuisance.

3.2.12. CONSTITUTION OF SOUTH AFRICA

Section 24 of the Constitution states that everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

- Prevent pollution and ecological degradation;
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The public's right to be involved in decisions that may affect them is enshrined in the South African Constitution. Section 57(1) of the new Constitution provides that: "The National Assembly may (b) make rules and orders concerning its business, with due regard to representative and participatory democracy, accountability, transparency and public involvement".

This provision, along with several others gave rise to many new trends in South African legislation. In environmental legislation, the idea of public participation (or stakeholder engagement) features strongly and especially the National Environmental Management Act (Act No. 107 of 1998 - NEMA) and the recent regulations passed under the auspices of this Act makes very strict provisions for public participation in environmental decision-making.

Public participation can be defined as "*a process leading to a joint effort by stakeholders, technical specialists, the authorities and the proponent who work together to produce better decisions than if they had acted*

independently" (Greyling, 1999, p. 20). From this definition, it can be seen that the input of the public is regarded as very important indeed.

3.3 OTHER APPLICABLE POLICIES AND PROGRAMMES

Over the past five years, the Department of Energy has been engaged in the review, and introduction of energy policies, regulations and plans to ensure that they enable the energy sector to provide the growth stimulus needed in South Africa. As part of the Department's 2014/15 medium-term planning process, the Department has ensured that as we introduce, revise and finalise our policies, regulations and plans, we incorporate the NDP provisions. For example, the Integrated Energy Plan (IEP), which is due for finalisation and submission to Cabinet for approval, will include the long- and short-term plans for electricity, gas, nuclear and liquid fuels. This energy plan seeks to provide a future energy roadmap for South Africa, by evaluating the best energy policy options or policy alternatives against each of the eight (8) key objectives identified during the planning process" (Department of Energy, 2014).

TABLE 7: SUMMARY OF DEPARTEMENTAL POLICIES AND PROGRAMMES

Policy/Programme	Objectives
White Paper Energy Policy	This policy aims to clarify government policy regarding the supply and consumption of energy for the next decade. It promotes the development of underdeveloped systems in certain areas and demonstrates a resolve to bring about extensive change in a number of areas. The White paper provides an overview of the of the energy sectors contribution to the GDP, employment, taxes and the balance of payments. Part 3 and Part 4 of the policy contain sections involving the management of the environment. Sections 7.5 and 7.7 of Part 3 focus Natural Gas and Renewable Energy Sources respectively. Section 7.5.3 lists the benefits of using natural gas as a source of energy. Sections 8.1, 8.3 and 8.4 focus on Integrated energy planning, energy efficiency and environment, health and safety respectively.
Integrated Energy Plan (IEP)	The purpose of the Integrated Energy Plan (IEP) is to determine and present the best way to meet current and future energy service needs in the most efficient and socially beneficial manner, while, amongst others, minimising the adverse impacts of the energy sector on the environment. The IEP identifies key objectives, of which the following relate to the management of the environment: • Objective 5: Minimise emissions from the energy sector; • Objective 6: Promote energy efficiency in the economy; and • Objective 8: Promote the conservation of water. The following are the key aspects of the plan: • Energy supply will remain reliant on coal for at least the next two decades. • Energy supply will be diversified through the increased use of natural gas and renewable energies. • Investigations into nuclear options as a future new energy source will be continued.

	• The use of energy efficiency management and technologies will be promoted. • Load factors on electricity generation plant to lower levelised lifecycle costs will be maximised. • Reliance on imported liquid fuels by exploring and developing oil I gas deposits will be lessened. • Existing oil refineries capacities when appropriate rather than green fields' development will be increased. • Existing synfuel plants will be maintained and supplemented with natural gas as feedstock. • New electricity generation will remain coal based with potential for hydro, natural gas and nuclear capacity. • Environmental considerations in energy supply, transformation and end use will be ensured. • Universal access to clean and affordable energy, with emphasis on household energy supply being co-ordinated with provincial and local integrated development programmes will be promoted. • Policy, legislation and regulation for the promotion of renewable energy and energy efficiency measures and mandatory provision of energy data will be introduced. Integrated energy planning will be undertaken on an ongoing basis.
Green Transport Programme	The "Green Transport Programme" has the following strategic focus areas: ▪ Piped Compressed Natural Gas (CNG) & refuelling infrastructure; ▪ Land Fill Gas, and municipal waste harvesting for municipal fleets and public transport; ▪ Liquid Petroleum Gas (LPG); ▪ Biodiesel and micro-emulsification technologies and refuelling infrastructure; ▪ Electric Vehicles (EVs) and recharge infrastructure; and ▪ A technology incubation hub, where SMME's and developers can be assisted in technology innovation and concept development to bring new solutions from concept to commercialisation.

TABLE 8: SUMMARY OF ADDITIONAL POLICIES AND PROGRAMMES

Policy/Programme	Objectives
Integrated Environmental Management Information guideline series: • Guideline 4: Strategic Environmental Assessment. • Guideline 7: Public Participation. • Guideline 9: Need and desirability.	Department of Environmental Affairs developed these guidelines as a tool to assist with the various environmental aspects of a development.

4. ALTERNATIVES

The identification of alternatives is a key aspect of the success of the EIA process. All reasonable and feasible alternatives must be identified and assessed to determine the most suitable alternatives for the proposed project. There are however some significant constraints that have to be taken into account when identifying alternatives for a project of this scope. Such constraints include financial, social, and environment related issues. Alternatives can typically be identified according to:

- Activity alternatives;
- Location alternatives;
- Design and layout alternatives;
- Technological alternatives;
- The No-Action alternative (No-Go).

For any alternative to be considered feasible such an alternative must meet the need and purposes of the development proposal without presenting significantly high associated impacts. The remainder of this section briefly describes the alternatives which were considered viable and feasible for this project as well as reasons why some will not be assessed in the EIA Phase.

Alternatives can also be distinguished into discrete or incremental alternatives. Discrete alternatives are overall development options, which are typically identified during the pre-feasibility, feasibility and or scoping phases of the EIA process (DEAT; 2004). Incremental alternatives typically arise during the EIA process and are usually suggested as a means of addressing identified impacts. These alternatives are closely linked to the identification of mitigation measures and are not specifically identified as distinct alternatives.

4.1. LOCATION ALTERNATIVES

Location alternatives relate to the main proposed project components (e.g. well sites) as well as the location of ancillary activities and structures (e.g. construction areas, access roads, laydown areas, etc.). The location alternatives considered for this project are discussed below.

4.1.1. EXPLORATION RIGHT APPLICATION AREA

The purpose of the exploration is to acquire and evaluate the relevant data to determine where the resource (oil, gas or condensate) may be located. The process is iterative and data gained in the early phases is used to improve the level of knowledge and refine the anticipated extent of the resource. Due to the low level of accuracy of the publicly available data, it is necessary to hold a right over a large area such that with ongoing data collation and refinement any identified resource is within the boundaries of the application area. Furthermore, due to the dispersed nature of petroleum resources is such that a reasonably large area is required initially in order to secure an economically viable resource. Therefore, exploration right applications are typically over extensive areas.

It is not possible for more than one exploration right to be held over land and, therefore, an application area must be distinct from other exploration rights (and applications). Therefore an exploration area is identified in association with PASA and allocated to a single applicant. See the PASA map (http://www.petroleumagencysa.com/index.php/maps) for details of all existing exploration rights and applications. The extent of the proposed Motuoane Henneman study area does not overlap with other exploration application areas.

In light of the above no alternative exploration right area will be considered further during the EIA.

4.1.2. PROPERTIES FOR EXPLORATION ACTIVITIES

The nature of exploration and the accuracy of the initial data available at the time of application is such that it is not possible to define the location for most of the proposed activities at this stage. Due to the costly and a low possibility of success, the exploration company is motivated to undertake the fewest activities in the most cost effective manner. Exploration is, therefore, undertaken, in an iterative manger with the data gained in the early phases used to improve the method and locality of the work planned for later stages. Therefore, it is only possible to determine where on the ground activities, such as drilling, may take place once the initial phases have been undertaken. These initial phases can only be undertaken once an exploration right is granted.

In terms of Section 48 of the MPRDA an exploration right may not be held over land comprising residential areas, any public road, cemetery or railway, land used for public or government purposes or reserved in terms of any other law or areas identified in terms of section 49 of the MPRDA. Section 48 of the National Environmental Management: Protected Area Act (Act 57 of 2003) (NEMPAA), also restricts exploration from all protected areas. Therefore, no exploration will be proposed on such properties, and these properties will be excluded from the exploration right application area.

4.1.3. LOCALITY OF ACTIVITIES

The specific locality of the on the ground activities, such as drilling, can only be identified once the initial phases have been undertaken and targets identified. Private property will only be accessed with prior consent of the landowner and then in terms of written agreement. The nature of the exploration activities is such that the target sites are somewhat adjustable. This provides the operator with flexibility to move the sites for on-the-ground-activities to avoid local sensitivities that must be avoided (e.g. residence, wetlands and watercourse, etc.) with buffers where required. The location of the wells will be determined based on the various specialist studies and associated sensitivity mapping exercise, as well as further detailed site specific assessments. This will be further assessed during the EIA phase.

4.2. TECHNOLOGY ALTERNATIVES

The selection of the techniques to be adopted for the proposed exploration will take into account the nature of the substrata and the levels of the drilling required. The technological alternative for this project involves drilling options that can be considered for the drilling of the proposed exploration wells.

Motuoane has only proposed the drilling of stratigraphic wells for early-phase exploration. These stratigraphic wells are drilled solely for the purpose of obtaining information on the geological, structural and stratigraphic parameters for the purpose of discovering a petroleum resource. These wells, and the associated equipment for drilling, are similar to those used for water boreholes on farm properties as well as prospecting wells for various other minerals.

The use of diamond core drilling has been proposed for drilling the stratigraphic wells. The alternative is to use Percussion/Reverse Circulation (RC) Drilling. However, Percussion/Reverse Circulation (RC) Drilling has limitations as a drilling method for petroleum exploration as the depth of drilling is limited by the air pressure, and the cutting delivered to the surface are a finely crushed material. The diamond core method delivers a cylindrical core of rock for examinations, which allows for better interpretation of stratigraphy and in-situ parameters. Percussion/Reverse Circulation (RC) Drilling is therefore not considered as a reasonable or feasible alternative technology and will not be assessed as an alternative in this regard.

4.3. ACTIVITY ALTERNATIVES

No activity alternatives have considered because the site has been identified by Motuoane Energy only for exploration for hydrocarbons. It is not possible for more than one exploration right to be held over land and, therefore, an application area must be distinct from other exploration rights (and applications). Therefore an exploration area is identified in association with PASA and allocated to a single applicant.

4.4. THE NO GO ALTERNATIVE

This alternative will imply that no exploration takes place and that the environment remains unchanged and unaltered. The proposed site for the exploration comprises large areas of cultivation and historical mining activities. The dominant farming activities are livestock and mixed farming. Livestock farming dominates agricultural activity with sheep and cattle being the main livestock bred. There are significant areas that have been altered by previous cultivation and mining activities, however sections of the site remain as unaltered natural vegetation. If the exploration should not take place, the verification of a potential viable economic activity in the form of production would not occur. This alternative will be assessed in detail during the EIA Phase.

4.5. PROJECT ALTERNATIVES TO BE CONSIDERED

The alternatives considered and discussed in this scoping report, including land use, location, and exploration placement alternatives have culminated into the identification of three feasible development alternatives. These three feasible development alternatives as discussed above are summarised below.

4.5.1. ALTERNATIVE 1: NO GO ALTERNATIVE

This alternative will imply that no exploration takes place and that the environment remains unchanged and unaltered. The proposed site for the exploration comprises large areas of cultivation and historical mining activities. The dominant farming activities are livestock and mixed farming. Livestock farming dominates agricultural activity with sheep and cattle being the main livestock bred. There are significant areas that have been altered by previous cultivation and mining activities, however sections of the site remain as unaltered

natural vegetation. If the development should not take place, the verification of a potential viable economic activity in the form of production would not occur.

4.5.2. ALTERNATIVE 2: MAXIMUM EXPLORATION EXTENT

In this alternative, the exploration activities are emphasised. Less restrictive mitigation measures will be used to protect the environmental features, thus allowing for unrestricted exploration. This approach will potentially increase the efficacy of the exploration activities at the potential cost of impacting more severely on environmental features. This alternative is likely to increase landscape character changes and impact more on aspects such as hydrology, ecology, wetlands, heritage, and land use, as exploration activities will be more likely to move through these sensitive environmental features.

4.5.3. ALTERNATIVE 3: SENSITIVITY PLANNING APPROACH

This alternative will emphasise resource protection and use stringent mitigation measures to minimise identified adverse impacts. In addition, this alternative will use specialist planning and evaluation of the following in order to avoid impacting on consolidated sensitive environmental features:

- Exploration footprint;
- Well placement; and
- Soil sampling sites.

This alternative will allow for the proposed Motuoane Henneman exploration activities to be undertaken whilst protecting identified sensitive environmental features as indicated in the consolidated sensitivity map. This alternative will use the consolidated sensitivity map to assist in the layout and placement of the proposed exploration activities as well as to guide the level of onsite environmental ground truthing required before final site selection is made.

5. PUBLIC PARTICIPATION PROCESS (PPP)

This section presents a summary of the various components pertaining to the Public Participation Process (PPP) for the project, full details are obtainable from the Issues and Responses Report (IRR) appended to this Scoping Report (refer to Appendix D)

5.1 STAKEHOLDER ENGAGEMENT

The PPP is a requirement of several pieces of South African Legislation and aims to ensure that all relevant Interested and Affected Parties (I&APs) are consulted, involved and their opinions are taken into account, and a record of consultation included in the reports submitted to authorities. The PPP ensures that stakeholders are provided the opportunity to be involved as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed Motuoane Henneman exploration project needs to be managed sensitively and according to best practises in order to ensure and promote the following:

- Compliance with international best practice options;
- Compliance with national legislation;
- Establish and manage relationships with key stakeholder groups; and
- Encourage involvement and participation in the environmental study and authorisation/approval process.

As such, the purpose of the PPP and stakeholder engagement process is to:

- Introduce the proposed exploration project;
- Explain the environmental authorisations required;
- Explain the environmental studies to be undertaken (where applicable);
- Determine and record issues, concerns, suggestions, and objections to the project;
- Provide opportunity for input and gathering of local knowledge;
- Establish and formalise lines of communication between the I&AP's and the project team;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent negative environmental impacts and maximize and/or promote positive environmental impacts associated with the project.

5.2 METHODOLOGY

The PPP for the proposed Motuoane Henneman exploration project has been undertaken in accordance with the requirements of the MPRDA and NEMA, in line with the principles of Integrated Environmental Management (IEM). IEM implies an open and transparent participatory process, whereby stakeholders and other I&APs are afforded an opportunity to comment on the project.

5.2.1. IDENTIFICATION OF I&APS

An initial I&AP database has been compiled from Windeed searches as well as information from previously conducted EIA projects, particularly those that were in the vicinity of the proposed project. The I&AP database includes amongst others landowners, organs of state, communities, regulatory authorities, and other specialist interest groups. Below is a summary of the various entities identified and consulted during scoping and they include the following broad groups:

- Authorities, including ward councillors, etc.
- Key stakeholders, including:
    - Land owners of the properties associated with the application.
    - Owners and custodians of existing infrastructure within the study area.
    - Adjacent land owners and land users.
    - Surrounding communities.
    - Non-Governmental Organisations (NGO's).
- Potential sensitive receptors.
- I&APs who express an interest in the project.

These I&APs have been and will continue to be consulted throughout the EIA process of the proposed Motuoane Henneman project. Furthermore, all I&APs (including new I&APs and those who have already registered) are encouraged through advertisements (newspaper and on-site notices), written correspondence, and consultation meetings to participate in the process.

5.2.2. AFFECTED LANDOWNERS AND OCCUPIERS

All the affected properties within the exploration right application area (see list attached in Appendix B) were identified and included in the project database as pre-identified I&APs. The affected properties were searched against the Deeds Office records to identify the landowner. A follow up Windeed contact details search was conducted on landowners identified. Where properties were owned by a company a further Windeed Company search was done to identify an active director and subsequently their relevant contact details. Where properties were owned by Trusts, a request was submitted to the relevant Department of Justice to obtain the contact details- where available the relevant contact information was included in the database.

All landowners for whom contact details were obtained were notified of the EIA process by means of a letter and Background Information Document (BID), which included a request for information on legal occupiers of the said properties where available. Site notices and posters were placed within and around the study area and in public venues, and advertisements placed in local and regional newspapers to ensure that occupiers and other community members were notified about the project.

Requests were made to the local municipalities, ward councillors and landowners to identify any relevant community organisations, and or tribal authorities that should be consulted in an effort to include as many I&APs as possible in the process.

5.2.3. AUTHORITIES AND ORGANS OF STATE

The following Government Authorities were notified of the proposed project:

- Matjhabeng Municipality;
- Masilonyana Local Municipality;
- Moqhaka Local Municipality;
- Lejweleputswa District Municipality;
- Fezile Dabi District Municipality;
- Free State Department of Cooperative Governance and Traditional Affairs;
- Free State Department of Economic, Small Business Development and Tourism;
- Free State Department of economic, small business development, tourism and environmental affairs
- Free State Department of Labour;
- Free State Department of Mineral Resources;
- Free State Department of Social Development;
- Free State Department of Public Works and Infrastructure;
- Free State Department of Police, Roads and Transport;
- Free State Department of Agriculture and Rural Development;
- Free State Department of Water and Sanitation;
- South African National Road Agency Limited (SANRAL – Free State Region);
- Catchment Management Agency;
- National Department of Agriculture, Forestry and Fisheries;
- National Development Agency;
- National Commission on Restitution on Land Rights
- National Department of Rural Development;
- National Department of Mineral Resources;
- National Energy Regulator of South Africa (NERSA)
- South African National Roads Agency Limited (SANRAL);
- Transnet.

5.2.4. INITIAL NOTIFICATION OF I&APS

The PPP commenced on the 27th May 2016 with an initial notification and call to register, and ended on the 30th June 2016. Initial notification was given in the following manner:

<u>REGISTERED LETTERS, FAXES AND EMAILS</u>

Notification letters (English, Afrikaans, and SeSotho), faxes, and emails were distributed to all pre-identified key I&APs including government organisations, landowners, NGOs, relevant municipalities, ward councillors, and other organisations that might be affected.

The initial notification letter included the following information:

- List of anticipated activities to be authorised;
- Scale and extent of activities to be authorised;
- Sufficient detail of the intended operation to enable I&APs to assess/surmise what potential impacts the proposed activities may have on them or on the use of their land;
- The purpose of the proposed project;
- Details of the affected properties (including a locality map);
- Details of the MPRDA and NEMA regulations that must be adhered to;
- Date by which any request to register as an I&AP must be forwarded through to EIMS; and
- Contact details of the EAP.

In addition, a registration sheet/ questionnaire was included in the registered letters, emails and facsimiles to landowners towards facilitating registration and soliciting input on local knowledge of the study area.

BACKGROUND INFORMATION DOCUMENT

A Background Information Document (BID) in English was prepared and distributed by post with the registered letter, and made available on the EIMS website (www.eims.co.za). The BID contains the following information:

- Project Name;
- Applicant name;
- Project location;
- Map of affected project area;
- Description of the exploration right application process;
- Information on document review;
- A detailed questionnaire;
- I&AP registration form; and
- Relevant EIMS contact person for the project.

NEWSPAPER ADVERTISEMENTS

Three (3) newspaper advertisements describing the Exploration Right Application and EIA process were placed in newspapers with adequate circulation in the area. The advertisements were placed in the following newspapers:

- Volksblad (in English and Afrikaans) on the 27th May 2016;
- Dumelang News (SeSotho) on the 27th May 2016; and
- Provincial Gazette (English).

The newspaper adverts included the following information:

- Project name;
- Applicant name;
- Project location;
- Nature of the activity; and

- Relevant EIMS contact person for the project.

SITE NOTICE PLACEMENT

A total of 75 A2 Correx site notices were placed along and within the perimeter of the proposed project area on the 30th and 31st of May 2016. The on-site notices included the following information:

- Project name;
- Applicant name;
- Project location;
- Map of proposed project area;
- Project description;
- Legislative requirements; and
- Relevant EIMS contact person for the project.

POSTER PLACEMENT

A3 posters in English, Afrikaans and SeSotho were placed at 11 local public gathering places in towns near the study area (Kroonstad, Theunissen, Ventersburg, and Henneman).

The notices and written notification afforded all pre-identified I&APs the opportunity to register for the project as well as to submit their issues/queries/concerns, and indicate the contact details of any other potential I&APs that should be contacted. The contact person at EIMS, contact number, email and faxes were clearly stated on the posters. Comments/concerns and queries were encouraged to be submitted in either of the following manners:

- Electronically (fax, email);
- Telephonically; and/or
- Written letters.

5.2.5. SCOPING REPORT REVIEW

Notification regarding the availability of this Scoping Report for public review has been given in the following manner:

- Registered letters with details on where the scoping report is available from, as well as the public review comment period, were distributed to all registered I&APs (which includes key stakeholders and landowners);
- Facsimile notifications with information similar the that in the registered letter described above, were distributed to all registered I&APs; and
- Email notifications with a letter attachment containing the information described above were also distributed to all registered I&APs.

The Scoping Report was made available for public review from the 11th of July 2016 until the 11th of August 2016, an overall comment period of 30 days.

5.2.6. SCOPING OPEN DAY

Details regarding the Open Day was included in the notification regarding the availability of the scoping report for public review. The details included the date, time and venue for the meeting and open day. The notifications were distributed via registered letter, facsimile, and email, all registered I&APs.

The public open day attendance register, as well as the minutes of the public open day will be included in the Scoping Report submitted to the competent authority (the PASA). I&APs who attend the open day will be registered for the project through the attendance register which will be available at the open day.

5.2.7. SUMMARY OF ISSUES RAISED

The issues and responses included in this report are those that have been received and responded to from the commencement of the initial registration period on the 27th of May 2016, to the end of the initial registration period, 30 June 2016. Any issues received after the 30th of June 2016 will still be responded to and included in the final report for submission to the PASA. Issues raised were addressed in a transparent manner and included in the Issues and Responses Report (Appendix D). Table 9 below provides a summary of the comments/issues raised and an indication of where these are addressed in the report or further comment on the issue.

TABLE 9: SUMMARY OF COMMENTS / CONCERNS RAISED.

Aspect	PPP Summary	Comment / Location in Report
Registration	Request to be registered, registration acknowledgement and confirmation	Section 5, Appendix D,
General Public Participation & EIA Information	Request for project information (affected properties, locality map, EIA timeframes, reports and meeting dates, registration forms), EAP independence, conflict of interest, landowner consultation,	Section 5, Appendix D
Alternatives	Renewable energy options	Section 4 (to be considered further in the EIA)
Fracking	Fracking concerns, earthquakes	The issue of “fracking” has been raised by a number if I&AP’s. It is important to note that the exploration

		activities do not include any form of artificial well stimulation
Objection	General objection to exploration	Section 5, Appendix D
Heritage	SAHRA application procedures, damage to cultural, heritage and historical features (structures, graves, etc.)	Section 6, Section 7
Socio-economic	Farm/ site access, safety and security, compensation, land value depreciation, loss of employment, veldfires, contractor liability, social benefits, health concerns	Section 6, Section 7
Ecology and wetlands	Impact on biodiversity (fauna and flora), impact on wetlands,	Section 6, Section 7, Appendix E
Existing infrastructure	Transnet infrastructure, Eskom infrastructure, impact on roads and farm infrastructure,	Section 6 Will also be considered further in the EIA
Existing land uses	Impact on agricultural/ farming activities	Section 7
Groundwater and surface water	Groundwater contamination, water consumption (quantity), water conservation	Section 6, Section 7
Air pollution	Air pollution, greenhouse gases, fossil fuels, climate change	This concern and associated impact will be further investigated during the EIA phase.
Land claims	Existing land claims	This concern and associated impact will be further investigated during the EIA phase.

6. DESCRIPTION OF RECEIVING ENVIRONMENT

6.1. CULTURAL AND HERITAGE RESOURCES

The following section provides information about the cultural and heritage baseline of the proposed Motuoane Henneman exploration area. Information in this section was sourced from the heritage scoping report that was conducted by PGS Heritage and is based on intensive archival and literature research. It must be noted that such an overview, which is based on available literature and archival research, is likely to reflect a bias toward a traditional white history of the region as this would have been the focus of publications and archival documents during the last 150 years. Refer to Appendix E1 for the heritage scoping report by PGS Heritage.

6.1.1. REGIONAL DESCRIPTION

The Free State has a rich archaeological and historical history going back millions of years and includes significant aspects such as Later Stone Age rock art, Battlefields and Iron Age stonewalled enclosures. The general surroundings of the study area became a melting pot of contact and conflict as it represents one of many frontiers where San hunter-gatherers, Nguni agro-pastoralists, Dutch Voortrekkers and British Colonists all came together. The ravages of war also swept across these plains, and in particular the South African War (1899-1902) as well as the Boer Rebellion (1914-1915).

The archaeological history of the area can broadly be divided into a Stone Age, Iron Age and Historic Period. Both the Stone and Iron Ages form part of what is referred to as the Pre-Colonial Period (Prehistoric Period) whereas the Historic Period is referred to as the Colonial Period (Historic Period).

6.1.2. SITE SPECIFIC DESCRIPTION

Table 10 below presents a summary of details from previous archaeological and heritage studies from within the study area as well its surroundings. This summary is based on previous reports that could be located on the South African Heritage Resources Information System (known as SAHRIS) and records of the SAHRA APM Report Mapping Project.

TABLE 10: ARCHAEOLOGICAL AND HISTORICAL OVERVIEW OF THE STUDY AREA AND SURROUNDING LANDSCAPE

DATE	DESCRIPTION
The Study Area during the Stone Age	
Very little is known about the Stone Age archaeology of the study area and its immediate surroundings. In the wider surroundings, probably the most significant Stone Age is at Florisbad, located roughly 69 km south-west of the present study area. Closer to the study area, a number of Middle and Later Stone Age material in associated with mammal fossil remains have been identified in erosion gulleys along the Sand, Doring and Vet Rivers between Virginia and Theunissen (De Ruiter *et. al.* 2011). See also Rossouw (n.d.).	
2.5 million to 250 000 years ago	The Earlier Stone Age (ESA) is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates back to approximately 1.5 million years ago. No information regarding Early Stone Age sites from the study area or surroundings could be located.
>250 000 to 40 000 years ago	The Middle Stone Age (MSA) is associated with flakes, points and blades manufactured by means of the prepared core technique. This phase is furthermore associated with modern humans and complex cognition (Wadley, 2013). During research fieldwork by the National Museum in Bloemfontein, ten sites were recorded where Middle Stone Age and/or Later Stone Age lithics were identified in association with mammal fossil remains from erosion gulleys along the Sand, Vet and Doring Rivers (De Ruiter *et. al.* 2011). While many of these sites are located within a distance of 20 km of the present study area, one site is located within the study area. This site is named Le Roux 717, and comprises a number of Middle Stone Age lithics exposed by erosion with some Later Stone Age lithics identified on the overlying undisturbed horizon above.
40 000 years ago to c. 1800s	The Later Stone Age (LSA) is the third archaeological phase identified and is characterised by an abundance of very small stone tools known as microliths as well many rock art sites across the country. This period is associated with hunter-gatherers (San) as well as early pastoralists (Khoekhoe) and lasted up until - and in

	many cases a considerable number of years after – the arrival of Iron Age and European communities. Apart from the occurrence of Later Stone Age lithics along the Sand, Vet and Doring Rivers (see above), no other Later Stone Age sites are known from the surroundings of the study area. Similarly, no known rock art sites are known from the study area or its wider surroundings.
The Study Area during the Iron Age	
The arrival of early farming communities during the first millendium, heralded in the start of the Iron Age for South Africa. The Iron Age is that period in South Africa's archaeological history associated with pre-colonial farming communities associated with agricultural and pastoralsit farming activites, metal working, cultural customs such as lobola as well as the tangible representation of the significance of cattle imprinted on their settlement layouts (known as the Central Cattle Pattern) (Huffman, 2007). According to the distribution map for Iron Age settlements on the Southern Highveld as published in Maggs (1976), the largest majority of such known Late Iron Age sites from within the study area are located in proximity to the Sand River as well as the Erasmus Spruit. With these Late Iron Age sites located within the study area, the majority comprise what is referred to as Type Z settlements, with a lesser number of Type V settlements also found. The distribution maps published by Huffman (2007), indicate that two Iron Age facies occurred in the surroundings of the study area during roughly the same period. These two comprise the Thabeng and Makgwereng facies.	
AD 1700 – AD 1840	The Thabeng facies of the Moloko Branch of the Urewe Tradition is one of the facies identified within the study area. The decoration on the ceramics associated with this facies is characterised by incised triangles, coloured chevrons and arcades. The Tlhaping at Dithakong, Rolong at Platberg and the Kubung from the Free State form a Southwestern Sotho-Tswana cluster that is associated with this Thabeng facies pottery and Type Z settlement layouts (Huffman, 2007). The Type Z settlements are one of the Late Iron Age stonewalled settlement types identified by Tim Maggs during his extensive archaeological research project on the Iron Age of the southern Highveld, which includes the present study area (Maggs, 1976). These sites are characterised by large primary enclosures enclosed by a 'discontinuous ring' of characteristic bilobial dwellings. Each of these bilobial dwellings comprises a hut at its front with a semicircular courtyard at the back. With the area in front of the hut enclosed by a low stone wall and the courtyard at the back similarly enclosed by a smaller enclosure, the layout plan of these huts comprise two lobes, one larger than the other. The huts are defined by a ring of uprihst stones and are usually paved with flat stones. Unlike Type V settlements (see below), corbelled

	hut are rarely associated with these Type Z settlements, and appear to be the result of contact with the Type V settlements located to the east. While a number of Type Z sites are located within the study area, one of the more prominent ones is OXF1, located roughly 2.5 km north of the present study area and a short distance north-west of the town of Ventersburg. This site was excavated by Tim Maggs during the 1970s as part of his overall research project alluded to above (Maggs, 1976). In his conclusions on the history of his entire study area, Maggs (1976:317) states that "…*the conclusion seems inescapable that the Kubung were the builders of Type Z. This conclusion could be put forward on the typological evidence alone, for the Kubung are the only known off-shoot of the Rolong to have settled in our area, and the Type Z industry was clearly the work of a group related to the rolong*."
AD 1700 – AD 1820	The Makgwareng facies of the Blackburn Branch of the Urewe Ceramic Tradition represents the next known Iron Age period within the surroundings of the study area. The decoration on the ceramics from this facies is characterised by finely stamped triangles, rim notching and appliqué (Huffman, 2007). This facies developed from Ntsuanatsatsi south of the Vaal River and can be associated with the Type V stone walling settlement type (Huffman, 2007), the name of which is derived from Vegkop (Maggs, 1976). Van Riet Lowe (1927) was one of the first to record these structures. Dreyer (1990) also conducted excavations on Type V Late Iron Age stonewalled settlements located a short distance south-west of Winburg. The Type V settlements comprise a core of cattle enclosures surrounded by beehive huts. Corbelled stone huts are associated with this walling type, and can be seen as characteristic. They are low stone huts located at the edge of the cattle enclosures and were where the boys herding the cattle often lived (Huffman 2007). As suggested by Huffman (2007), the corbelled huts were in fact beehive huts made of stone rather than grass and reeds. Furthermore, the presence of beehive huts at these sites necessarily indicates a Nguni association or origin with these settlements. Based in information presently avaiable, the best known site of this type found within the surroundings of the study area, comprises a so-called "Early Sotho Settlement, Waterval, Sandrivierhoogte" that was originally declared a National Monument and which is now registered as a Provincial Heritage Site. The site is located a short distance outside the boundaries of the present study area. The site was proclaimed a national monument by virtue of a notice in the Government Gazette on 17 December 1982. In the declaration, the site is described as a 'Leghoya Village'

	comprising corbelled huts and stonewalls. The site has since been declared a Provincial Heritage Site in terms of the National Heritage Resources Act (www.sahra.org.za).
1820s	Across the Southern Highveld, this period was characterised by warfare and unrest. Known as the Mfecane, these years of upheaval originated primarily in the migration of three Nguni groups from present day Kwazulu-Natal into the present day Free State as a result of the conquests of the Zulu under King Shaka. The three Nguni groups were the Hlubi of Mpangazitha, the Ngwane of Matiwane and the Khumalo Ndebele (Matabele) of Mzilikazi. In c. 1821, the Hlubi migrated across the Drakensberg Mountains in a westerly direction (Maggs, 1976) and attacked the Tlokwa of MaNthatisi along the banks of the Wilge River. This river has its source near Harrismith and flows into the Vaal River where the Vaal Dam is located today. While it is not exactly certain where MaNthatisi's settlements would have been located (in all likelihood further south), the Tlokwa fled westward as a result of the Hlubi attack and in turn attacked other groups in its path. This started a period of unrest and warfare, which rippled across the Highveld on both sides of the Vaal River (Legassick, 2010) (Lye and Murray, 1980). The Ngwane followed closely on the Hlubi and further augmented the unrest and warfare along the southern Highveld (Legassick, 2010). Although the effects of the migrations of the Hlubi and Ngwane would certainly have had a profound impact on the northern Free State, this was also the case in terms of the Khumalo Ndebele who would have played a significant role in the surroundings of the study area during this time. The Khumalo Ndebele (also known as the Matabele) were also forced to leave Kwazulu-Natal and between 1823 and 1827 settled along the central Vaal River (Bergh, 1999). Mzilikazi attacked a number of Sotho-Tswana groups and settlements and incorporated them into his kingdom. As a result, his activities would have had a definite impact on the northern Free State at the time.
The Early Colonial Period	
The early Colonial Period within the study area and surroundings was characterised by the arrival of newcomers to the Transoraniga. The first arrivals were the Griqua followed by white Trekboers, who for the most part practiced a nomadic pastoralist way of life and were small in number. During the 1830s a mass migration of roughly 2 540 Afrikaner families (comprising approximately 12 000 individuals) from the frontier zone of the Cape Colony to the interior of Southern Africa took place. The people who took part in this Great Trek were later to be known as Voortrekkers (Visagie, 2011).	

1804	The Griqua were of European and Khoikhoi descent, and although they had been present on the Orange River for some time, they only established themselves permanently north of the Orange River in 1804, when they settled at Klaarwater, between present-day Danielskuil and Prieska (Reader's Digest, 1994).
Early 1800s	During the early 1800s, frequent droughts forced white farmers from the Cape Colony to move with their livestock across the Orange River to look for better grazing. Initially, these Trekboers first obtained permission from the Cape authorities before departing across the frontier, however with time, increasing numbers of Trekboers moved across this river into the Transorangia (as it became known) without any prior permission (Schoeman, 1980).
Early 1836	The first Voortrekker party of some 70 wagons crossed over the Orange River during early 1836. More groups followed and primarily established themselves along the Vet River (Schoeman, 1980). Of significance for the study area, is that during this same period, a family trek under the leadership of Petrus Albertus Venter departed from Renosterberg in the Graaff-Reinet district and arrived in proximity to the present-day town Ventersburg, where their farm Kromfontein was later inspected and proclaimed (Visagie, 2011). A number of farms from the surroundings of Ventersburg that are located within the study area, still memmorialise the surname of this Voortrekker leader and group. These include Venters Hoek, Venterskraal and Venterskroon while the town of Ventersburg was also named after Petrus Albertus Venter. One of the few tangible reminders of these Voortrekkers are their graves, buried at the reconstructed remains of a stone rampart immediately west of Ventersburg. The Voortrekkers buried here include Petrus Albertus Venter (17 April 1790 – 11 January 1858) and his wife Wilhelmina Catharina Francina Venter (10 February 1796 – 12 October 1868), as well as an unknown number of their relatives. One reference was found which indicates that these graves were originally buried along the Perdespruit (locality unknown, but more than likely situated on the farm Kromfontein). However, due to frequent flooding of the banks of this stream, the graves were relocated in 1983 to their current place of burial (https://pathfinda.com/en/ventersburg/attractions/skanskraal-monument). The stone rampart and Voortrekker graves were declared a National Monument on 9 December 1988, and is currently a Free State Provincial Heritage Site (www.sahra.org.za).

	The site is located 67 m east of the present study area boundary, on the western edge of the town of Ventersburg.
1837 - 1843	In 1841 the town of Winburg was established on the banks of the Vet river. After the annexation of Natal by the British in 1843 and the subsequent dissolution of the Voortrekker Republic of Natalia, Winburg became the capital of the Voortrekkers in what is today known as the Free State (Erasmus, 2004). Winburg is located 9.2 km south-east of the study area. On 10 October 1968, an extensive Voortrekker Monument was opened south of Winburg (www.artefacts.co.za).This monument is located 12 km south of the study area.
The Mid to Late Nineteenth Century	
3 February 1848	The Orange River Sovereignty was proclaimed over the Transorangia by Great Britain and had its capital at the newly established Bloemfontein (www.wikipedia.org). The sovereignty came about after one-sided agreements (favouring the British) had been reached by Great Britain with King Moshesh of the Basotho and Adam Kok III of the Griqua. The Voortrekkers present in the Transorangia were completely by-passed by these agreements, which led to serious dismay and disappointment amongst them. In terms of the surroundings of the study area, the response of the Voortrekkers was to force the British magistrate at Winburg, Thomas Biddulph, out of town and proclaim the Republic of Winburg (Reader's Digest, 1994).
16 January 1852	On this day, the Sand River Convention was signed between the British Government, represented by British Assistant Commissioners W.S. Hogge and C.M. Owen, and the Transvaal Boers under the leadership of General Andries Pretorius. This convention formally recognised the existence and independence of the Boer Republic north of the Vaal River by the British Government, and was the foundation for the creation of the *Zuid-Afrikaansche Republiek* (South African Republic) (Oberholster, 1972). The site where the signing of the convention took place, was declared a monument and for many years was marked by a stone cairn and plaque (Oberholster, 1972). The present condition of the monument is not known. The site is located near the bridge where the N1 highway passes over the Sand River, and is located approximately 622 m east of the present study area.

23 February 1854	The Orange River Convention (sometimes referred to as the Bloemfontein Convention) was signed by representatives of Great Britain and the Boers, and resulted in the proclamation of the Boer Republic of the Orange Free State. The convention was signed at Bloemfontein (www.wikipedia.org). As with the proclamation of the Sovereignty, the Orange River Convention was again one-sided and did not obtain the blessing or inputs of all the major role-players in the Free State. While the Voortrekkers were excluded in 1848, the signing of the Orange River Convention in 1854 did the same to the Basotho and Griqua. For the next 48 years, the study area fell within the boundaries of the Boer Republic of the Orange Free State.
July 1854	In July 1854, the *Volksraad* of the newly established Free State Republic instructed the *landdrost* of Winburg, Joseph Orpen, to look for a site for the establishment of a new town within the northern region of the Boer republic. Orpen chose the farm Klipplaatsdrift and Kroonstad's first residential stands were sold on 30 April 1855 (Erasmus, 2004). The town of Kroonstad is located 6.2 km north of the present study area.
1858	The first war between the newly established Free State Republic and the Basotho of Moshoeshoe took place. To protect the local people in this war, a stone rampart was constructed on the farm Kromfontein, which had originally been owned by Field-Cornet P.A. Venter (Erasmus, 2004). Some sources indicate that Field-Cornet P.A. Venter and King Moshoeshoe were good friends, and before the start of hostilities the king made a force of 200 Basotho men available to the Field-Cornet to assist in the building of the stone rampart. See for example *Kontrei* of 22 June 2005. The remains of this rampart can still be seen immediately west of the town of Ventersburg, and is located where the Voortrekker graves alluded to before are situated (Erasmus, 2004). The site is 67 m east of the present study area.
1872	The town of Ventersburg was laid out on the farm Kromfontein in 1872. As indicated above, the farm Kromfontein had originally belonged to one of the early Voortrekker leaders, namely Field-Cornet P.A. Venter. After his death in 1857, his son B.G. Venter allowed church services to be held in his father's homestead. The second Gereformeerde (Dopper) church north of the Orange River was also established at Kromfontein in 1859. The use of the farm for church services led to the establishment of a town. The new town was named after Field-Cornet P.A. Venter, and formal

	proclamation for Ventersburg took place in 1876 (Erasmus, 2004). Ventersburg is located immediately to the east of the present study boundaries.
Early 1890s	The railway line between Bloemfontein and Johannesburg was built during the early 1890s, and eventually reached Johannesburg during September 1891 and Pretoria in January 1892 (Schoeman, 1980). In terms of the study area, this railway line cuts through the northern end of the present study area, with sidings and stations along this line such as Holfontein (partially), Geneva and Bosrand located within the present study area.
Mid 1890s	During the mid-1890s two men arrived on the farm Aandenk to undertake prospecting work. Alexander Edward King Donaldson was a prospector and his associate Herbert Hinds an engineer. They excavated an 18-meter-deep shaft and took samples from their excavations for further testing and analysis. On their return journey to England, both men died when their ship, the Drummond Castle, wrecked at Ushant off France, and with it the samples they had brought from the Free State (www.sahra.org.za) (Felstar Publishers, 1968). The activities of these two men laid the foundation for the discovery and development of the Free State Goldfields. The farm Aandenk is located immediately south of Allanridge today, some 13 km west of the present study area.
The South African War (1899 – 1902)	
The South African War was fought between the Boer Republics of the Transvaal and Free State on the one side and the Great Britain on the other, but is referred to as the South African War as the victims and participants of the war were not excluded to British or Boer alone. As will be discussed in more detail below, the march of Lord Roberts from Bloemfontein to Pretoria in May and June 1900 was especially significant in terms of the study area. In particular, the so-called Battle of Zand River (7 – 10 May 1900) was fought very close to the study area, with at least the movement of troops during the battle taking place across the study area.	
13 March 1900 – 6 May 1900	Bloemfontein, the capital of the Boer Republic of the Orange Free, was occupied by the British Army under Lord Roberts on 13 March 1900. The Boer Republic of the Orange Free State was renamed the Orange River Colony. With the Republican forces of the Transvaal and Free State retreating northwards from Bloemfontein, Lord Roberts's eyes drifted further north, where the greatest prize of the war lay waiting, Pretoria. Lord Roberts and his staff strongly believed that once the capital of the *Zuid-Afrikaansche Republiek* fell, the war would be over.

	However, the success of the British Army required all focus on the immediate front, as the land between Bloemfontein and Pretoria was bisected by a myriad of rivers, dongas and hills, all strategically significant obstacles from where the Boer forces could implement a solid defence. The Boer forces standing between Lord Roberts and Transvaal capital were estimated by British Intelligence to comprise two main groups namely a force of between 5 000 to 6 000 burghers with 18 guns under General Louis Botha and a similarly large force in the surroundings of Kroonstad (Maurice & Grant, 1906). After departing from Bloemfontein, Lord Roberts's force was involved in a couple of successful actions on their way to Pretoria, including Brandfort (3 May 1900) and Vet River (4 - 6 May 1900). With the successful conclusion of the battle of Vet River, Lord Robers and almost his entire army crossed over the river successfully, and by the evening of 6 May 1900 bivouacked at the small railway siding known as Smaldeel. The town of Theunissen is located here today and is roughly 12 km south of the present study area (Maurice & Grant, 1906). A short distance to the north lay the next, and far more daunting, obstacle on Lord Roberts's march to Pretoria, the Zand (or Sand) River. It was here, at this river, that General Louis Botha, the commanders-in chief of the Transvaal republican forces, was determined to halt Lord Roberts's march on Pretoria.
7 – 10 May 1900	On 7 May 1900 a reconnaissance of the Zand River by General Edward Hutton indicated that the northern bank of the river was held by a force of roughly 6 000 Boers supported by two heavy and eight light pieces of artillery. These estimates provided by General Hutton allowed Lord Robers to draw up a battle plan (Maurice & Grant, 1906). On the 9th of May 1900, Lord Roberts moved his army forward and established his headquarters at the Welgelegen Station, roughly 7.8 km west of the study area. The movement of the British Army under Lord Roberts from a position a short distance south of the study area at Smaldeel (present-day Theunissen) to a position a short distance east of it, suggests that the main component of Lord Roberts's force followed the railway line and in this way skirted around the study area. However, in view of the closeness of this railway line to the present study area, sections of his force would almost certainly have crossed over the study area as well. Lord Roberts's battle plan focussed on securing significant drifts that provide safe crossing for his infantry over the Zand River, and especially so Junction Drift (the farm of this name is located within the study area with the actual drift either within or very close to the study area), Merriespruit (8.8 km north-west of the study area), Du Preez Leger Drift (24.8 km north-west of the study area) and De Klerks Kraal Drift

	(roughly 25.7 km north-west of the present study area). For the purposes of this discussion, the events associated with the Junction Drift will be discussed in more detail below. On 9 May 1900, Lord Roberts and his army advanced on the Zand River. On his army's eastern flank, General Ian Hamilton advanced on the river and arrived at the farm Bloemplaats, roughly three miles south of his destination. No farm of this name could be found south of the river, however the farm Bloemskraal is located at this distance south of the river and is situated within the present study area. From this farm, Hamilton was to orchestrate the crossing of the river at Junction Drift. Anxious to secure the drift, Hamilton ordered the 5th Corps Mounted Infantry and 1st Derbyshire Regiment forward and that same evening both the southern and northern banks of the river at the drift were held by Hamilton's men. Meanwhile, unaware of Hamilton's occupation of the drift, Colonel Charles Tucker of the VIIth Division ordered the 2nd Cheshire Regiment from his 15th Brigade to the drift. Upon reaching the drift, his men realised that the crossing had already been secured, and camped on the southern bank of the river. The southern bank of another unnamed drift located to the east of Junction Drift, was also occupied that same evening by picquets of the Mounted Infantry. Hamilton's men at Junction Drift was faced by a strong Boer force, which occupied a range of hills from Doornkop in the west to Boskop (Baskop) in the east. This range of hills is located north of the Zand River, and stretches roughly parallel to it. While Doornkop and the western end of this position were located outside of the study area, the remainder of the Boer position all the way to Baskop was located within the study area. On the morning of 10 May 1900, Lord Roberts's army advanced on the river. At dawn of the same day, the 1st Royal Sussex Regiment under fire from Boer artillery, advanced from the northern bank of the drift to occupy a low ridge located two miles to the east. From this foothold, Hamilton advanced the infantry of his 21st Brigade in the following order: the 1st Royal Sussex Regiment and 1st Cameron Highlanders in the front, followed by the 1st Derbyshire Regiment and City Imperial Volunteers. The 1st Gordon Highlanders from the 19th Brigade was attached to Major-General Bruce Hamilton's force, which was in the process of advancing on the right flank of the infantry assault. With General Ian Hamilton's infantry advancing on the Boer position, and the drift and northern banks of the river secure, his 76th Battery crossed the stream and started engaging the enemy from the ridge north of the river. Meanwhile, Tucker of the VIIth Division also advanced on Junction Drift and ordered two batteries to cover the drift and at 8h30 that morning ordered the 1st East

	Lancashire and 2nd Cheshire Regiment, which had camped the previous night on the southern bank of the drift, across the drift to provide assistance on Hamilton's left flank north of the river. They eventually engaged the Boers occupying Doornkop, so no further mention will be made of these Tucker's men. With his infantry advancing, General Hamilton deployed his artillery along the river to cover the assault. The 74th and 82nd Batteries occupied a position on the south bank of the river, a short distance east of Junction Drift while a battery of two 5-inch guns opened up on the Boer position from a spot four hundred yards to the south. An intensive crossfire developed between the British artillery along the river and the Boer guns on the ridge a few miles to the north and north-east. The effective British barrage on the Boers allowed for the infantry under Major-General Bruce Hamilton to advance closely on the enemy position, from which point well-executed infantry assaults started clearing the Boer position. However, the Boer artillery comprising two guns to the west and a Vickers Maxim to the east started having an effect on the battle, until both artillery positions were targeted by the British artillery and effectively neutralised. With no artillery support, the Boer positions were quickly taken by Hamilton's infantry. By 11 am that same morning, all the hills and ridges north of Junction Drift were taken by Hamilton's men. With the Boer forces retreating towards Kroonstad, Hamilton ordered his Mounted Infantry under General Robert George Broadwood to pursue them and push the assault forward. At this critical time, a Boer flanking manoeuvre took place on the rear right flank of General Ian Hamilton's position, where the 10th Hussars and Kitchener's Horse guarding a hill roughly seven miles south-east of Junction Drift, were attacked. The Boer attack was supported by fresh artillery, and Hamilton, fearing that his entire flank would fall, brought two guns to support the defence. The Mounted Infantry under Broadwood also temporarily halted their pursuit should they be required to the south-east. After receiving news that Hamilton's flank was no longer threatened, Broadwood continued with his pursuit and was in Ventersburg by 14h30 that afternoon. In his pursuit, his force managed to capture 28 prisoners and five wagons before darkness halted the pursuit. That evening Lord Robert's army had all crossed the Zand River successfully, and were holding positions some 20 miles north of the river. In terms of the study area, General Ian Hamilton's cavalry had reached Ventersburg whereas his 21st Infantry Brigade occupied Baskop. The Battle of Zand River was a resounding victory for Lord Roberts and cleared the way for his next objective on the road to Pretoria, the town of Kroonstad (Maurice & Grant, 1906).

10 May 1900	In a last ditch attempt to halt the British advance through the Free State, the Boer leaders decided to entrench themselves on both sides of the railway line along a ridge known as Boschrand some six miles south of Kroonstad. This strong position was supported by artillery as well. However, Lord Roberts acquired intelligence on 10 May 1900, which informed him of the strong Boer position at Boschrand. In an attempt to outflank the Boer position and at the same time place more pressure on the Boer forces and their leaders, Lord Roberts ordered General French and his cavalry to flank around Boschrand and Kroonstad, and destroy the railway line leading north out of town. Lord Roberts's intention with this manoeuvre was to trap the majority of the Boer artillery, goods and ammunition in the town.
11 May 1900	Early on the morning of 11 May 1900, General French and his cavalry started on their journey to outflank the Boer position. However, he became bogged down by the Boer defenders to the west of Kroonstad, and was unable to push forward. Nonetheless, the destruction of the railway was successfully executed that evening by a small force of 50 hand-picked men of the 1st Cavalry Brigade and eight mounted Sappers, all under the command of Major A.G. Hunter-Weston and assisted by an American scout named F.R. Burnam (Maurice & Grant, 1906). Meanwhile, on the morning of 11 May 1900, Lord Roberts's forces moved slowly forward toward Kroonstad, until their advance was halted by the Boer position at Boschrand. An artillery duel ensued between the British artillery forming part of Lord Roberts's advance and the Boer artillery ensconced at Boschrand. The artillery duel lasted until sunset, and the infantry units at the front of Lord Roberts's forces bivouacked below Boschrand while Lord Roberts established his headquarters at Geneva Station. That evening, the Boer positions at Boschrand and Kroonstad were evacuated and the Boer armies retreated further north (Maurice & Grant, 1906). In this way, the window of history moved away from the study area and surroundings as Lord Roberts's march on the Transvaal capital continued in earnest. While the flanking movement of General French as well as the destruction of the railway line occurred outside the present study area, the Boer position at Boschrand was located within the study area. Geneva Station, where Lord Roberts placed his headquarters on the night of 11 May 1900, was also located within the present study area. Lastly, the artillery duel would also have taken place within the study area.
1900 - 1902	After the fall of Pretoria on 5 June 1900 and the subsequent battles of Diamond Hill (11-12 June 1900) and Bergendal (21-27 August 1900), the Boer generals decided

	that the only way to proceed with the war would be the implement of a completely different strategy, a strategy based on mobility by using smaller commandos to attack and harass the British on all fronts in what was to become known as guerrilla warfare. This style of warfare had significant successes, and extended the war for nearly another two years. However, these successes came with significant losses as the war increasingly dragged the civilian population of the Boer Republics into the carnage of war. No skirmishes or battles associated with the guerrilla war are known from within the study area or its immediate surroundings. This said, the study area and surroundings, as with almost the entire South Africa, experienced the effects of guerrilla warfare. For example, after reports had been received that the Boer commandoes were using Ventersburg as a storage place for food, Major-General Bruce Hamilton was ordered to burn a number of houses in town. Furthermore, in retaliation to the new form of warfare, the British High Command devised a strategy of building extensive blockhouse lines across the country as a way of hindering the mobility of the Boer commandoes. By December 1900, earth and stone blockhouses had been built at a number of places along the main railway line between Bloemfontein and Pretoria, including at Boschrand and Holfontein stations located within the study area. Shortly thereafter, a number of key positions along the railway line in proximity to Kroonstad were further fortified. Within the study area, a soil defensive structure was erected at Boschrand while a hexagonal fort was built at Holfontein. Between December 1900 and early 1901, a number of stone blockhouses were also erected in proximity to Kroonstad, including two such stone blockhouses built by contractors at Holfontein. From early 1901 onward, the existing soil and stone defensive works along the railway line between Kroonstad and Bloemfontein were replaced by stone and corrugated iron blockhouses. For example, the non-permanent defensive works at Boschrand were replaced by a Rice-type blockhouse (Hattingh & Wessels, 1997).
1900 - 1902	Lord Kitchener, in particular, also implemented a strategy that was to become known as scorched earth whereby Boer farms were burnt to the ground and the civilian population (both white and black) remaining on these farms forced into concentration camps. Untold hardship ensued in these camps, and many women and children died as a result of exposure, inadequate nutrition and poor medical facilities. Three black concentration camps were located within the study area. While their exact localities are not known, these camps were situated along the railway line at the following stations: Holfontein, Geneva and Boschrand. It is worth noting that Campbell (1995) indicates that the latter two camps were two of the three largest

	camps during the war, and with Honing Spruit (the third camp located outside of the present study area) housed a combined population of an incredible 7 000 people. None of the white concentration camps were located within the study area, with the closest two such camps located at Kroonstad (north of the study area) and Winburg (south of the study area) (www.angloboerwar.com).
The Early Twentieth Century (1902 – 1913)	
1904	After the South African War, renewed efforts were made to carry out gold prospecting work in the area. In 1904, a prospector named Archibald Megson arrived on the farm Aandenk, and the farmer showed him the trench where Donaldson and Hind had looked for gold. Megson opened up the old trench and continued with the excavations. At a depth of 30 meters, he found indications of gold and took a number of samples. Megson returned to Johannesburg with his samples and attempted to gain the interest of various mining houses and investors on the rand. However, with the rapid development and expansion of the Witwatersrand gold mining industry attracting all of the attention, no one seemed interested in possible gold discoveries so far away from Johannesburg (www.sahra.org.za).
August 1907	In August 1907, the town of Theunissen was proclaimed. This proclamation followed on a petition by farmers living in proximity to Smaldeel Siding. The town was named in honour of Commandant Helgaardt Theunissen, who led the petition and had also been the leader of the local commando during the South African War. The town of Theunissen became a municipality in 1912 (Erasmus, 2004). Theunissen is located 2.5 km from the study area.
The Boer Rebellion (1914 – 1918)	
At the end of the South African War (1899 – 1902), the Transvaal and Orange Free State republics lost their independence to the British Empire. In 1910, the Union of South Africa was established consisting of the Cape Colony, Natal, the Transvaal Colony and the Orange River Colony. General Louis Botha was appointed the Union's first prime minister and believed that South Africa's future would be best served as a part of the British Commonwealth. In 1914, the South African government under General Louis Botha decided to assist Great Britain in its war with Germany. A number of Boer leaders were not happy about this turn of events, and when General Koos de la Rey was killed at a roadblock in Johannesburg, emotions reached a boiling point and rebellion broke out across the former Boer republics. This rebellion saw more than 11 000 Boer men under the leadership of some of the former Boer War generals such as De Wet, Maritz, Kemp and Beyers rebelling against the South African government and its armed forces under the leadership of former Boer War generals Louis Botha and Jan Smuts.	

16 November 1914	In terms of the study area, the most notable event relating to the Boer Rebellion was the battle, which occurred between the commando of General De Wet and the Government forces under the command of Colonel Enslin at the Virginia railway station on 16 November 1914. This battle followed on the defeat of De Wet's rebels at Mushroom Valley, south-east of Winburg, at the hands of General Louis Botha. De Wet and 2 000 rebels managed to escape from Mushroom Valley and followed the railway line north-eastwards towards the Virginia Station on the Zand River. De Wet wanted to cross over the railway line, and as a result, a fight ensued with Colonel Enslin's forces stationed at Virginia Station. General De Wet suffered a number of casualties and 50 of his men were also taken prisoner. After the battle, De Wet and his men followed the Zand River in a western direction and crossed over the river into the Transvaal Colony in proximity to Hoopstad (Union of South Africa, 1916). The Virginia Station is located 7.6 km west of the study area, and as a result the battle would have taken place outside the study area boundaries.
The Remainder of the Twentieth Century (1915 – Present Day)	
1929 - 1933	Nearly 25 years after finding the first indications of gold on the farm Aandenk, Archibald Megson finally managed to raise the interests of possible investors in Johannesburg. In 1929, during a chance encounter with Joseph Freedman, Megson found a more welcoming response. Freedman introduced the prospector to Johannesburg attorney, Emmanuel Jacobson, and his friend Allan Roberts, a dental technician. Despite being interested in what the prospector had to say, it took almost four years before Jacobson, Roberts and Megson travelled to the Free State (Shorten, 1970). Allan Roberts, who was an amateur prospector, was able to trace a conglomerate outcrop all along the farm Aandenk, and incorrectly identified it as part of the Upper Witwatersrand series. The two friends returned to Johannesburg and formed a syndicate comprising themselves, F.L. Marx, Dr. E.B. Woolf, Samuel Potter and Joseph Freedman. Freedman represented the interests of the old prospector Archibald Megson in the syndicate (Shorten, 1970). The syndicate acquired prospecting options on 31 farms in the area and the company Wit. Extensions Limited was established by the syndicate. On 23 October 1933, drilling commenced at a point roughly 80 m from Megson's trench on the same farm Aandenk. However, by February 1935 the drilling work had to be halted due to a lack of funds without any evidence for gold-bearing reefs identified. Many years later, it was estimated that if the two friends had only managed to deepen the hole by another 400 feet, they would have become very rich men and the discoverers of the

	Free State goldfields. Sadly, this was not to be their fate. Allan Roberts died in such poverty in 1939 and his friends had to pay for his funeral whereas Emmanuel Jacobson had to sell all his assets to survive (Shorten, 1970). Today, the town of Allanridge (named after Allan Roberts) and a monument to the west of the road between Welkom and Bothaville are all that is left of the dreams and expectations of these two mining pioneers.
1935	After the failure of Wit. Extensions Limited, an agreement was reached with the Anglo-French Exploration Company to continue prospecting work at Aandenk. However, instead of continuing deeper on the same borehole, the Anglo-French Exploration Company decided to rather deflect the borehole and no results were achieved. It was later estimated that if either one of these companies had deepened the borehole by only another 400 feet, payable gold would have been discovered (Shorten, 1970). The agreement between Wit Extensions Limited and Anglo-French Exploration Company came to an end and the famous geologist Dr. Hans Merensky acquired an interest in Wit. Extensions Limited. He subsequently carried out extensive prospecting work including the drilling of further boreholes. However, even these more extensive attempts by Merensky to find the Free State goldfields also failed (Shorten, 1970). Machens (2009) indicates that when news broke that the famous discoverer of inter alia South Africa's platinum reserves owned options in a company working on the Free State goldfields, the interest from investors and mining companies to this part of the Free State was further awakened.
1 February 1937 – April 1939	After failing to discover any payable gold, Merensky sold his shares in Wit. Extensions to the Anglo American Corporation, who on 1 February 1937 established the West Rand Investment Trust. The trust also carried out an extensive drilling operation. The activities and interest of the Anglo American Corporation in this part of the Free State attracted the interest of other mining houses and investment companies, and prospecting options were taken out on a large number of farms from this area (Shorten, 1970).
	Despite all this interest, the first payable gold in the Free state was only identified in March 1939 during drilling operations by the African and European Investment Company on the farm Uitsig at a depth of 2 701 feet (Felstar Publishers, 1968). One month later, during April 1939, another discovery of payable gold was made on the farm St. Helena at a depth of 1 143 feet (Shorten, 1970). The discoveries of payable gold at Uitsig and St. Helena created significant excitement amongst mining companies and investors, and increasing numbers of

	prospecting options and eventually mines were acquired and developed. The Free State gold rush had begun. The farm Uitsig is located 27 km north-west of the present study area with the farm St. Helena roughly 25.3 km to the north-west.
1941	The first gold mining lease in the Free State was granted by the government of the Union of South Africa for the farm St. Helena in 1941, and the St. Helena Gold Mining Company was established to mine and develop the property (Felstar Publishers, 1968). A number of other gold mining companies were also established in a relatively short spate of time, including the Welkom Gold Mining Company, President Steyn Gold Mining Company and the President Brand Gold Mining Company.
16 April 1946	The borehole of the Blinkpoort Gold Syndicate Limited on the boundary of the farms Geduld and Friedenheim, reached payable gold in 1946. On 16 April 1946 it was announced that the gold-bearing material retrieved at a depth of 3 922 feet from this borehole assayed at an impressive 1 252 dwts per ton which was unique in the history of golf prospecting and mining in South Africa, with averages usually in the region of 250 dwts per ton. This discovery led to further interest in the Free State goldfields (Felstar Publishers, 1968).
11 July 1946 – 15 April 1947	On 11 July 1946 an application was made by the land company of Sir Ernest Oppenhaimer's Anglo American Corporation, namely the South African Township and Mining and Finance Corporation, for the establishment of a new town called Welkom. After some legal and procedural processes and debate between the township applicants and its opponents (including the Odendaalsrus Town Council), the application for the establishment of the town of Welkom was approved on 15 April 1947 (Felstar Publishers, 1968). William Backhouse designed the town as a garden city with a commercial centre built around a town square and traffic circles rather than stop streets or traffic lights. More than a million trees were also planted (Erasmus 2014).
1953	After gold was discovered in the area, Odendaalsrus became a prominent town in the Free State. A railway line was built from Allanridge to Odendaalsrus in 1953 and served the two Freddie's mines (Nienaber et al. 1982).
1954	Three of the six mines surrounding Welkom had reached production stage by 1954. These were the Welkom, Western Holdings and St. Helena Mines. During the same year, the town of Virginia was laid out on the banks of the Zand River. As indicated elsewhere, the name of this town was derived from the nearby

	railway station, which in turn was named this after two American engineers working on the line in 1890 had carved the name “Virginia” on a boulder from a nearby hill (Erasmus 2014). Virginia is located 11.6 km north-west of the present study area.

6.1.3. KEY SENSITIVITIES

All the relevant sources of heritage information used for the Motuoane Henneman project was summarised in a heritage sensitivity map (refer to Figure 2). This map provides a zoned depiction of the study area wherein areas of varying heritage sensitivity are indicated. This map will be used in conjunction with the other specialist field sensitivity maps to assess the feasibility of the proposed development and to allow the planning of the layout of the proposed development in such a way that the least possible impact is generated.

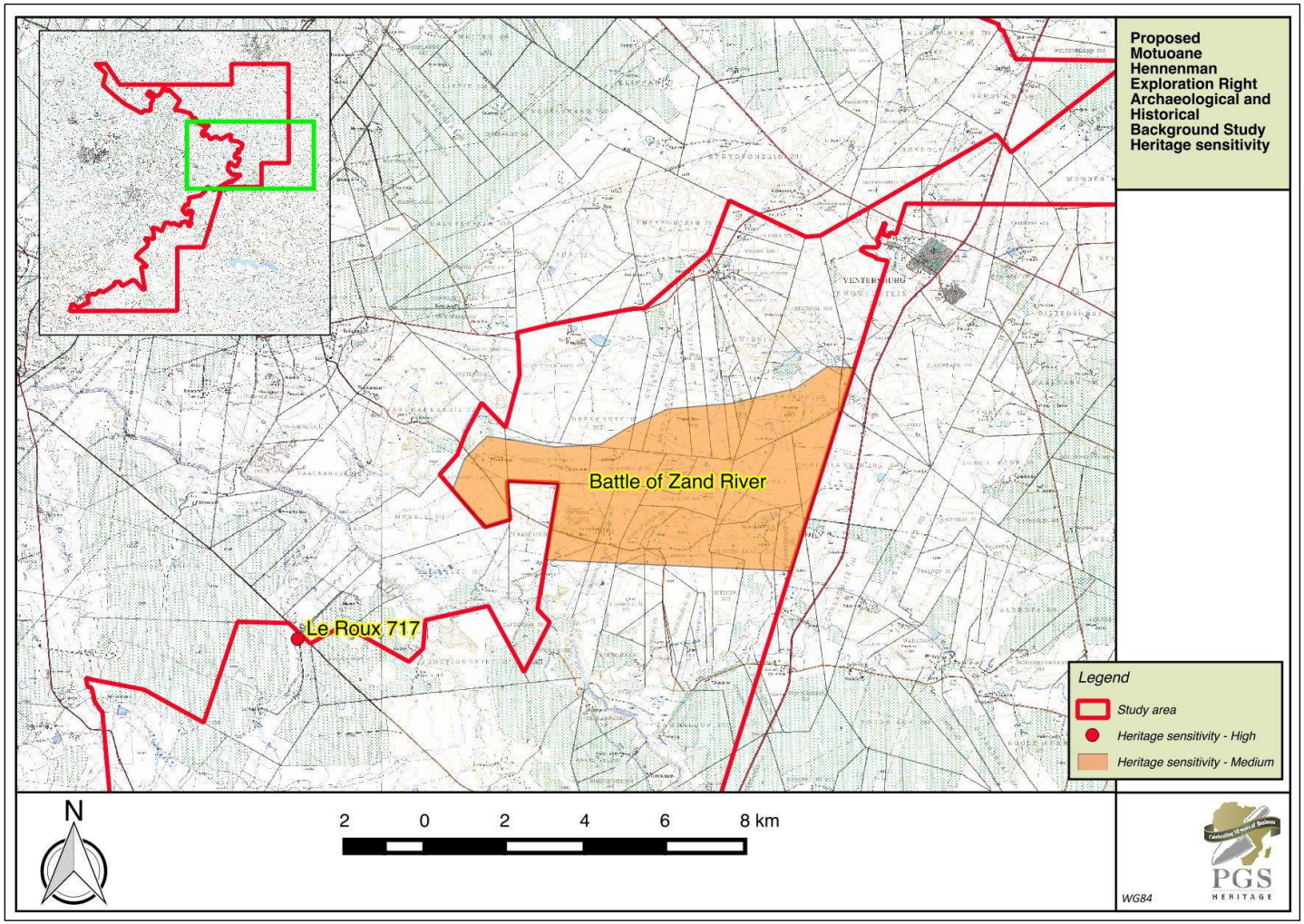

FIGURE 2: HERITAGE SENSITIVITY MAP

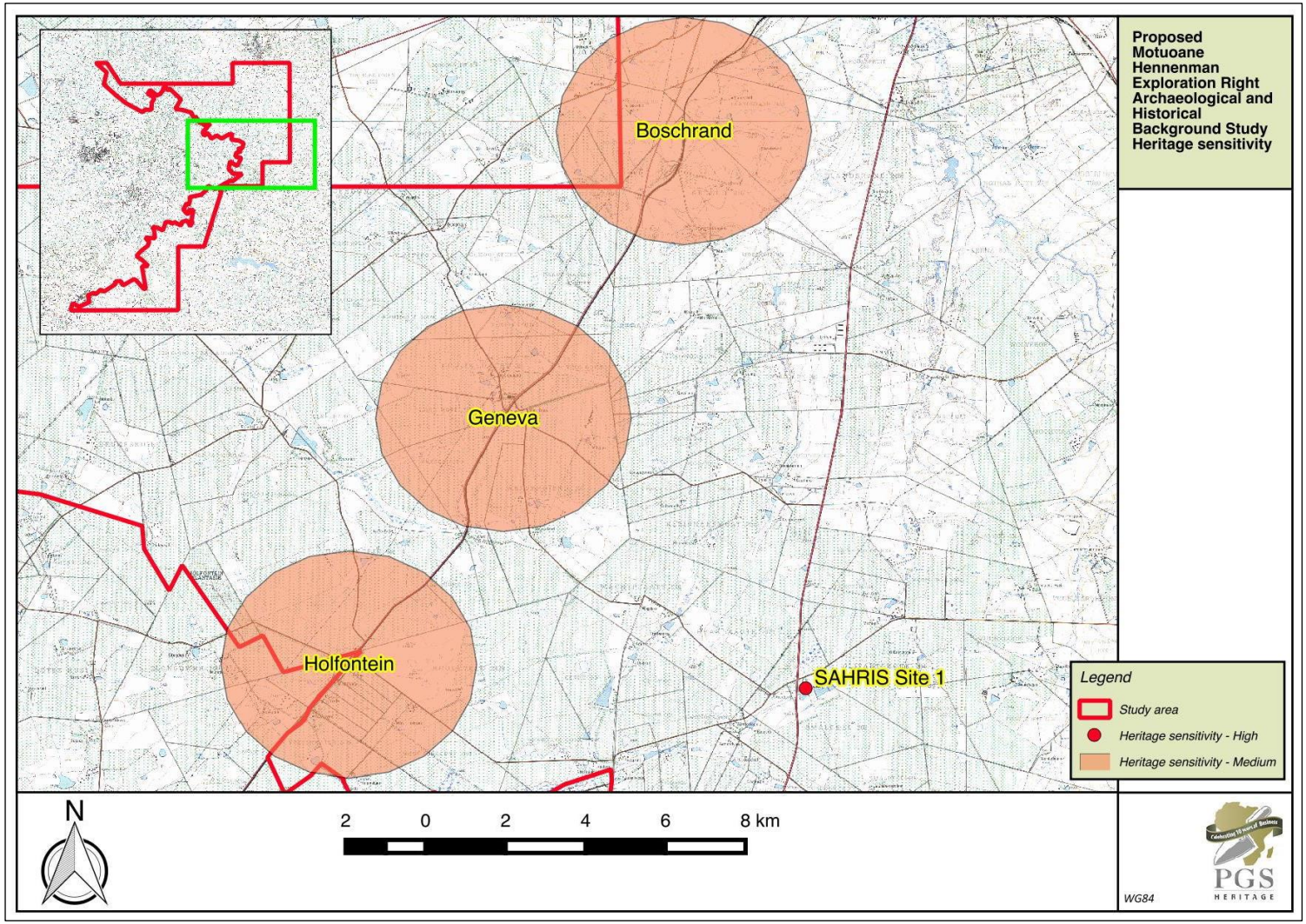

FIGURE 2: HERITAGE SENSITIVITY MAP

6.2. SOCIO-ECONOMICS

The following section provides a summary of the social and economic environment that may be influenced by the proposed project. Information in this section was obtained from the Integrated Development Plans (IDPs) for the Matjhabeng-, Masilonyana-, and Moqhaka Local Municipalities as well as from the StatsSA website. The information provided in the IDPs are based on a 2011 National census.

According to the National Environmental Management Act (NEMA, 1998) environment refers to the surroundings in which humans exist. When viewing the environment from a socio-economic perspective the question can be asked what exactly the social environment is. Different definitions for social environment exist, but a clear and comprehensive definition that is widely accepted remains elusive. Barnett & Casper (2001) offers the following definition of human social environment:

"*Human social environments encompass the immediate physical surroundings, social relationships, and cultural milieus within which defined groups of people function and interact. Components of the social environment include built infrastructure; industrial and occupational structure; labour markets; social and economic processes; wealth; social, human, and health services; power relations; government; race relations; social inequality; cultural practices; the arts; religious institutions and practices; and beliefs about place and community. The social environment subsumes many aspects of the physical environment, given that contemporary landscapes, water resources, and other natural resources have been at least partially configured by human social processes. Embedded within contemporary social environments are historical social and power relations that have become institutionalized over time. Social environments can be experienced at multiple scales, often simultaneously, including households, kin networks, neighbourhoods, towns and cities, and regions. Social environments are dynamic and change over time as the result of both internal and external forces. There are relationships of dependency among the social environments of different local areas, because these areas are connected through larger regional, national, and international social and economic processes and power relations."*

Environment-behaviour relationships are interrelationships (Bell, Fisher, Baum & Greene, 1996). The environment influences and constrains behaviour, but behaviour also leads to changes in the environment. The impacts of a project on people can only be truly understood if their environmental context is understood. The baseline description of the social environment will include a description of the area within a provincial, district and local context that will focus on the identity and history of the area as well as a description of the population of the area based on a number of demographic, social and economic variables.

Table 11 below presents a summary of the socio-economic aspects that may be influenced by the proposed project.

TABLE 11: SUMMARY OF THE SOCIO-ECONOMIC ASPECTS OF THE PROPOSED PROJECT

Aspect	Matjhabeng Local Municipality	Masilonyana Local Municipality	Moqhaka Local Municipality
District Municipality	Lejweleputswa	Lejweleputswa	Fezile Dabi
Province	Free State	Free State	Free State
Municipal Area Size	5155.46 km^2	6796.08 km^2	7925 km^2
Number of Wards	36 wards	10 wards	25 wards
Social			
Population Size	406 461 individuals	63 334individuals	160 532 individuals
Number of households	123 195	17 575	45 661
Estimated growth/change in population size from 2001	2.4% increase	Decline of 0.17%	Decline of 0.45%
Population composition	89.48% individuals of the population are Black African, followed by 8.75% White, 1.42% Coloured, and 0.35% Indian or Asian.	91.6% individuals of the population are Black African, followed by 6.66% White, 1.5% Coloured, 0.33% Indian or Asian, and 0.27% classified as Other.	87.4% individuals of the population are Black African, followed by 9.4% White, 2.9% Coloured, and 0.3% Indian or Asian.
Languages	SeSotho – 64.0%. IsiXhosa – 12.3%. Afrikaans – 12.3%. English – 3.6%. Other – 7.8%.	SeSotho – 66.9%. IsiXhosa – 10.8%. Afrikaans – 9.6%. SeTswana – 6.9%. Other – 5.8%.	SeSotho – 74.6%. Afrikaans – 13.6% IsiXhosa – 3.9%. English – 2.5% Other – 5.4%

Aspect	Matjhabeng Local Municipality	Masilonyana Local Municipality	Moqhaka Local Municipality
Gender	They are slightly more females than males as 50.42% of the population are females, and the remaining 49.58% are males.	There are slightly more males (50.46%) than females (49.54%).	The sex ratio in the Census 2001 results was 99.2, and as of the Census 2011 the ratio is 98.1. In general there are slightly more females than males especially for age groups above 40 years old.
Education	There has been considerable progress towards higher education levels since 2001. The proportion of persons with no schooling has dropped from 11.3% to 4%. This has important implications for employment. Although the majority of the population enrols in educational facilities only 18.1% are able to complete matric, compared to 11.6% in 2001. The municipality with the highest level of development (measured in HDI) in Lejweleputswa District is Matjhabeng (0.66), while Tokologo (0.55) has the lowest development level.	Among the population aged 20 years and above, in terms of higher education, results show a significant decrease (12%) whereby the population reported to have no schooling in Census 1996 was 19.5 %, to 7.5 % in Census 2011. Furthermore, an increase from 5.4% to 7.9% among the population reported to have some secondary and matric education in 2001 and 2011 Censuses, respectively.	Of those aged 20 years and older, 5.5% have completed primary school, 36% have some secondary education, 27,8% have completed matric, and 8,6% have some form of higher education. 5.4% of those aged 20 years and older have no form of schooling.
Land use	The following land uses occur currently in this municipality: Business, cemetery, education, government, industrial, parks and residential.	The region accommodates predominantly agricultural related activities, land use in the area comprises of commercial agriculture (59%), Residential (10%), Unspecified (38%) and Conservation area (3%). A significant portion of the area is under dry land cultivation. The following irrigation schemes do however exists that enables intensive farming:	

Aspect	Matjhabeng Local Municipality	Masilonyana Local Municipality	Moqhaka Local Municipality
		➢ The sand-vet scheme below the Erfenis and Allemanskraal Dams; ad ➢ Irrigation along the Modder River.	
Housing	Formal dwellings numbers were 56.8% in Census 2001, and the number increased to 78.5% in Census 2011. Housing owned/paying off was 51.4% in Census 2001and this has increased to 58.5% in Census 2011.	Although the Municipality has continued to provide housing opportunities to the people, it must be mentioned that the number of people who qualify for housing subsidy, is growing on daily basis, especially because the masses of the people continue to migrate to the area in search of employment opportunities. In the spirit of intergovernmental relations and line with Intergovernmental Relations Act, the Municipality is working closely with the Department of Human Settlements as well as the Department of Agriculture and Rural Department; to solicit land for housing development. Middle income housing is one area that has been neglected for so long. The Municipality will continue to play an enabling environment with aim of addressing the middle income housing backlog.	Formal dwellings numbers have increased from 82.5% in Census 2001 to 88.7% in Census 2011. Housing owned/paying off – Census 2001 indicated 61.4% and this has decreased to 56.1% according to the Census 2011 results.
Access to water	Water infrastructure consists mostly of reservoirs (18) and 99 Km of bulk pipelines of Sedibeng Water, 29 pump stations, 1 water treatment plant and 12 waste water treatment plant. Sedibeng Water is the water service provider in terms of Water Service Act, and supply	Census 2011 results show a significant decline of piped water to dwelling as compared to 78.7 % in Census 2001.	There are 45 661 households in the municipality, with an average household size of 3.2 persons per household. 57.7% of households have access to piped water either in their dwelling or

Aspect	Matjhabeng Local Municipality	Masilonyana Local Municipality	Moqhaka Local Municipality
	mainly the Goldfields region and the mines with water from the Vaal River, Bulkfontein near Bothaville and to a lesser extent from the Sand River. Main reservoirs are east of Allanridge, in Welkom, north and south of Virginia. Pump stations are east of Allanridge and at Virginia where purification plant exist. Other water infrastructure resources were constructed by the DWS including dams in Allemanskraal and canals serving the Sand – Vet irrigation scheme.		in the yard. Only 1% of households do not have access to piped water. Access to piped water inside dwelling was 28.4% in Census 2001 results, and 57.7% in Census 2011.
Sanitation facilities	The second generation of democratic local government was mandated to among others to improve levels of sanitation and eradicate bucket system as form of sanitation. In this regard this mandates was fulfilled. However challenges were identified, among others were poor project planning, execution and reporting. This has led to a particular number of households still not able to use proper sanitation thus reverting back to old system. The other challenge that came with expansion of service has been the capacity of waste water treatment plants and pump stations. As indicated above there are 12 treatment plants and	The Census results also indicate an increase of access to sanitation by 70.5% as compared to 23.4% in Census 2001.	Flush toilet connected to sewerage – was 65.6% in Census 2001, and 85.6% in Census 2011.

Aspect	Matjhabeng Local Municipality	Masilonyana Local Municipality	Moqhaka Local Municipality
	all of them require major upgrade and refurbishment.		
Energy	The bulk electrical network is well established around the Matjhabeng area. Eskom serves all mines and all townships in the municipal area and thus there is sufficient bulk infrastructure available to serve the whole area. Main challenge however remains an aging electrical infrastructure in particular in towns where the municipality is provider. A change in cost recovery and their subsidisation policy has made it very expensive to electrify the rural areas, and these include farms and farming communities who need such basic power support. The municipality is overly dependent on electricity as a source of energy for lighting, cooking and heating. In fact, the statistics reflect an increase of electricity as energy source in that the use electricity for lighting has increased from 84.98 to 8702; for cooking from 60% to 80%; and heating from 54% to 57%.	According to Census 2011, electricity provision has increased significantly by 93.2% compared to Census 2001 figures.	Electricity for lighting – was 83.8% in Census 2001, and has increased to 93.3% in Census 2011.

Aspect	Matjhabeng Local Municipality	Masilonyana Local Municipality	Moqhaka Local Municipality
Economic			
Major towns	Welkom, Virginia, Odendaalsrus, Henneman, Ventersburg and Allanridge.	Theunissen, Brandfort, Winburg, Soutpan and Verkeerdevlei.	Kroonstad, Viljoenskroon/ Rammulotsi, Steynsrus/ Matlwangtlwang, and Vierfontein.
Percentage unemployment	The number of unemployed residents in Matjhabeng has marginally decreased since 2001. However, Matjhabeng still has the worst unemployment rate within the District at 42.0%, which is also above the provincial rate.	General and youth unemployment trends in the municipality show a 3.3 % decline of overall unemployment rate between Census 2001 and 2011 respectively. Similarly, results show a minimal decline of 4.6 % of youth unemployment during the same period. However, unemployment remains a serious challenge in the municipality.	Overall unemployment rate is 35.2%; and youth the unemployment rate is 47.2%. Employment opportunities mainly created in Kroonstad as a continuous growth point, whilst opportunities in the other smaller towns, remain limited and agricultural orientated.
Largest Employing sector	The district of Mangaung is the biggest employer in the province, employing 30% of the people employed in the province; this is in line with its 31% contribution to provincial GDP. The biggest regional economy is within the Fezile Dabi District, with a GDP share of around 35%, only employs 19% of the employed in the province, although its share has increased from only 15% in 2002. As is the case with the ranking in terms of GDP, Lejweleputswa (24%), and Thabo Mofutsanyane (22%) hold the third and fourth positions respectively in terms of employment share.		
Largest economic contribution	The current statistics shows that the economies of Welkom 53%, Odendaalsrus 38%, and Virginia 78% are dominated by mining, whilst Henneman is dominated by manufacturing 41%, agriculture 17%, trade 10%, and finance 10%. The total area percentages show a combined figure of 58% dominance by the mining sector.	The agricultural sector of certain areas in the district is extremely prominent and contributes largely to the GDP of the Lejweleputswa District, which emphasize the agricultural significance of this district. The latter results to industrial development that is agricultural orientated. The Municipal area has a significant weekend related tourism potential that could, in future, contribute to the GDP of the district and should be further exploited. Brick Making projects in	The Greater Kroonstad is the centre of a large agriculture community that plays an important role in the economy of the district. Industrial activities subsequently contribute significantly to the district's economy.

Aspect	Matjhabeng Local Municipality	Masilonyana Local Municipality	Moqhaka Local Municipality
	The biggest sectors in the district in 2012 were: • Mining (42.9%); • Community services (20.4%); and • Trade (11.7%). Matjhabeng has a relatively large economy with a production value of almost R27 billion (current prices 2011). The mining sector is by far the largest sectoral contributor.	Masilo, Tshepong (Verkeerdevlei) and resuscitating the same project in Makeleketla (Winburg).Transportation modes the residents use mostly consist of private vehicles buses, minibuses/ taxis, bicycles, motor cycles and non-motorized transport, walking is also common.	
Tourist attractions/ heritage resources	There is one formal land-based protected area in the municipality, being the Willem Pretorius Nature Reserve.	Brandfort is also known for its rich political history, which includes the National Military Museum on a farm that used to be a concentration camp during the Anglo-Boer War and the Winnie Mandela House, where Mandela was sentenced to House Arrest during the State of Emergency in the 1980s. Winburg prides itself with the Voortrekker Monument as its Heritage Site, and Masilonyana boasts several game reserves across all its towns (e.g. Erfenis Dam Nature Reserve and Soetdoring Nature Reserve).	Kroonstad has of late become a distinguished holiday destination due to the ultra-modern and popular holiday resort of Kroonpark, adjacent to the Vals River. The hunting and guesthouse industries displayed an exceedingly rapid growth the past few years.

6.3. GEOLOGY AND TOPOGRAPHY

The following section provides information about the geological setting of the proposed Motuoane Henneman exploration area. Information in this section was sourced from the geological description in the hydrogeology scoping report that was conducted by Exigo Sustainability (Pty) Ltd (Exigo). Refer to Appendix E2 for the hydrogeology scoping report.

6.3.1. REGIONAL DESCRIPTION

The study area is generally flat to gently undulating and supporting short grassland. There are some low hills in various parts of the study area. The regional geology consists of sedimentary rocks belonging to the Karoo Supergroup with a stable floor comprising the Kaapvaal Craton. The Karoo Supergroup ranges in age from Late Carboniferous to Middle Jurassic and attains a total cumulative thickness of approximately 12km. The proposed exploration area is underlain by the Beaufort Group and comprises a lower Adelaide Subgroup and an upper Tarkastad Subgroup, with the latter subgroup eroded away to expose sandstones and mudrocks. Several post-Karoo dyke intrusions and faults give rise to the development of linear structures developed through the Karoo Supergroup. These dykes are composed of dolerite and porphyritic dolerite, and occur as tabular bodies with a thickness of 2 to 20m.

In depth the Karoo Supergroup is underlain by lavas of the Ventersdorp Supergroup and sediments of the Witwatersrand Supergroup.

KAROO SUPERGROUP

Deposition of sediments of the Karoo Supergroup commenced approximately 2400Ma after the deposition of Ventersdorp Supergroup. In the Henneman area the Karoo Supergroup comprises the Dwyka Group (Tillite), Ecca and Beaufort Groups respectively. The Adelaide Sub Group of the Beaufort Group and the Volksrust formation of the Ecca Group outcrop in the Henneman area. Large areas of the Karoo Supergroup were intruded by dolerite sills and dykes.

VENTERSDORP SUPERGROUP

The intense uplift in the final stages of the Witwatersrand Supergroup sedimentation culminated in the rupturing of the Kaapvaal craton resulted from a collition between the Kaapvaal craton and a younger Zimbabwe craton. Huge fractures developed, up which basaltic magma from the mantle flowed. This volcanic event commenced approximately 2700Ma ago and represents the volcanic rocks of the Ventersdorp Supergroup. Basaltic and andesitic lavas were deposited in grabens and half grabens directly on top of Witwatersrand Supergroup sediments.

WITWATERSRAND SUPERGROUP

The Witwatersrand Supergroup is representative of deposition in an early intracratonic basin about 2800Ma ago. The sequence with a thickness of about 6900m is generally poorly exposed and information pertaining to the stratigraphy is mainly derived from borehole data and mining activities.

An argillaceous lower group ie Westrand Group and an arenaceous upper group (i.e Central Rand Group define the Witwatersrand Supergroup).

The rocks of the Witwatersrand Supergroup were originally widely distributed over the Kaapvaal Craton but much has been removed by Erosion, leaving only scattered remnants. The major Goldfields in the Witwatersrand basin occur in an arc around the western and northern parts of the basin. The location of the known Goldfields were determined by earth movements along faults such as the Thabazimbi-Murchison line, the Rietfontein Fault, the Sugarbush fault and the Border fault (Free State).

Many of these fractures developed along the old suture lines where island arcs had amalgamated during the growth of the Kaapvaal Craton. Movement on these fractures involved lateral sliding, as well as vertical slip. The overall effect of these movements was to cause some sections of the crust to rise relative to others, producing mountainous terrain within and around the formerly extensive West Rand Group depression. This depression became fragmented into a number of sub-basins, separated by uplands.

River systems eroded these rising uplands. Sediments were transported to the subsiding regions and were deposited on wide pediments and further downstream on extensive alluvial plains. Continued uplift and subsidence of the low lying areas resulted in the accumulation of thick fluvial deposits in the depressions. The resulting sedimentary deposits are known collectively as the Central Rand Group.

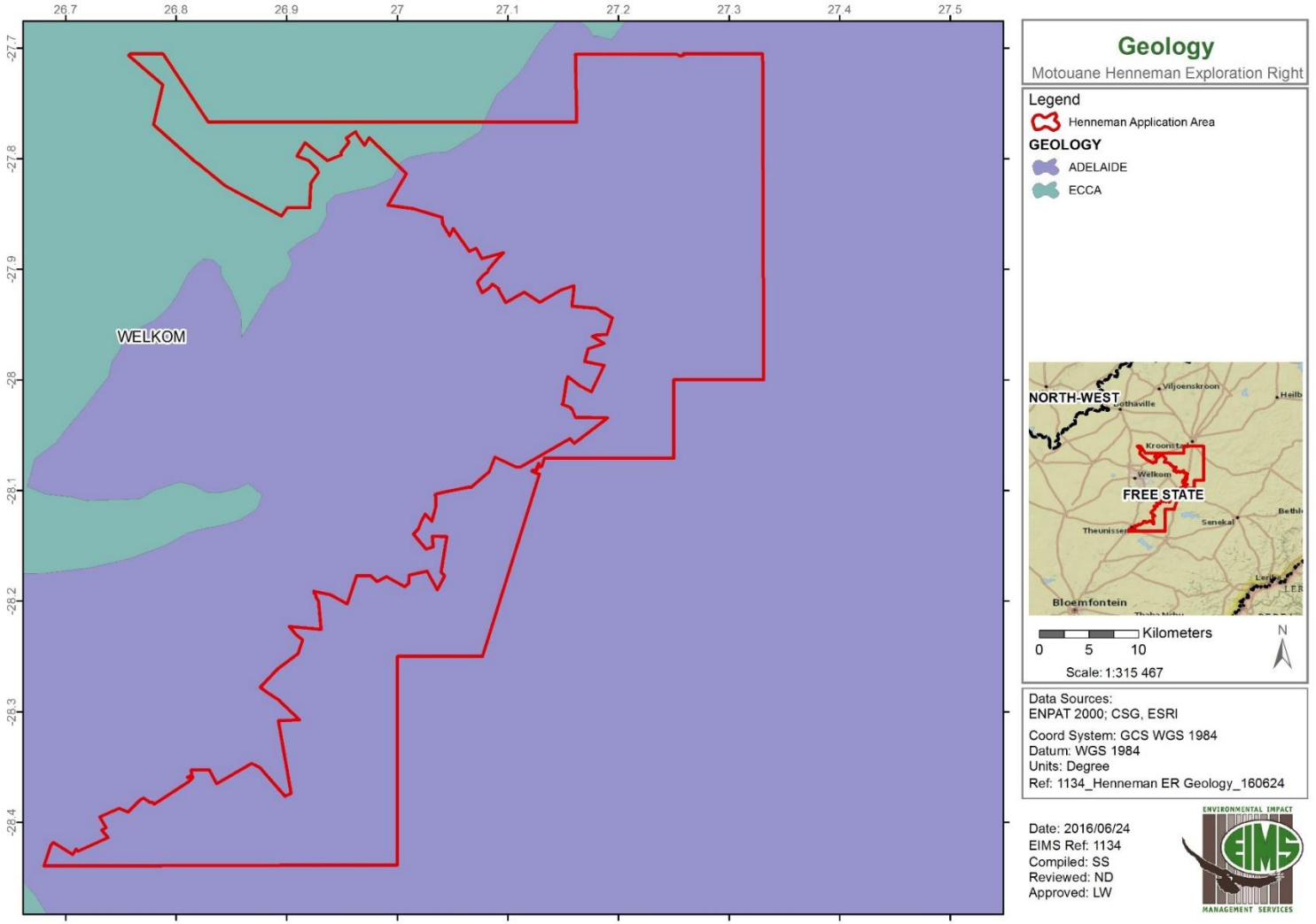

FIGURE 3: GEOLOGY WITHIN AND AROUND STUDY AREA

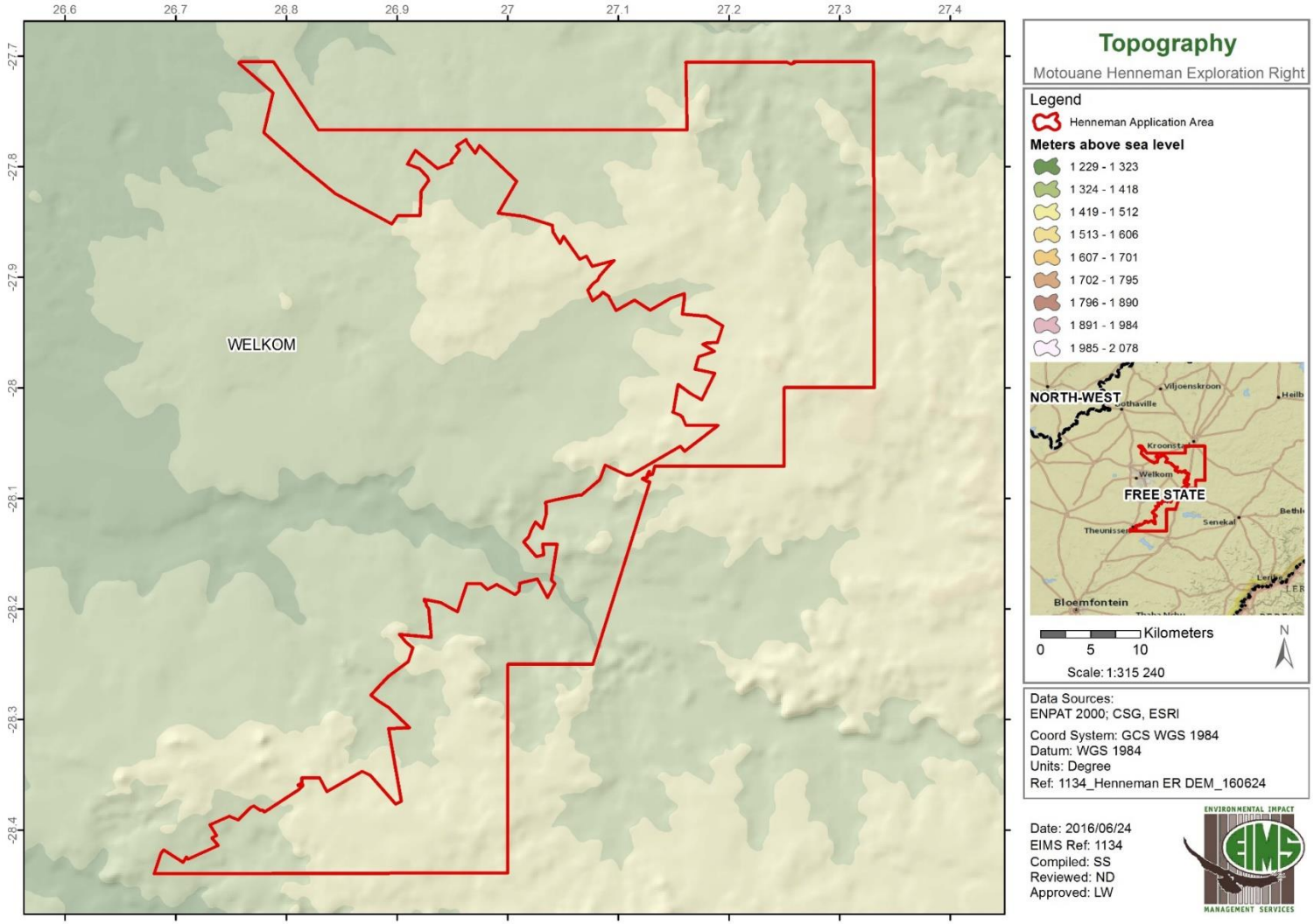

FIGURE 4: TOPOGRAPHY OF STUDY AREA

6.4. SOILS

The following section provides information about the major soil characteristics of the study area. Information in this section was sourced from the ecology scoping report that was conducted by David Hoare Consulting cc. Refer to Appendix E3 for the ecology scoping report.

6.4.1. REGIONAL DESCRIPTION

Detailed soil information is not available for broad areas of the Free State. As a surrogate, landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). There are a number of landtypes in the study area (refer to Table 13). The most common landtypes in the study area are Bd, Dc and Ea, with smaller areas of Bc and Db (Land Type Survey Staff, 1987).

The B-group of landtypes contains soils with a plinthic catena in which upland duplex and margalitic soils are rare. The Bc land type consists of soils that are dystrophic or mesotrophic and red soils are not widespread. The Bd land type consists of plinthic soils over more than 10% of the area, soils are eutrophic and red soils are not widespread (MacVicar et al. 1974).

The D-group of landtypes contains soils in which prismacutanic and/or pedocutanic diagnostic horizons are dominant. The Db landtype refers to land where duplex soils with non-red B horizons comprise more than half of the area covered by duplex soils. The Dc landtype consists of duplex soils (sandier topsoil on clay subsoil) in which more than 10% of the land type is made up of soil forms that have one or more of vertic, melanic or red structured diagnostic horizons. These are the soils of the alluvial valleys of the study area.

The E-group of landtypes contains soils in which there are one or more of vertic, melanic, red-structured diagnostic horizons. These are areas with high base-status, dark coloured and/or red soils, usually clayey, associated with basic parent material. The Ea landtype consists of land in which more than half is covered by soil forms with vertic, melanic and red structured diagnostic horizons.

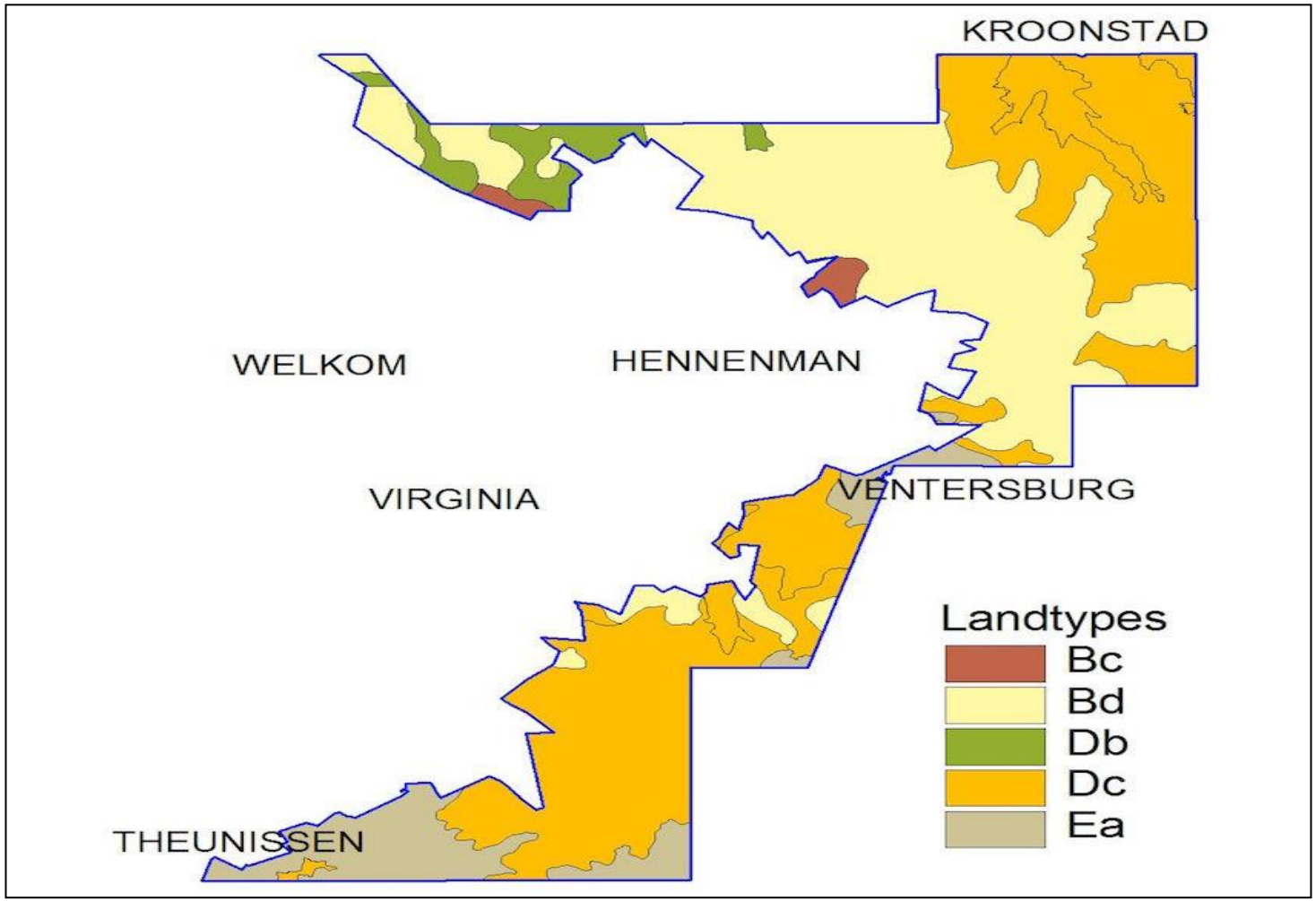

FIGURE 5: LAND TYPES OF THE STUDY AREA

6.5. LAND USE

The following section provides information about the current land use across the application area. Information in this section was sourced from the ecology scoping report by David Hoare Consulting cc. Refer to Appendix E3 for the ecology scoping report.

6.5.1. REGIONAL DESCRIPTION

According to a National Landcover map of the country produced in the 1990s (Fairbanks et al. 2000), the majority of the study area has been transformed through cultivation (refer to Figure 6). Most of the uncultivated area is classified as “unimproved grassland”, and which is natural (uncultivated) grassland. Natural thicket vegetation, according to this map, is mainly confined to the watercourses, which have a high probability of being invaded by alien vegetation. Areas of transformation also include mining and urbanisation.

Detailed mapping from aerial imagery of the study area indicates that the Landcover map of Fairbanks et al. (2000) is largely correct. Currently, the degree of transformation due to cultivation and mining is slightly greater than that indicated in Figure 6, but the general pattern is correct.

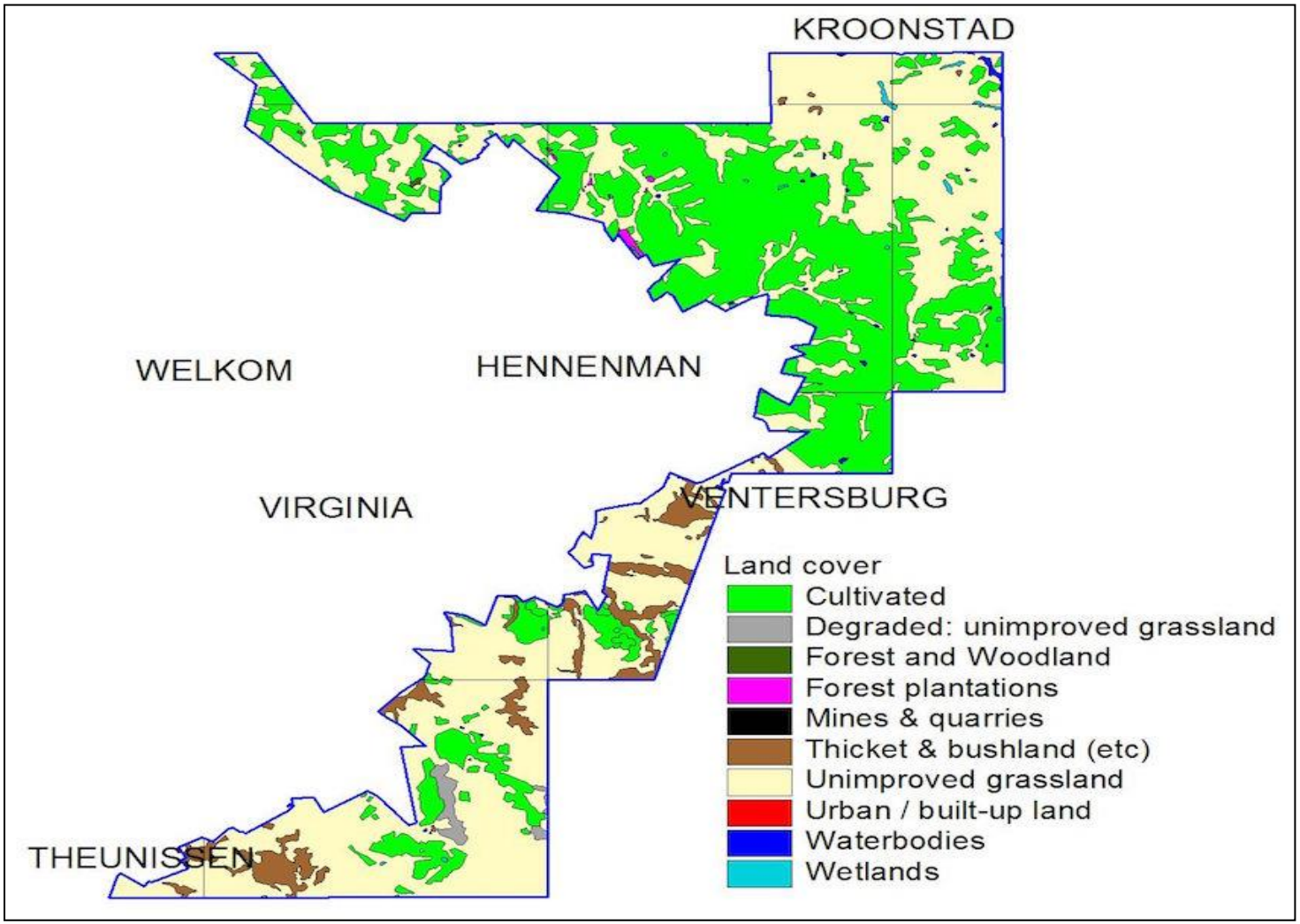

Figure 6**: Land cover of the study area, as depicted in the National Landcover Map of South Africa (Fairbanks et al. 2000**)

6.5.2. BROAD VEGETATION PATTERNS OF THE AREA

According to the most recent vegetation map of the country (Mucina et al., 2005) the study area is dominated by Central Free State Grassland and Vaal-Vet Sandy Grassland, with drainage lines and floodplains being characterised by Highveld Alluvial Vegetation and pan areas dominated by Highveld Salt Pans (Mucina and Rutherford 2006). There are also some small areas of Winburg Grassy Shrubland and Bloemfontein Karroid Shrubland on site. An indication of the regional vegetation types in relation to the study area is shown in Figure 7.

Driver et al. (2005) classified regional vegetation types into ecosystem status on the basis of rates of transformation and conservation. The dominant vegetation types occurring in the study area (Vaal-Vet Sandy Grassland and Central Free State Grassland) are classified as Endangered and Vulnerable. In these regional vegetation types, the amount of transformation is relatively high, and in both cases less than 1% of the vegetation type is conserved.

A brief description of each regional vegetation type that is likely to occur on site is provided below. Full descriptions can be found in Mucina et al. (2005).

CENTRAL FREE STATE GRASSLAND

This vegetation type is found on undulating plains. The vegetation is a short grassland, in natural condition dominated by *Themeda triandra*, while *Eragrostis curvula* and *Eragrostis chloromelas* become dominant in degraded areas. This is one of two of the most widespread vegetation type within the study area.

Central Free State Grassland is considered to be Vulnerable, with less than 1% conserved of a target of 24% and nearly 24% transformed. It is not listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004).

VAAL-VET SANDY GRASSLAND

This vegetation type is found on the plains irregularly scattered with hills. The grasslands are mainly low-tussock, with an abundant karroid element. It is dominated by *Themeda triandra* but in heavily grazed areas, or erratic rainfall, there is an associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* (Mucina et al. 2006b). This is one of the two the most widespread vegetation type within the study area.

Vaal-Vet Sandy Grassland is considered to be Endangered, with only a very small portion conserved of a target of 24% and more than 63% transformed. It is also listed as Endangered in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004 – NEMBA).

HIGHVELD ALLUVIAL VEGETATION

The topography supporting riparian thickets is usually flat and dominated by *Acacia karroo* accompanied by seasonally flooded grasslands and disturbed herblands. Alien vegetation often prevails (Mucina et al. 2006b).

Highveld Alluvial Vegetation is considered to be Least Threatened, in spite of less than 10% conserved of a target of 31% and more than a quarter transformed. It is not listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the NEMBA, but is protected to some degree as a riparian area and/or wetland area under the National Water Act (Act 36 of 1998 – NWA).

HIGHVELD SALT PANS

The pans occupy depressions in plateau landscape. On the pan edges, dwarf shrubland may develop when the pan is under heavy grazing pressure. The threatened grass species, *Sporobolus oxyphyllus* occurs on the edge of the pans although has not yet been discovered in the study area.

Highveld Salt Pans vegetation is considered to be Least Threatened, in spite of less than 1% conserved of a target of 24% and 3% transformed. It is not listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the NEMBA but is protected to some degree as a riparian area and/or wetland area under the National Water Act (Act 36 of 1998).

WINBURG GRASSY SHRUBLAND

This vegetation type is found on solitary hills, slopes and escarpments of mesas. It exists as a mosaic of habitats ranging from open grassland to shrubland. The vegetation is a medium-height evergreen shrubland dominated by a combination of *Olea europea* subsp. *africana*, *Euclea crispa* subsp. *crispa*, *Gymnosporia buxifolia*, *Diospyros lycioides*, *Searsia burchellii*, *Searsia ciliata*, *Searsia erosa*, *Clutia pulchella*, and *Grewia occidentalis*. Trees such as *Searsia lancea*, *Celtis Africana*, and *Ziziphus mucronata* are found in more deeply incised drainage lines.

Winburg Grassy Shrubland is considered to be Least Threatened, with less than 2% conserved of a target of 28% and 11% transformed. It is not listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under NEMBA.

BLOEMFONTEIN KARROID SHRUBLAND

This vegetation type is found on plateaus or slightly sloping flanks of dolerite outcrops. The vegetation is a low shrubland dominated by dwarf small-leafed karroid and succulent shrubs. Grasses are restricted to depressions and crevices filled with fine soils. There is a high abundance of geophytic herbs. Solitary shrubs or small groups of shrubs with *Diospyros austro-africana*, *Euclea crispa* subsp. *ovata*, *Searsia burchellii*, *Searsia ciliate*, and *Searsia erosa* are occasionally present, especially in habitats where root penetration into deeper crevices is possible.

Bloemfontein Karroid Shrubland is considered to be Least Threatened, with less than 1% conserved of a target of 28% and 10% transformed. It is not listed in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the NEMBA.

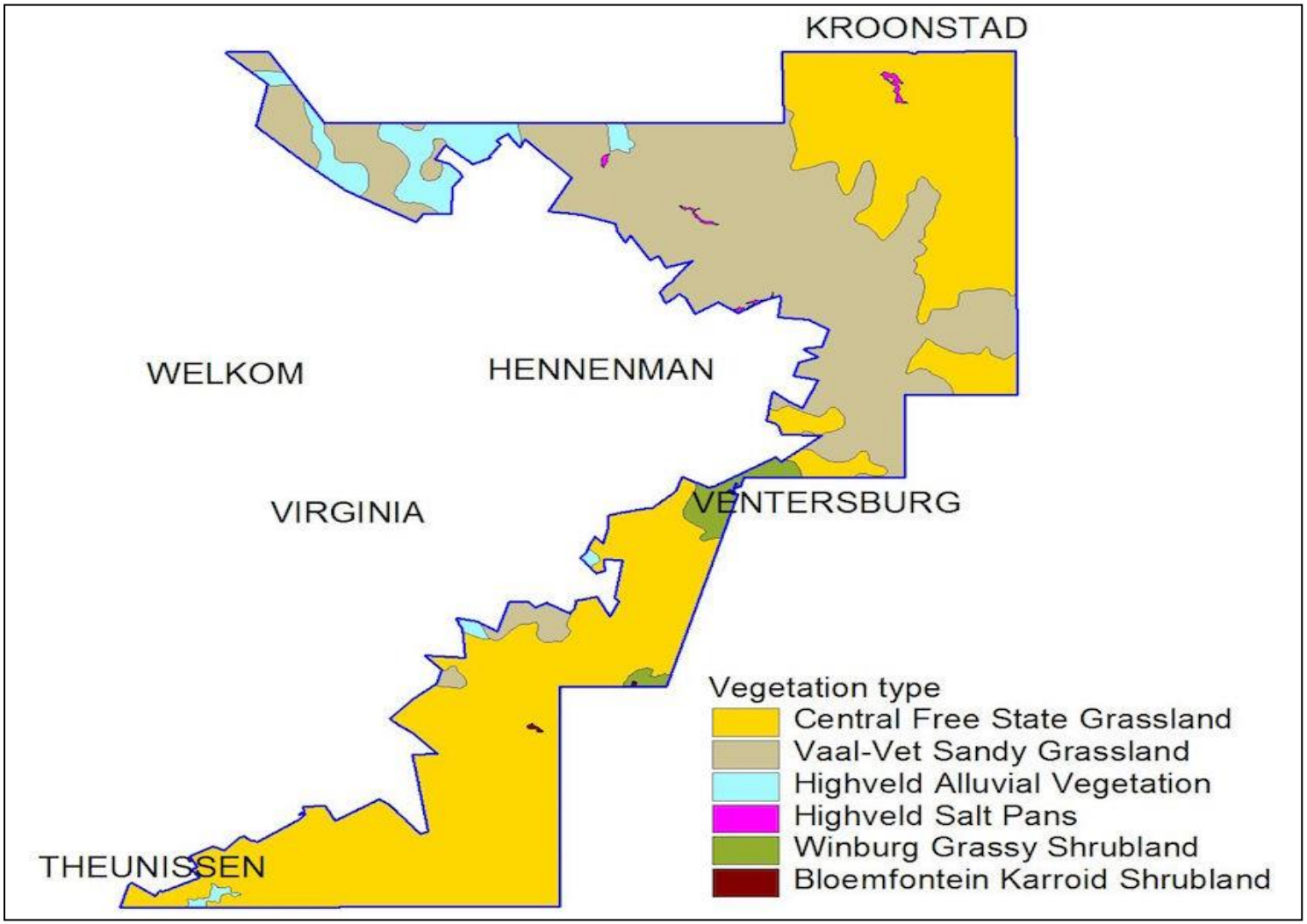

FIGURE 7: REGIONAL VEGETATION TYPES OF THE STUDY AREA (MUCINA ET AL. 2005

6.6. CLIMATE

The following section provides an overview of the regional meteorology and climatic conditions occurring across the extent of the project area. Information in this section has been sourced from the ecology scoping report by David Hoare Consulting cc.

6.6.1. REGIONAL DESCRIPTION

The study area has warm summers and cold winters. Frost is a common phenomenon and the coldest periods (usually from June to August) are exacerbated by seasonal aridity. The daily minima for the coldest months are below freezing. The monthly distribution of average daily maximum temperatures shows midday temperatures ranging from 17°C in June to 29°C in January. The region is the coldest during July when the temperatures drop to 0°C on average during the night. Winter frost and cold is therefore a potentially limiting factor for plant growth.

The study area is situated in a summer rainfall area, with rainfall peaking in January and at a lowest during July. Rainfall data was obtained from rainfall station 0365058 (Henneman) and the Mean Annual Precipitation (MAP) was calculated at 612 millimetres per annum (mm/a) over a 36 year period. The 95th percentile is 884 mm/a and the 5th percentile 408 mm/a. Annual rainfall is approximately 450 mm/a, which is considered to be relatively dry for an area of grassland.

6.7. FLORA

The following section provides an overview of the regional and site specific flora occurring across the extent of the project area. Information in this section has been sourced from the ecology scoping report by David Hoare Consulting cc. Refer to Appendix E3 for the ecology scoping report.

6.7.1. RED LIST PLANT SPECIES

No threatened species or species of conservation concern has been historically collected in the study area or from the grids in which the study area falls. Species that could occur in the study area, as determined from literature sources, are listed as an appendix to the ecology report (refer to Appendix E3) including the status and habitat information for each species.

Only one threatened species (*Bowiea volubilis* var. *volubilis*), which is listed as Vulnerable due to being overharvested for the medicinal trade, has a probability of occurring in the study area. The total distribution range of this widespread species (which occurs throughout Africa) overlaps with the study area and suitable habitat possibly occurs on site.

Six additional species of conservation concern have a moderate or high probability of occurring on site. Three (*Boophane disticha*, *Drimia altissima*, *Eucomis autumnalis*, and *Hypoxis hemerocallidea*) are widespread plants under threat from unsustainable harvesting for medicinal purposes and are therefore listed as Declining (refer to Table 12 for definitions). All three species have a moderate to high probability of occurring in the area as the study area overlaps with the total distribution area of their range.

Two species listed as Near Threatened could occur in the study area, one that is widely distributed (*Merwilla plumbea*), and the other that occurs in habitat that is found in the study area (*Sporobolus oxyphyllus*). These two species also have a moderate to high probability of being found in the study area.

It is therefore concluded that the six listed plant species are likely to occur on site, but a careful search within the footprint of proposed infrastructure is recommended to make sure of this.

TABLE 12: EXPLANATION OF IUCN VER. 3.1 CATEGORIES (IUCN, 2001), AND OTHER CATEGORIES OF CONSERVATION CONCERN (VICTOR & KEITH 2004; VICTOR 2006)

Category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Threatened
EN	Endangered	Threatened
VU	Vulnerable	Threatened
NT	Near Threatened	Conservation concern
Declining	Declining taxa	Conservation concern
Rare	Rare	Conservation concern
Critically Rare	Rare: only one subpopulation	Conservation concern
DDD	Data Deficient: well-known but not enough information for assessment	Data Deficient
DDT	Data Deficient: taxonomic problems	Data Deficient
LC	Least Concern	Least Concern

6.7.2. PROTECTED TREES

Tree species protected under the National Forest Act are listed in Table 13 below. The only species that has a geographical distribution that includes the study area is *Acacia erioloba*. This tree occurs in dry woodland along watercourses in arid areas where underground water is present as well as on deep Kalahari sands.

TABLE 13: LIST OF PROTECTED TREE SPECIES (NATIONAL FORESTS ACT)

Acacia erioloba	*Acacia haematoxylon*
Adansonia digitata	*Afzelia quanzensis*
Balanites subsp. *maughamii*	*Barringtonia racemosa*
Boscia albitrunca	*Brachystegia spiciformis*
Breonadia salicina	*Bruguiera gymnhorrhiza*
Cassipourea swaziensis	*Catha edulis*
Ceriops tagal	*Cleistanthus schlectheri* var. *schlechteri*
Colubrina nicholsonii	*Combretum imberbe*
Curtisia dentata	*Elaedendron (Cassine) transvaalensis*
Erythrophysa transvaalensis	*Euclea pseudebenus*
Ficus trichopoda	*Leucadendron argenteum*
Lumnitzera racemosa var. *racemosa*	*Lydenburgia abottii*
Lydenburgia cassinoides	*Mimusops caffra*
Newtonia hildebrandtii var. *hildebrandtii*	*Ocotea bullata*
Ozoroa namaensis	*Philenoptera violacea (Lonchocarpus capassa)*
Pittosporum viridiflorum	*Podocarpus elongatus*
Podocarpus falcatus	*Podocarpus henkelii*
Podocarpus latifolius	*Protea comptonii*
Protea curvata	*Prunus africana*
Pterocarpus angolensis	*Rhizophora mucronata*

Sclerocarya birrea subsp*. caffra*	*Securidaca longependunculata*
Sideroxylon inerme subsp*. inerme*	*Tephrosia pondoensis*
Warburgia salutaris	*Widdringtonia cedarbergensis*
Widdringtonia schwarzii	

6.8. FAUNA

The following section provides an overview of the regional fauna occurring across the extent of the project area. Information in this section has been sourced from the ecology scoping report by David Hoare Consulting cc. Refer to Appendix E3 for the ecology scoping report.

6.8.1. TERRESTRIAL FAUNA OF CONSERVATION CONCERN

All vertebrates (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in as an appendix to the ecology scoping report (refer to Appendix E3). Those threatened or near threatened vertebrate species with a geographical distribution that includes the study area, and habitat preference that includes habitats available within the study area are also listed in the ecology report appendix, along with associated habitat information as discussed below.

Mammals

A total of 66 mammal species have a geographical distribution that includes the general study area in which the site is found (Friedmann and Daly 2004, Mills and Hes 1997). Six of the species with a geographical distribution that includes the site have been listed in the Red Data Book of the Mammals of South Africa (Friedmann and Daly 2004). These species are as follows: Brown Hyaena, Spotted-necked Otter, Natal long-fingered Bat, Welwitsch's Hairy Bat, Geoffroy's Horseshoe Bat, and the White-tailed Rat.

The Brown Hyaena (*Hyaena brunnea*) is listed as Near Threatened in both South Africa (Friedmann and Daly 2004, http://vmus.adu.org.za) and globally (www.iucnredlist.org). It is found in all parts of South Africa, but is more concentrated in the northern parts of the country. It is found in a variety of biomes, including desert areas, particularly along the west coast, semi-desert, open scrub and open woodland savannah (Mills and Hes 1997). It is a solitary scavenger that travels vast distances every day in search of food. It has a medium chance of occurring on site since the distribution range includes the study area and there are historical records from nearby grids. It is a mobile animal that is likely to move away from the path of any construction and development of parts of the study area is therefore highly unlikely to have any negative effect on the species.

The Spotted-necked Otter (Hydrictus (Lutra) maculicollis) is listed as Near Threatened in both South Africa (Friedmann and Daly 2004) and globally (www.iucnredlist.org), although the University of Cape Town Animal Demography Unit have it listed as Least Concern (http://vmus.adu.org.za). The species is protected according to the NEMBA. It is native to sub-Saharan Africa, where it is found in lakes and larger rivers throughout much of Africa south of 10°N. In South Africa it is found in the eastern half of the country. It is found in permanent, unsilted and unpolluted rivers, streams and freshwater lakes, where sufficient numbers of its prey are present. Adequate riparian vegetation is essential to provide cover during periods of inactivity. It has been recorded in the grid in which the study area is located as well as most surrounding grids. There is a high probability that it

occurs in the study area, but only within suitable riparian areas. Any impacts on suitable habitat could have an effect on the species.

The African White-tailed Rat (Mystromys albicaudatus) is listed as Endangered in both South Africa (Friedmann and Daly 2004, http://vmus.adu.org.za) and globally (www.iucnredlist.org). It is found in South Africa and Lesotho, from the Western Cape, through the Eastern Cape, Free State and KwaZulu-Natal to Gauteng Mpumalanga and parts of the North-West. The white-tailed rat is restricted to savannas and grasslands. They tend to inhabit burrows of meerkats and cracks in the soil during the day and venture out at night. They require sandy soils with good cover. They are nocturnal and tend to emerge after rains. The species has been recorded in the grid in which the study area is located as well as a number of nearby grids. It is considered likely that it occurs in the study area.

There are a number of Chiroptera that have a geographical distribution that includes the study area, some only marginally, including the Natal Long-fingered Bat (*Miniopterus natalensis*), listed as Near Threatened, Welwitsch's Hairy Bat (*Myotis welwitschii*), listed as Near Threatened, and Geoffroy's Horseshoe Bat (*Rhinolophus clivosus*), listed as Near Threatened. In all cases, the global assessment is Least Concern (www.iucnredlist.org). All these species depend on caves for roosting. They are therefore unlikely to be found on site other than during foraging excursions, except at specific potential roosting sites. Activities on site are therefore highly unlikely to have any negative effect on any of these species.

Of the species currently listed as threatened or protected, the following are considered to have a medium to high probability of occurring on site and being potentially negatively affected by proposed activities on site:

- Spotted-necked Otter (NT); and
- African White-tailed Rat (EN).

Amphibians

A total of 16 frog species have a geographical distribution that includes the general study area in which the site is found (Du Preez and Carruthers 2009). Some of these species are only marginally present in the study area due to the fact that their distribution range ends close to the study area. Of the frog species that could potentially occur in the study area, none are listed in a threat category, but the Giant Bullfrog, previously listed as Near Threatened, is protected.

The Giant Bull Frog (*Pyxicephalus adspersus*) previously listed as Near Threatened, is found in seasonal shallow grassy pans, vleis and other rain-filled depressions in open flat areas of grassland or savanna and, at the limits of its distribution, in Nama Karoo and thicket. For most of the year the species remains buried up to 1 m underground. They emerge only during the peak of the rainy season to forage and breed. If conditions are extremely dry, they may remain cocooned underground for several years. Long distances often separate suitable breeding sites. In order to breed, they require shallow, rain-filled depressions that retain water long enough for the tadpoles to metamorphose. Before and after breeding, bullfrogs forage in open grassland, feeding mostly on insects, but also on other frogs, lizards, snakes, small birds and rodents. After breeding males

generally bury themselves within 100m of the breeding site, but females may disperse up to 1km away. Based on habitat requirements, there is a high probability that this species occurs in the study area.

It is concluded that the site contains habitat that is suitable for various frog species, although only one species of conservation concern is likely to occur in the study area. One frog species of concern is therefore potentially likely to be affected by development on site, as follows:

- Giant Bullfrog (protected).

Reptiles

A total of 48 reptile species have a geographical distribution that includes the general study area in which the site is found (Alexander and Marais 2007, Bates et al. 2014, Branch 1988, Marais 2004, Tolley and Burger 2007). Of the reptile species that could potentially occur in the study area, the Giant Dragon Lizard, listed as Vulnerable, and the Striped Harlequin Snake, listed as Near Threatened, have been listed in a threat category.

The Giant Dragon Lizard (*Smaug giganteus*), listed as Vulnerable, occurs only in the north-eastern Free State. It has been recorded in the north-eastern grid of the study area, as well as in grids to the north and east of there. The study area only just infringes into this grid and the distribution of this species is probably slightly outside the study area. Nevertheless, due to the geographical proximity of the study area to the known location of this species, it must be assumed that where suitable habitat occurs, there is a possibility of the species occurring on site. It is found in flat or sloping Highveld grassland, where it lives in self-excavated burrows. Threats to this species include habitat loss due to agriculture, mining and urbanisation, commercial exploitation for the pet trade, use in the traditional medicine market, agricultural poisoning and poor fire management of the grasslands.

The Striped Harlequin Snake (*Homoroselaps dorsalis*), listed as Near Threatened, occurs in Limpopo, Mpumalanga, Gauteng, Free State and KwaZulu-Natal Provinces as well as in western Swaziland. It has a patchy distribution and has not been recorded in any of the grids in which the site is located, but the overall geographical distribution includes the study area. It is partially fossorial and known to inhabit old termitaria in grassland habitat. Suitable habitat occurs on site and the study area is within the distribution range of this species. It is therefore considered possible that this species occurs on site. The main threat to this species is related to loss, degradation and fragmentation of suitable habitat.

There are therefore two reptile species of conservation concern that could potentially occur in the study area and that may therefore be affected by the proposed project, as follows:

- Giant Dragon Lizard (NT); and
- Striped Harlequin Snake (NT).

Birds

A total of 320 bird species have a geographical distribution that includes the general study area in which the site is found (Chittenden, 2007). A total of 189 of these species have been recently recorded in the grid (SABAP2). This includes a wide variety of species from different groups (see Appendix E3) and occurring in

different types of habitats. The habitat on site is only potentially suitable for a smaller number of these species and not all would be expected to be found there.

A total of 27 of the bird species with a geographical distribution that includes the site are listed in "The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland" (Taylor et al. 2015) and/or on the IUCN Red List (www.iucnredlist.org). Twelve of these are listed as Near Threatened, nine as Vulnerable and six as Endangered. The Endangered species are Ludwig's Bustard, Martial Eagle, African Marsh Harrier, Black Harrier, Yellow-billed Stork and Cape Vulture. The Vulnerable species are Burchell's Courser, Verreaux's Eagle, Lanner Falcon, African Grass Owl, Great White Pelican, Pink-backed Pelican, Secretarybird, Black Stork and Caspian Tern.

Ludwig's Bustard (*Neotis ludwigii*), listed as Endangered, is found in semi-arid dwarf shrublands, arid savanna and fynbos. Depending on rainfall, it may be found in the western grasslands of the Free State and Eastern Cape, the southern Kalahari and cultivated fields and pastures. It is an uncommon resident in the study area, but this is just outside its known range. Eggs are laid in a shallow scrape on the ground, but it is unlikely that the species would breed in the study area, if it was found there. The main threat to the species is collisions with distribution and transmission power lines and telephone lines. The species could potentially occur in the study area, but the probability is considered to be low. Any localised loss of habitat is unlikely to affect any individuals significantly.

The Martial Eagle (*Polemaetus bellicosus*), listed as Endangered, is found mostly in open savanna and woodland on plains and also semi-arid shrublands and edges of forests. It is rare in mountainous areas and in naturally treeless grasslands. Birds will occupy any habitats where there are adequate tall trees or pylons for nesting and perching, including wind-pumps and alien trees. Martial Eagles generally require exceptionally large home ranges in excess of 130 km2. It occurs at low densities in the study area. The species is virtually absent from cultivated areas. The species could potentially occur in the study area, but the probability is considered to be relatively low. It is possible that the study area constitutes the home range of individuals, but any localised loss of habitat is unlikely to affect any individuals significantly, unless nesting or perching sites are affected.

The African Marsh-Harrier (*Circus ranivorus*), listed as Endangered, is found in inland and coastal wetlands and adjacent moist grasslands. It is a common resident in the study area and has been recorded at a high reporting rate for the grid. The nest is built of sticks, reed stems and grass and usually placed in a reedbed over water. There is a moderate probability of the species being found in the study area. The primary threat faced by this species in southern Africa is "loss and degradation of its sensitive wetland habitats, brought about by drainage or damming for development and agriculture..., as well as pollution. Changes in the extent of moist wetland edges and surrounding grassland...could be more significant than changes in the extent of permanently inundated wetland and reedbeds." (Taylor et al. 2015). The species is not endemic to South Africa and also occurs in East and Central Africa. However, the high threat status attributed to this species means that any localised impacts should be avoided.

The Black Harrier (*Circus maurus*), listed as Endangered, is found in fynbos, renosterveld, Karoo shrublands, dry grasslands and croplands. It is endemic to southern Africa and is a common non-breeding migrant in the

study area. Its favoured breeding habitat is fynbos, particularly Strandveld and mountain fynbos. There is a moderate probability of the species being found in the study area, but it breeds further south in fynbos areas only and in the study area, it uses habitat only for foraging during non-breeding periods. Any localised loss of habitat is therefore unlikely to affect any individuals significantly.

The Yellow-billed Stork (*Mycteria ibis*), listed as Endangered, is found on the shoreline of most inland freshwater bodies and also occasionally in estuaries. They forage in a diversity of permanent and seasonal wetland habitat where there is open shallow water that is generally free of vegetation. It is an uncommon non-breeding migrant in the study area. There is a low probability of the species being found in the study area. The main threat to the species is loss of wetland habitats, including the system of pans, marshes and floodplains on which the bird depends for foraging. Impacts on these habitats could affect individuals of the species. Based on the threatened status of this species and the high frequency of sitings nearby, the potential effects on this species could be significant.

The Cape Vulture (*Gyps coprotheres*), listed as Endangered, breeds in cliff breeding sites in mountainous area but ranges widely in surrounding areas. It is mapped in Chittenden (2009) as a common resident in the study area, but atlas data indicates that it has not been recorded in the study area or surrounding grids. There is a very low probability of the species being found in the study area. Any localised loss of habitat is unlikely to affect any individuals significantly.

Burchell's Courser (*Cursorius rufus*), listed as Vulnerable, is found in sparsely vegetated arid regions, with typical habitat including heavily grazed or burnt grassland, stony or gravelly plains, stubbly sandveld, dry riverbeds and edges of saline pans. It is endemic to southern Africa and is an uncommon resident in the study area. There is a moderate probability of the species being found in the study area, although atlas data suggest that it currently does not occur in the study area. A small localised loss of habitat is unlikely to have any significant effect on this species, unless it affects breeding individuals.

Verraeux's Eagle (*Aquila verreauxii*), listed as Vulnerable, is found in mountainous and rocky areas with large cliffs. It is a common resident in nearby areas, but the study area is at the very edge of its known distribution range and it probably does not occur within the study area. There is a very low probability of the species being found in the study area. Localised loss of habitat will not affect this species.

The Lanner Falcon (*Falco biarmicus*), listed as Vulnerable, favours open grassland or woodland near cliff or electricity pylon breeding sites. It prefers open grassland, cleared woodlands and agricultural areas. It is an uncommon resident in the study area. It nests on cliffs, using the stick nests of other species when breeding in trees or on electricity pylons. There is a moderate probability of the species being found in the study area. Depending on the habitat affected, localised loss of natural areas could affect individuals of this species, but only in terms of available foraging habitat. The overall effect on the species is unlikely to be significant.

The African Grass Owl (*Tyto capensis*), listed as Vulnerable, is found in tall rank, or dense, short, grassland. It is an uncommon resident in the study area. The species has been recorded at a low recording rate in the grid. Nests on the ground in tall grassland where it makes a network of tunnels in the grass. There is a moderate probability of the species occurring in the study area. Depending on the habitat affected, localised loss of natural

areas could affect individuals of this species, including breeding individuals. The major threat to this species is loss of habitat as well as degradation of habitat due to unfavourable grazing and burning practices that prevent the development of rank grassland. If any suitable habitat or breeding individuals occur, it would be important to protect any suitable habitat.

The Great White Pelican (*Pelecanus onocrotalus*), listed as Vulnerable, is found in shallow lakes, estuaries, large pans and dams. It has a patchy distribution in South Africa, but is a common resident in the study area. There is a moderate probability of the species occurring in the study area, but these are likely to be transient individuals that are highly nomadic outside breeding periods. Known breeding sites include significant water bodies, none of which occur in the study area. Localised loss of habitat may affect transient individuals of this species, but the overall impact on regional populations will not be significant.

The Pink-backed Pelican (*Pelecanus rufescens*), listed as Vulnerable, is found in wetlands and estuaries. They forage in a wide range of wetlands, both fresh and saline. They may loaf on shorelines, but roost in trees. It is an uncommon resident in the study area, which is also at the edge of its known distribution range. There is a moderate to low probability of the species occurring in the study area, but it is unlikely to breed there. Important breeding and foraging sites are large wetland and pan systems in South Africa, which do not occur within the study area. Localised loss of habitat may affect transient individuals of this species, but the overall impact on regional populations will not be significant.

The Secretarybird (*Sagittarius serpentarius*), listed as Vulnerable, prefers open grassland and scrub, with the ground cover shorter than 50 cm and with sufficient scattered trees as roost/nest sites. It is found throughout South Africa, although absent from mountain fynbos, forest, dense woodland and very rocky, hilly or mountainous woodland. It is a very common resident in the study area. There is a high probability of the species occurring in the study area. The species occurs throughout South Africa and individual birds move large distances within the region. Localised loss of habitat and general disturbance may affect individuals of this species, but it is unlikely to do more than displace localised individuals.

The Black Stork (*Ciconia nigra*), listed as Vulnerable, is associated with mountainous regions, but not restricted to them. It is a solitary cliff-nester. It is piscivorous and is reliant on shallow waterbodies, such as estuaries and rivers, in which it forages. It is absent from seasonal pans that lack fish. The species is found in most parts of South Africa and is a common resident in the study area. There is a moderate probability of the species occurring in the study area, but due to the absence of cliff breeding sites it is unlikely to breed there. Disturbance of suitable waterbodies where foraging could occur may affect individuals of this species. This is potentially significant in terms of the threatened status of the species.

The Caspian Tern (*Sterna caspia*), listed as Vulnerable, is predominantly a marine or estuarine species, but also occurs inland, where it breeds on small, low islets in pans and dams. Their diet consists entirely of small fish. The species is a common resident in the study area. There is a moderate probability of the species occurring in the study area. Localised loss of habitat and general disturbance may affect individuals of this species.

The Blue Crane (*Anthropoides paradiseus*), listed as Near Threatened, is found mostly in natural grassland but also in wetlands, cultivated pastures and croplands. It is a common resident in the study area and has been recorded at a low reporting rate in the grid in which the study area is located as well as most surrounding grids. Eggs are laid on the ground. There is a moderate probability of the species occurring in the study area. Localised loss of habitat and general disturbance may affect individuals of this species, but this will probably lead to localised displacement and not an overall effect on the population within the study area. The species is relatively widely distributed in South Africa and not dependent on any small localised pieces of habitat.

The Eurasian Curlew (*Numenius arquata*), listed as Near Threatened, is found mainly at large, relatively undisturbed estuaries or lagoons. It may occur as a transient passage migrant at virtually any waterbody in inland South Africa, but mostly on the central Highveld. It is an uncommon non-breeding migrant in the study area. There is a moderate probability of the species occurring in the study area, but no individual habitat is likely to be of specific importance for the species.

The Maccoa Duck (*Oxyura maccoa*), listed as Near Threatened, is found during the breeding season in small, shallow and nutrient-rich inland freshwater lakes and also makes use of man-made infrastructure, such as farm dams and sewage farms. Nests are in emergent vegetation over deep water. It is a very common resident in the study area. There is a high probability of the species occurring in the study area. Depending on the habitat affected, localised loss of natural areas could affect individuals of this species.

The Red-footed Falcon (*Falco vespertinus*), listed as Near Threatened, is found in open semi-arid and arid savanna. It roosts communally at dusk in large numbers around traditional roosts, typically tall alien trees in rural towns. The species is a common non-breeding migrant in the study area. There is a moderate probability of the species occurring in the study area. Localised loss of roosting habitat could potentially affect populations of this species by displacing them.

The Greater Flamingo (*Phoenicopterus roseus*), listed as Near Threatened, is found in saline and brackish shallow water bodies such as saltpans, large dams and coastal mudflats. It is a common resident in the study area. The nest is a cone of mud. There is a moderate probability of the species occurring in the study area, but they are more likely to occur within the larger pans around Welkom. Damage to suitable wetland areas could affect individuals of this species, but breeding populations are unlikely to be affected.

The Lesser Flamingo (*Phoeniconaias minor*), listed as Near Threatened, is found in eutrophic shallow wetlands, especially saltpans. It is a common resident in the study area. It breeds colonially and its nest is a cone of mud. There is a moderate probability of the species occurring in the study area, but they are more likely to occur within the larger pans around Welkom. Damage to suitable wetland areas could affect individuals of this species, but breeding populations are unlikely to be affected.

The Pallid Harrier (*Circus macrouras*), listed as Near Threatened, is found in grassland associated with open pans or floodplains and also in croplands. It is a common non-breeding migrant in the study area. There is a moderate probability of the species occurring in the study area. Threats in South Africa are related to general habitat destruction and degradation. Localised loss of habitat and general disturbance may affect individuals of this species, but it is unlikely to have a significant effect on the regional population.

The Greater Painted-snipe (*Rostratula benghalensis*), listed as Near Threatened, is found in freshwater wetlands in vegetated waterside habitats with exposed mud. They occur sparsely along the shorelines of dams, lakes and pans, on the banks of slow-moving rivers, on marshy floodplains, in temporarily-flooded grassland and at rainwater pools on clay soils with plentiful adjacent cover. It is a common resident in the study area. There is a moderate probability of the species occurring in the study area. The greatest threat faced by this species is transformation, degradation and loss of its wetland habitat. Damage to suitable wetland and grassland areas within the study area could affect individuals or populations of this species.

The Chesnut-banded Plover (Charadrius pallidus), listed as Near Threatened, is found in natural and man-made saltpans, being rare at freshwater habitats. It is strongly associated with hyper-saline or hyper-alkaline wetlands. It is usually found in areas devoid of vegetation and rarely ventures more than 50 m from the water's edge. It is a common resident in the study area. The nest is a shallow scrape in sand or placed on pebbly substrata or dry mud. There is a moderate probability of the species occurring in the study area. Damage to suitable wetland areas could affect individuals or populations of this species. Key habitats in the general area are the larger pans around Welkom, so habitat within the study area is probably of low importance for this species.

The Black-winged Pratincole (*Glareola nordmannii*), listed as Near Threatened, is found in open grasslands, on edges of pans and in cultivated fields. It is attracted to damp ground and newly flooded grassland. It is a very common non-breeding migrant in the study area. It is a gregarious species that is found in small groups or large flocks of up to many thousands of birds. There is a high probability of the species occurring in the study area. Threats to this species are not within South Africa, but a large proportion of the global population overwinters in southern Africa. Key regional sites for this species are the Amersfoort-Bethal-Carolina District, Chrissie Pans and the Nyl River Floodplain. Within the study area, any suitable habitat in proximity to pans is important to conserve.

The European Roller (Croacius garrulus), listed as Near Threatened, is found in open woodland, perching on open dead branches, telephone poles and power lines. It is a common non-breeding migrant in the study area, but occurs at low densities in the study area and surrounding areas. There is a moderate probability of the species occurring in the study area. Threats to this species are within its breeding range and not in southern Africa. The study area has limited amounts of suitable habitat. It is unlikely that localised loss of habitat will affect the species in any significant way at all.

Abdims' Stork (*Ciconia abdimii*), listed as Near Threatened, is found in grassland, savanna woodland, near pans and cultivated lands in groups of up to 100 birds. It is a common non-breeding migrant in the study area. The threats to the species are not well-understood and it has been listed until more detailed information is available to make an informed assessment. It is unlikely that localised loss of habitat will affect the species in any significant way at all.

It is concluded that the site contains habitat that is suitable for various bird species of conservation concern. Those that are potentially significantly vulnerable to proposed activities in the study area are as follows:

- African Marsh Harrier (EN),
- Yellow-billed Stork (EN),

- Burchell's Courser (VU),
- African Grass Owl (VU),
- Secretarybird (VU),
- Black Stork (VU),
- Maccoa Duck (NT),
- Red-footed Falcon (NT),
- Greater Painted Snipe (NT),
- Black-winged Pratincole (NT).

Important Bird Areas

The site does not fall within any Important Bird Area, as defined by BirdLife South Africa, but is in moderate proximity to a number of them. The closest IBA is 13km to the east, the Willem Pretorius Game Reserve. Further east, approximately 90km away, is the Fouresburg-Bethlehem-Clarens IBA, approximately 100km to the south-west is the Soetdoring Nature Reserve IBA and the same distance to the north-west is the Sandveld-Bloemhof Dam IBA.

6.8.2. KEY SENSITIVITIES

There are features within the study area that need to be taken into account in order to evaluate sensitivity of the site and its surroundings. These include the following:

- Wetlands areas: There are a variety of different wetland habitats on site, including riparian areas, stream channels, floodplains, a number of pans, open water areas and seepage areas. The wetlands are protected according to the National Water Act and also constitute important ecological areas in terms of hydrological processes and as refugia for species.
- Natural vegetation: The major vegetation type of this region is Vaal-Vet Sandy Grassland, which is listed as Endangered in the scientific literature and according to the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the NEMBA. These remaining patches of grassland have high conservation value. There are also other areas of natural habitat that do not fall within the Endangered vegetation type and which do not, therefore have as high conservation value.

A summary of the factors used to classify sensitive habitats on site is given in Table 14 and a map of sensitive habitats in terms of the ecological environment is shown in Figure 8.

TABLE 14: FACTORS CONTRIBUTING TO SENSITIVITY CLASSIFICATION OF DIFFERENT HABITATS ON SITE.

Vegetation/habitat type	Sensitivity	Reason
Remaining patches of Endangered vegetation type	Very High	• Vegetation type listed as Endangered in scientific literature and according to the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004). • Potential habitat for various species of concern.
Wetlands	High	• Protected habitats (areas protected according to national / provincial legislation, e.g. National Water Act). • Ecosystem providing high value ecosystem goods and services.
Other natural areas	Medium	• Vegetation type not listed in scientific literature nor according to the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004). • Potential habitat for various species of concern.

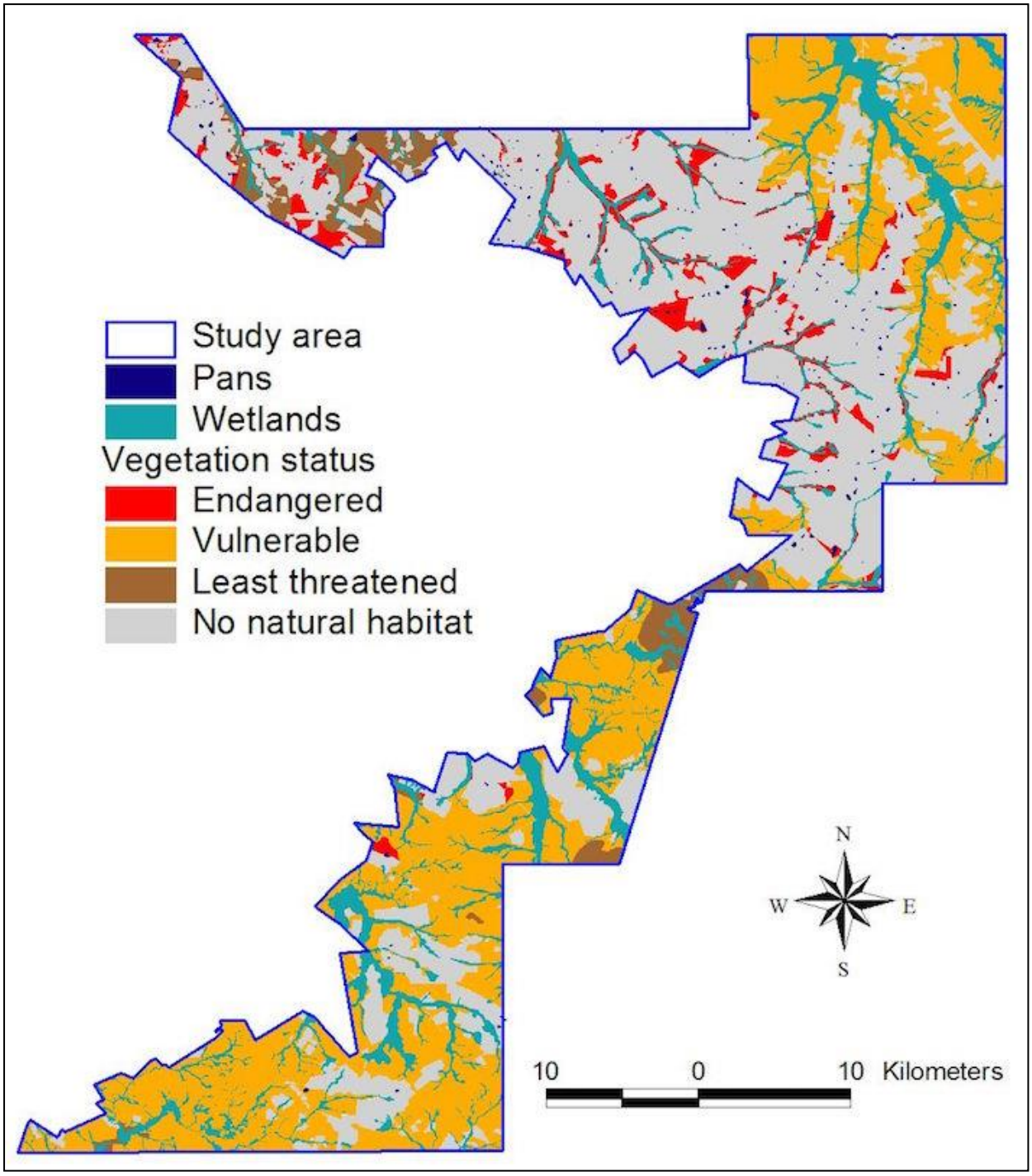

FIGURE 8: LOCATION OF SENSITIVE HABITATS WITHIN THE STUDY AREA

6.9. SURFACE WATER

The following section provides an overview of the regional hydrological (surface water) environment across the extent of the project area. Information in this section has been sourced from the ecology and geohydrology scoping reports by David Hoare Consulting cc and Exigo, as well as local municipality IDPs.

6.9.1. REGIONAL DESCRIPTION

Five rivers run through the Matjhabeng local municipality, including the Koolspruit, Sand, Sandspruit and Vet. Wetlands cover 5.5% of this municipality. There is only one water management area in this municipality, namely the Middle Vaal.

The Vaal River borders Moqhaka local municipality to the west. The Vals and Renoster Rivers drain through the area towards the Vaal River. These rivers play a significant role in providing the raw water supply to Kroonstad, Steynsrus and Viljoenskroon respectively. The western areas, in the vicinity of Viljoenskroon, are known for various shallow and non-perennial pans.

6.9.2. SITE DESCRIPTION

The Sand and the Vet Rivers are the two main drainage systems in the study area, but a number of smaller streams drain into these two systems, including the Erasmusspruit, Schoemansspruit, Middelspruit, Klipspruit, Leeuspruit, Blomspruit, Enslinspruit, and the Doringrivier. The low hills consist mostly of undulating areas with hills at Koppieskraal north-east of Ventersburg and steeper river valleys in the region south-west of Ventersburg. The site varies in elevation from approximately 1330 to 1495m above sea level with the highest point being on the central western boundary and the lowest point on the north-eastern boundary.

The entire site is made up fully or partially of 13 quaternary catchments located in the Middle Vaal Water Management Area (WMA) (refer to and Figure 9 below). No major surface water features are located within the proposed exploration area. The Allemanskraal dam is located 21km south of Ventersburg, however, it is outside the exploration area. The area surrounding the Allemanskraal Dam is also the only protected area in the vicinity, according to the Department of Water and Sanitation GIS data.

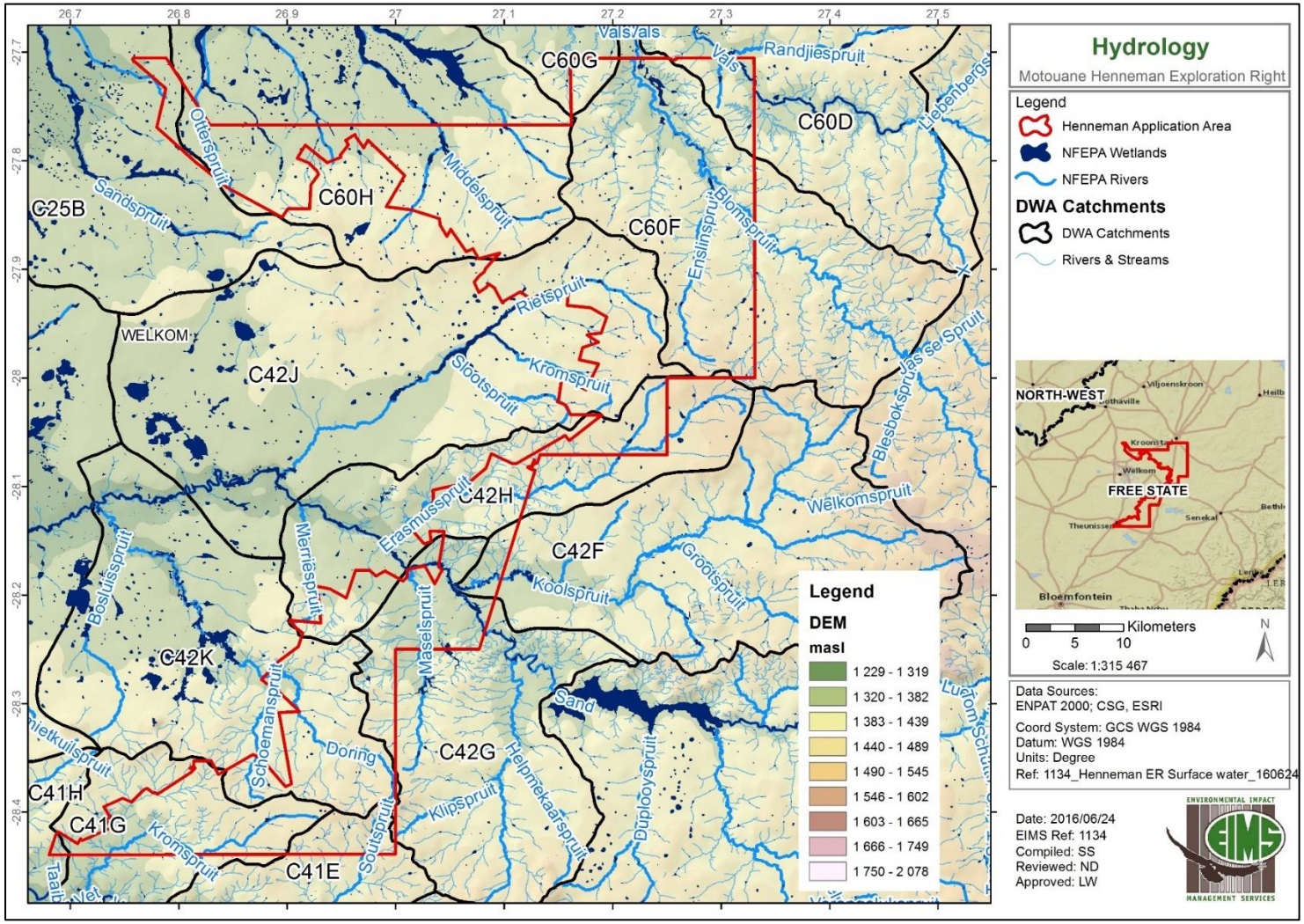

FIGURE 9: HYDROLOGY OF THE STUDY AREA

6.10. GROUNDWATER

This section was sourced from the geohydrological (ground water) scoping report by Exigo, and presents information about the geohydrological characteristics and sensitivities within the study area. Refer to Appendix E2 for the geohydrological scoping report.

6.10.1. REGIONAL GEOHYDROLOGY

The proposed exploration application is located in an area characterised by fractured or secondary hard rock aquifers. Although it is not verified, it is anticipated that locally developed alluvial and weathered aquifers would occur close to the streams and rivers. In general, the development potential of these aquifers (excluding dolomite) is low, but able to supply the basic water needs of rural settlements and farms (DWA, 2010). The yields of (successful) water supply boreholes in these formations are to be confirmed with field surveys. Once the precise exploration areas have been identified, further field verification should be done.

However, typically for these fractured rock aquifers, yields of between 1 Litres per second (L/s) to 5 L/s could be expected. These yields are considered as moderate as high yielding boreholes have yields > 5 L/s. The aquifers within which the boreholes were drilled, can in general be classified as Minor Aquifers that have yields of < 5 L/s, which in some areas are used as Sole Source Aquifers (Parsons, 1991). Locally, Major Aquifers with yields > 5 L/s are expected to be associated with regional scale fault zones or geological contact areas (dolerite dykes/sills etc.). The fault zones are deemed important to feed groundwater as a base flow component to streams and rivers.

6.10.2. BOREHOLES

Data from the National Groundwater Archive (NGA) indicate that numerous water boreholes have been drilled in the area (refer to Figure 10). There are 56 boreholes recorded in the NGA database located within the proposed exploration area. Given the size of the area, it is safe to assume that this only represents a fairly small percentage of actual boreholes and geosites in the exploration area.

Of the 56 recorded geosites, only 27 have a recorded water level measurement. The average water level depth is 17 metres below ground level (mbgl), with a maximum and minimum water level measurements of 60 mbgl and 2.44 mbgl respectively (refer to Figure 11). There is no springs on record.

Once the detailed exploration sites have been identified, a detailed hydrocensus should be carried out within a 3km radius of the proposed exploration areas. All water users, sensitive receptors and geosites should be recorded and sampled to obtain a representative baseline of the immediate area.

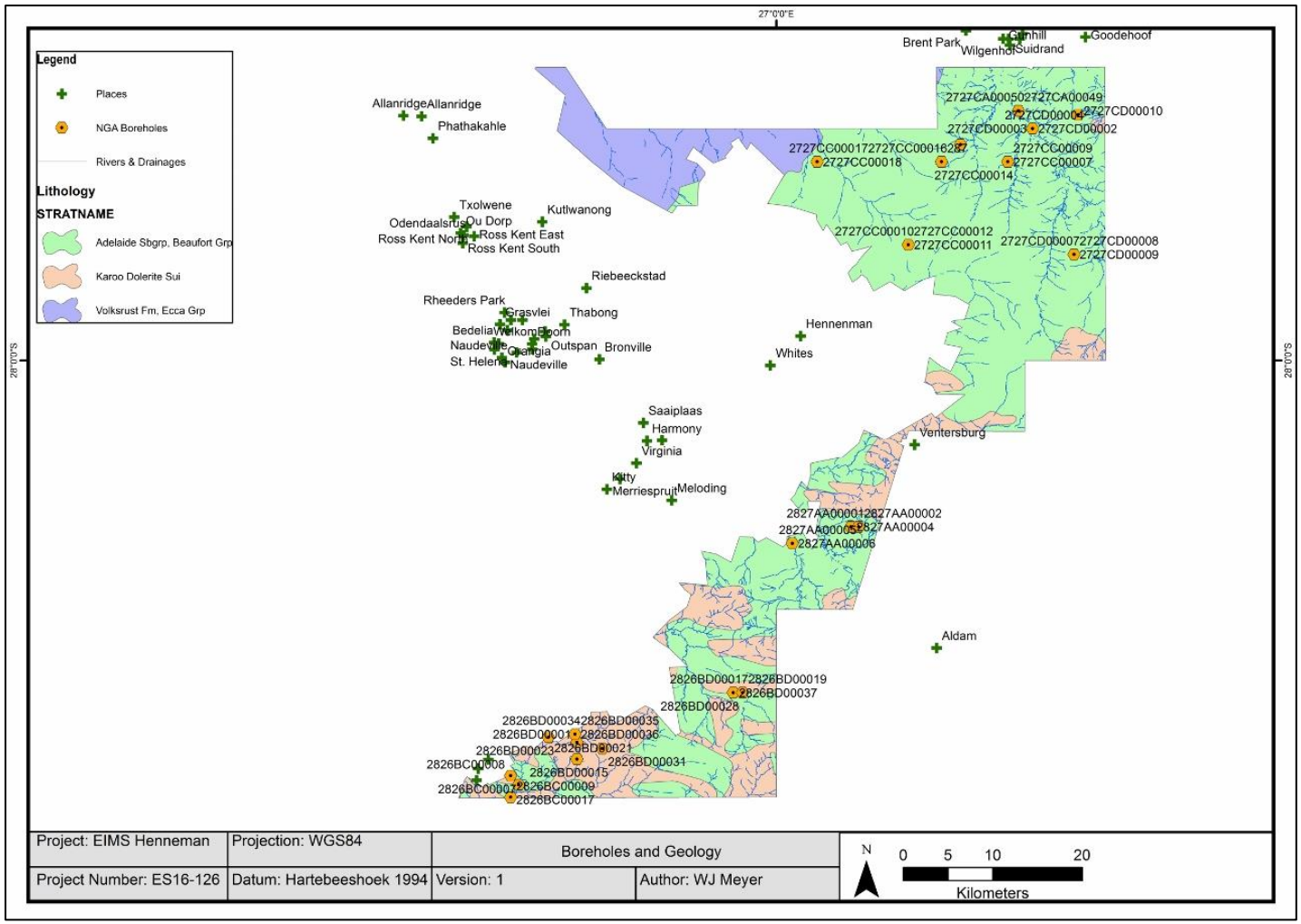

FIGURE 10: GEOLOGICAL SETTING AND NATIONAL GROUNDWATER ARCHIVE (NGA) BOREHOLES

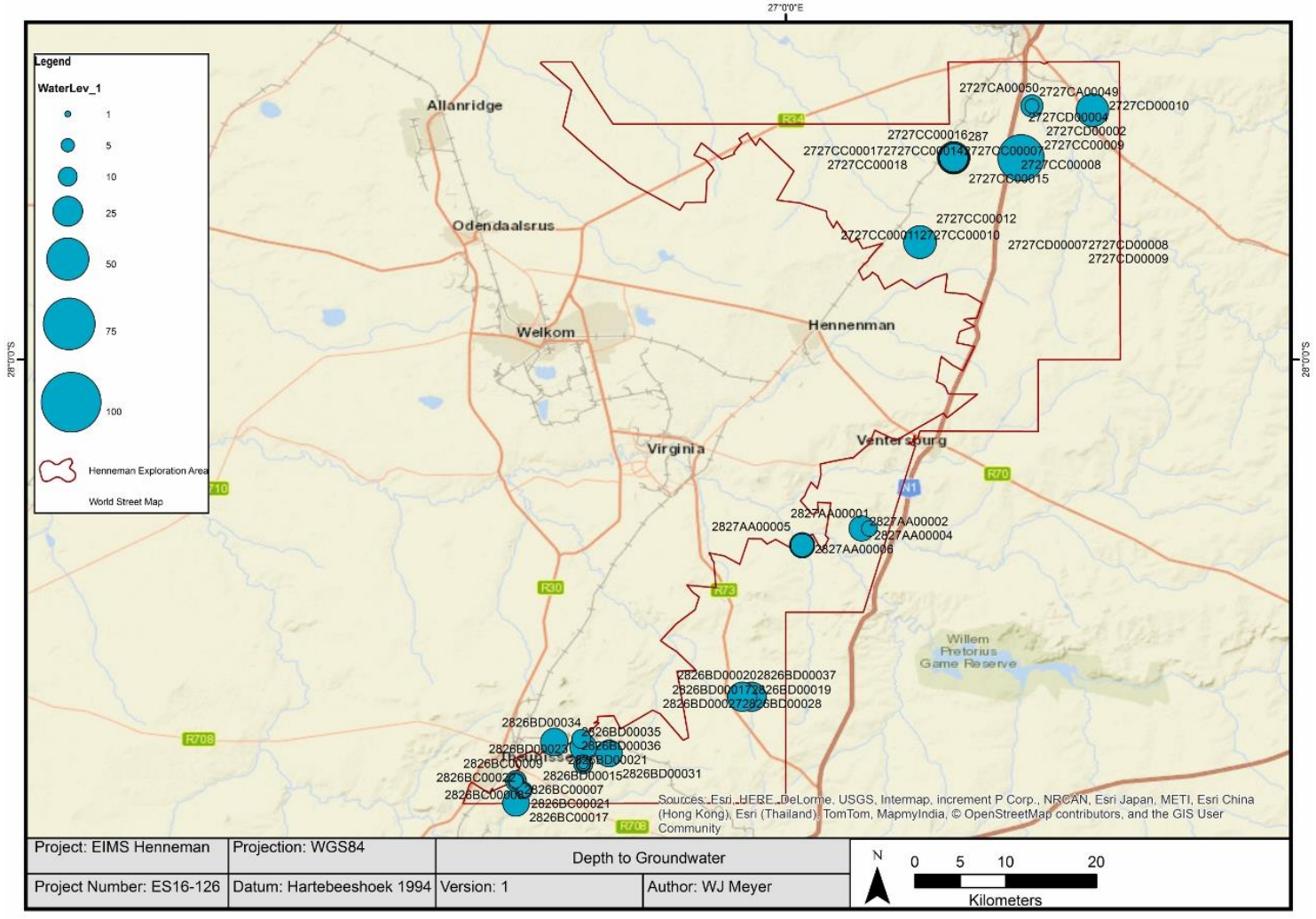

FIGURE 11: DEPTH TO GROUNDWATER FOR NGA DATABASE BOREHOLE

6.10.3. KEY SENSITIVITIES

The following potentially sensitive surface water and groundwater zones were identified during this study:

- Wetlands: No drilling should be done in or adjacent to defined wetlands. Wetland buffer zones of at least 500m should be implemented where possible.
- Green riparian zones along local drainages and fault zones: These zones are evident along drainages that can be identified from aerial photographs. No drilling should be done in the green riparian zones. Should drilling in these zones be planned, it should be done with an ecological and biological specialist study that should be done prior to drilling to determine whether drilling should be permitted and/or whether rehabilitation could be sufficient for the specific area.
- Layered Aquifers: Drilling of exploration boreholes could link layered aquifer systems and cause cross flow. For this purpose, boreholes that are drilled through defined aquifer layers should be sealed as a preventative measure to prevent cross flow.
- Existing boreholes: Drilling that takes place in the vicinity (1km) of existing water supply boreholes should be done with additional mitigation measures. Water gains or losses should be recorded and boreholes in these areas should be sealed before drilling should continue – should water gains or losses be experienced. Water level measurements and samples should be taken before and after drilling on the water supply boreholes to verify any water quantity and quality impacts.
- Regional fault zones that could feed aquifer dependent eco-systems.

The sensitivity of the study area with regards to hydrogeological aspects in relation to the aspects highlighted above is presented in Figure 12 below

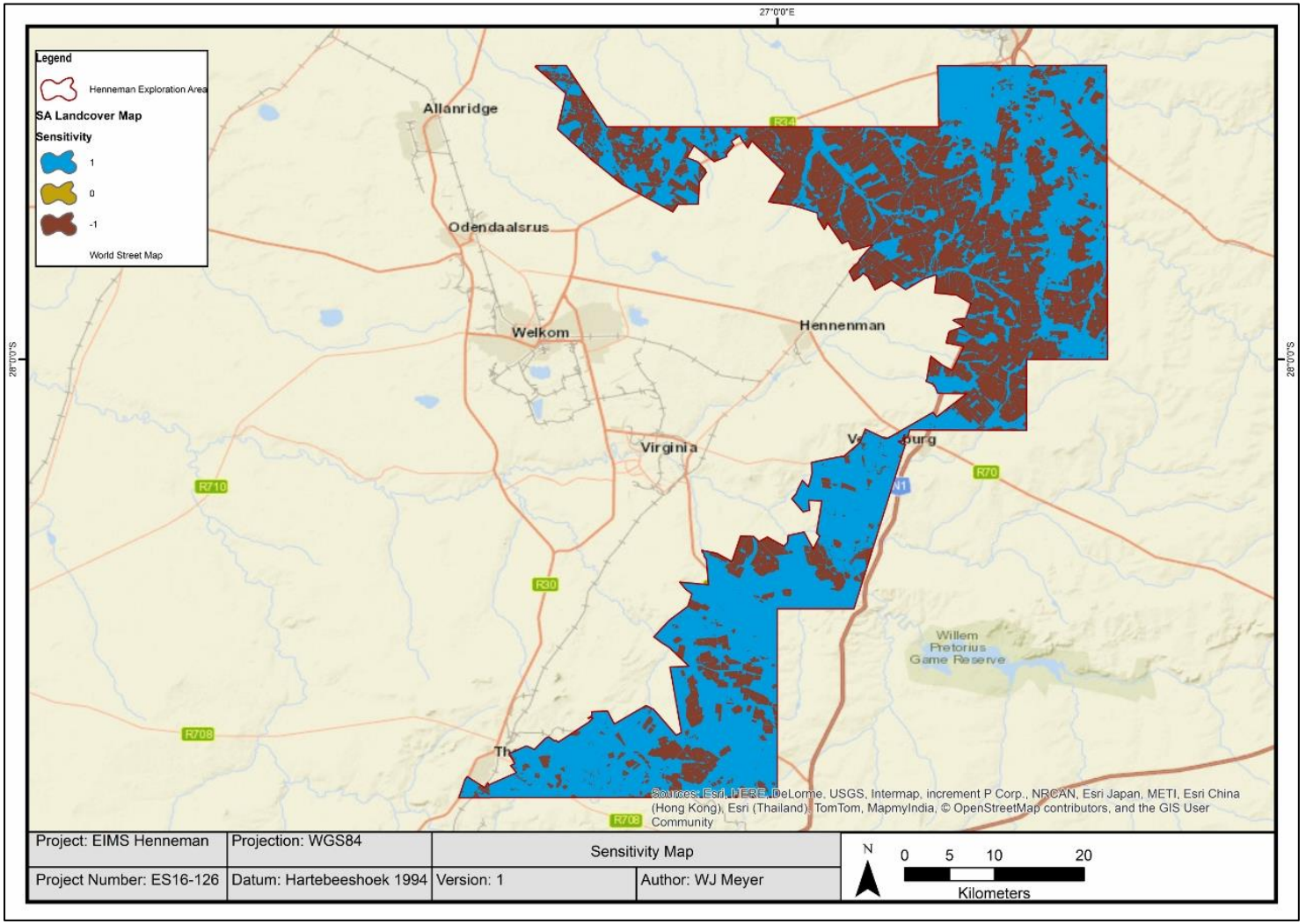

FIGURE 12: GEOHYDROLOGICAL SENSITIVITY MAP FOR PROPOSED HENNEMAN EXPLORATION

6.11. OVERALL SENSITIVITY / CONSTRAINTS

The environmental sensitivity maps created by each of the specialists above have been combined into a consolidated sensitivity map below (Figure 13). The map has been split between northern (Figure 14) and southern (Figure 15) sections to aid in discernment of features. This map will aid in determining the avoidance of sensitive features and/or guide the mitigation measures thereof as well as the placement of exploration activities to minimise the impact of the proposed project on the environment.

A constraints map has additionally been included in Figure 16 (overall map), Figure 17 (northern section) and Figure 18 (southern section) based on the legislative principles, namely:

- MPRDA Section 122(3)[1];
- GNR704;
- MPRDA Section 48(1); and
- NEM:PAA Section 48.

These sensitivities and constraints will be further assessed during the course of the EIA. Finally these constraints and sensitivities will guide the consideration and compilation of mitigation measures to be put forth in the EMPR during the next phase of this EIA process.

[1] The NFEPA wetlands GIS layer was utilised to determine the extent of wetland in the study area. This layer does not always represent the ground truth and would need further assessment (refining) prior to final site selection.

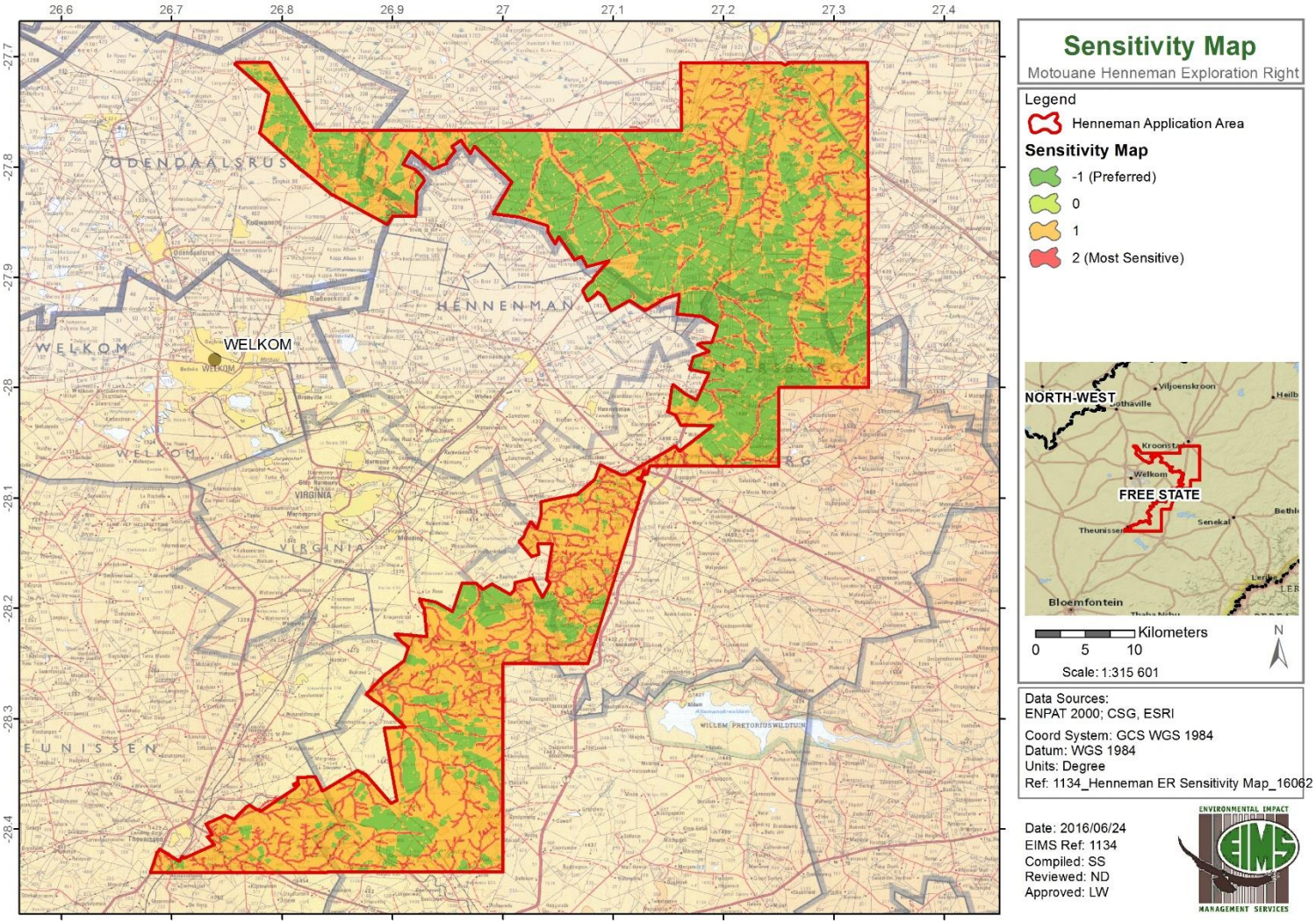

FIGURE 13: CONSOLIDATED SENSITIVITY MAP

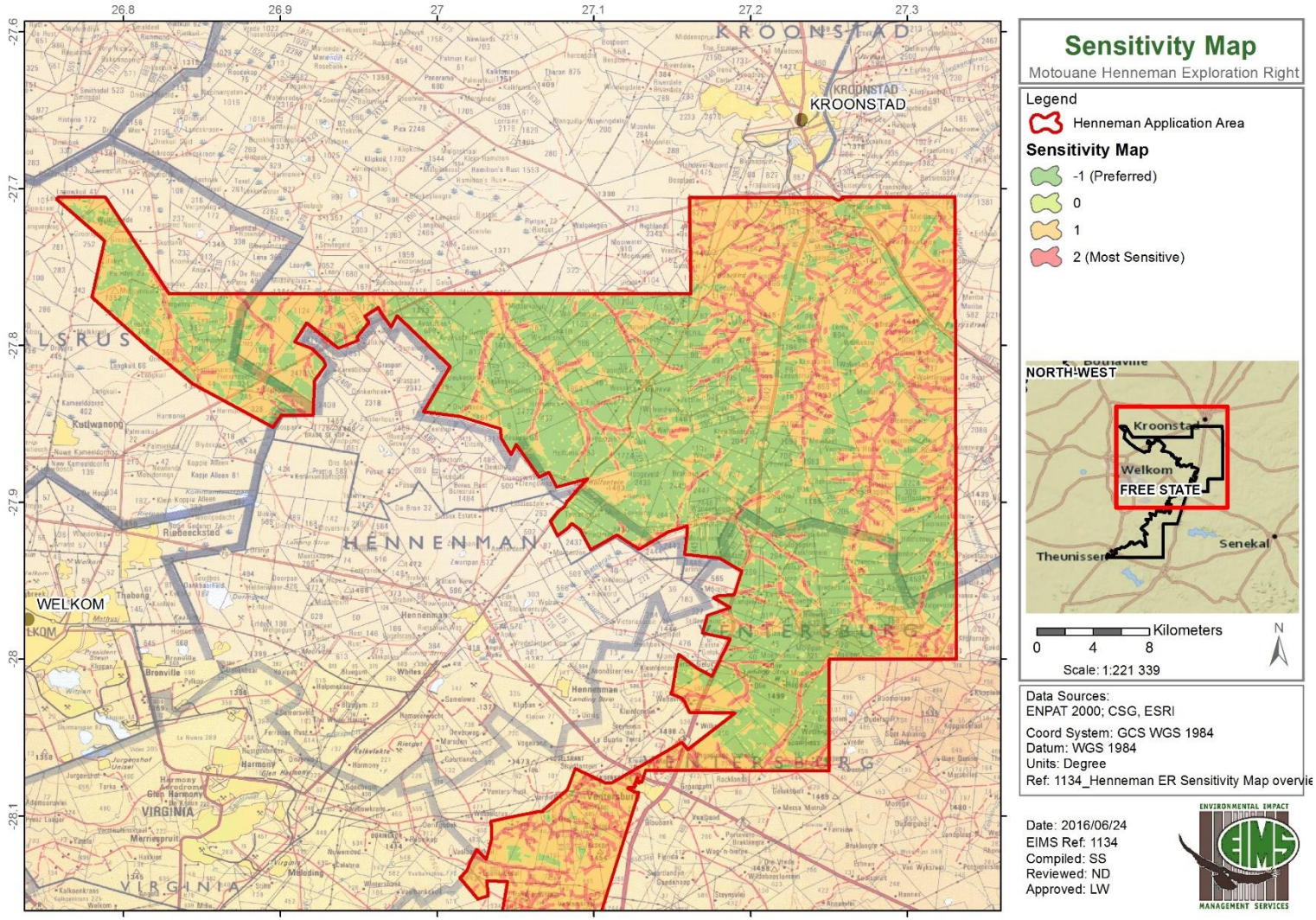

FIGURE 14: CONSOLIDATED SENSITIVITY MAP (NORTHERN SECTION

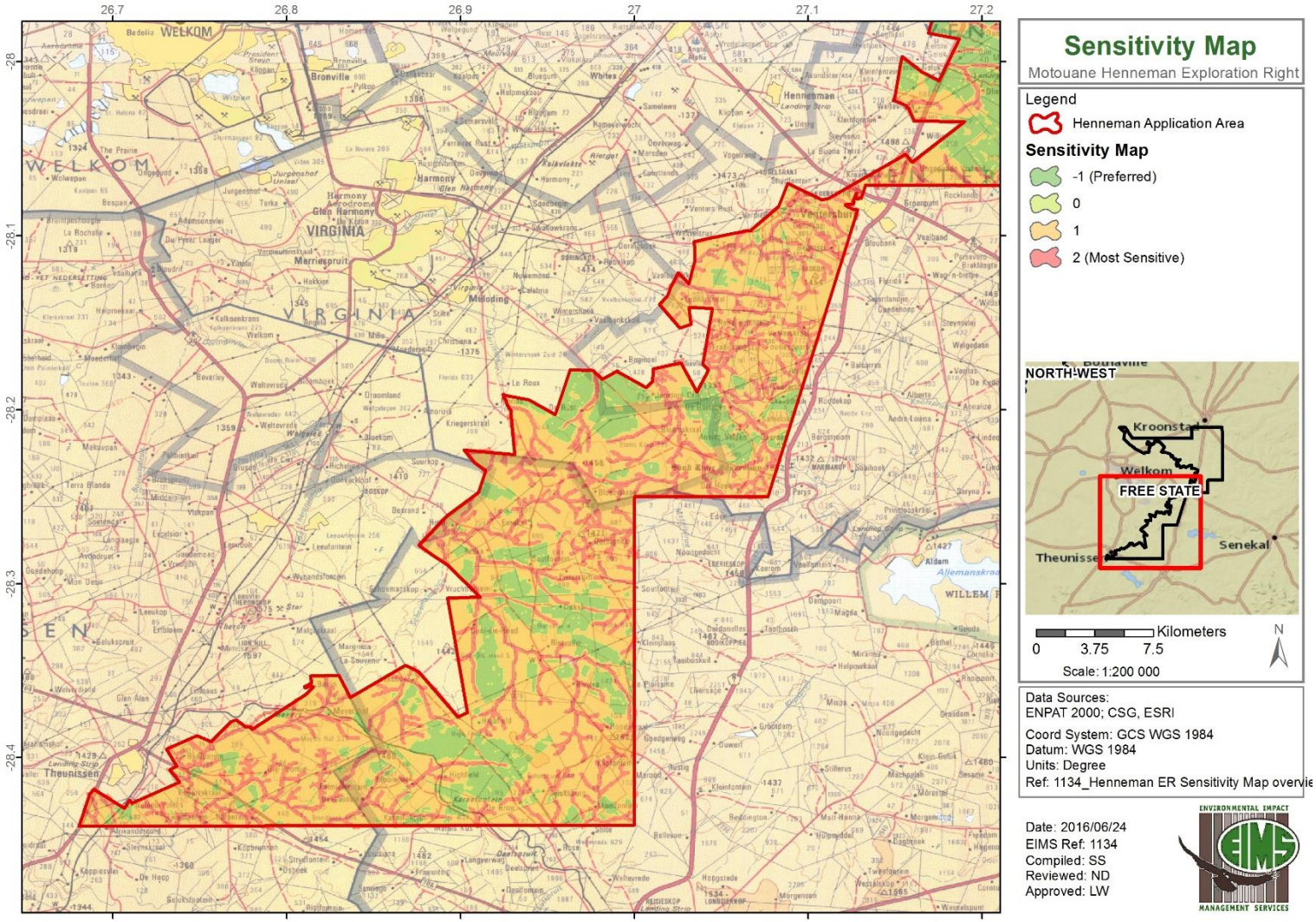

FIGURE 15: CONSOLIDATED SENSITIVITY MAP (SOUTHERN SECTION).

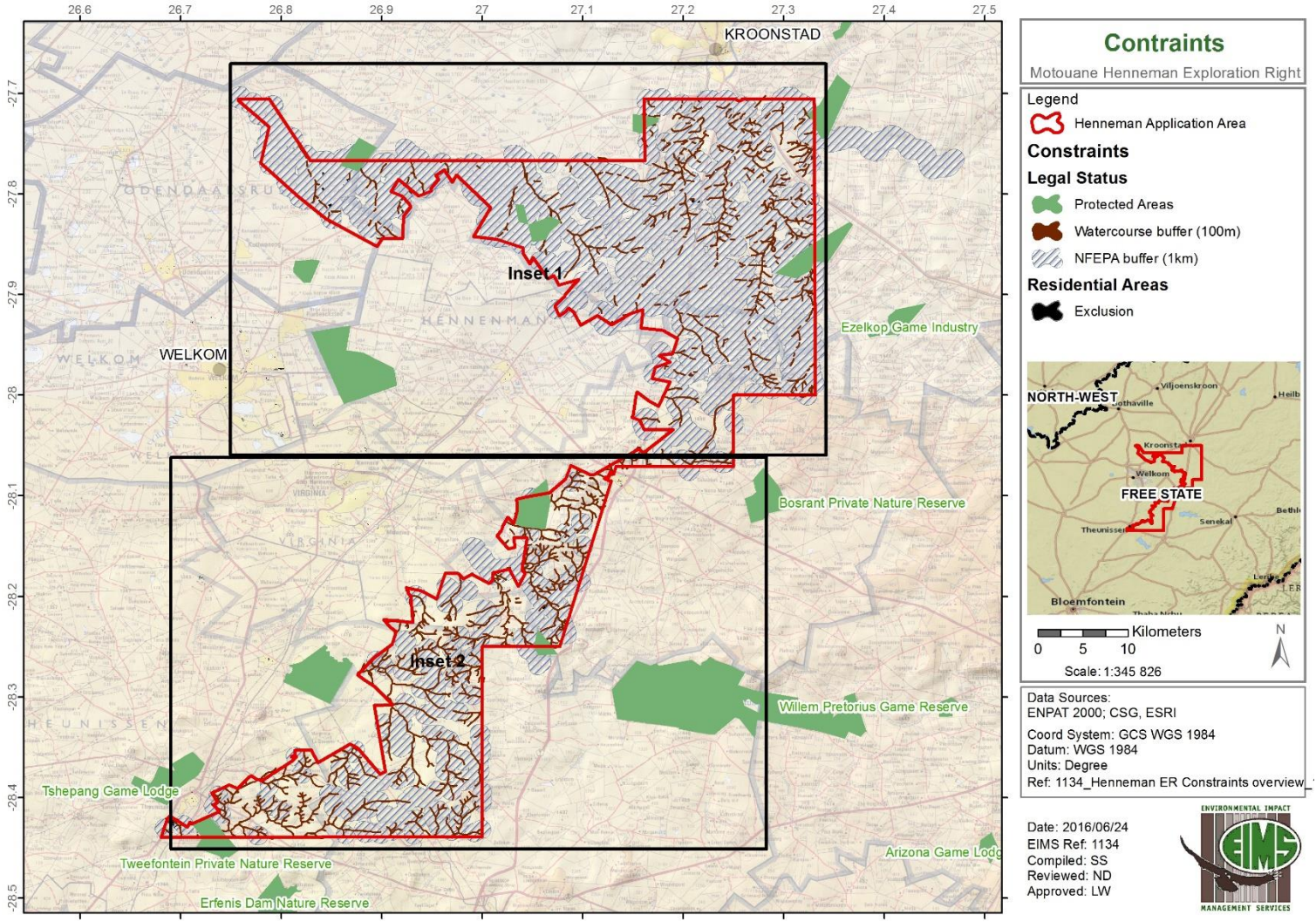

FIGURE 16: CONSTRAINTS MAP

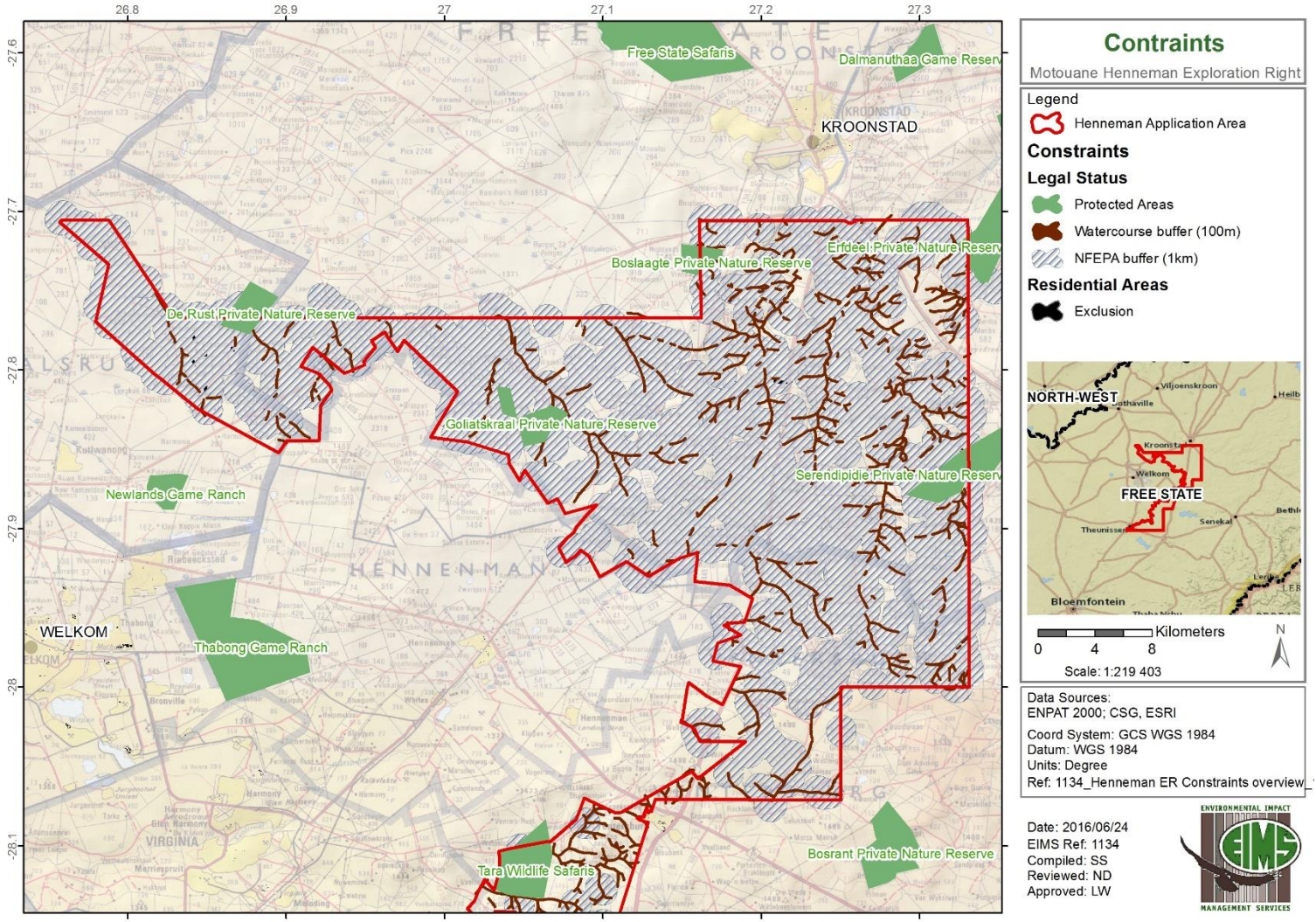

FIGURE 17: CONSTRAINTS MAP (NORTHERN SECTION).

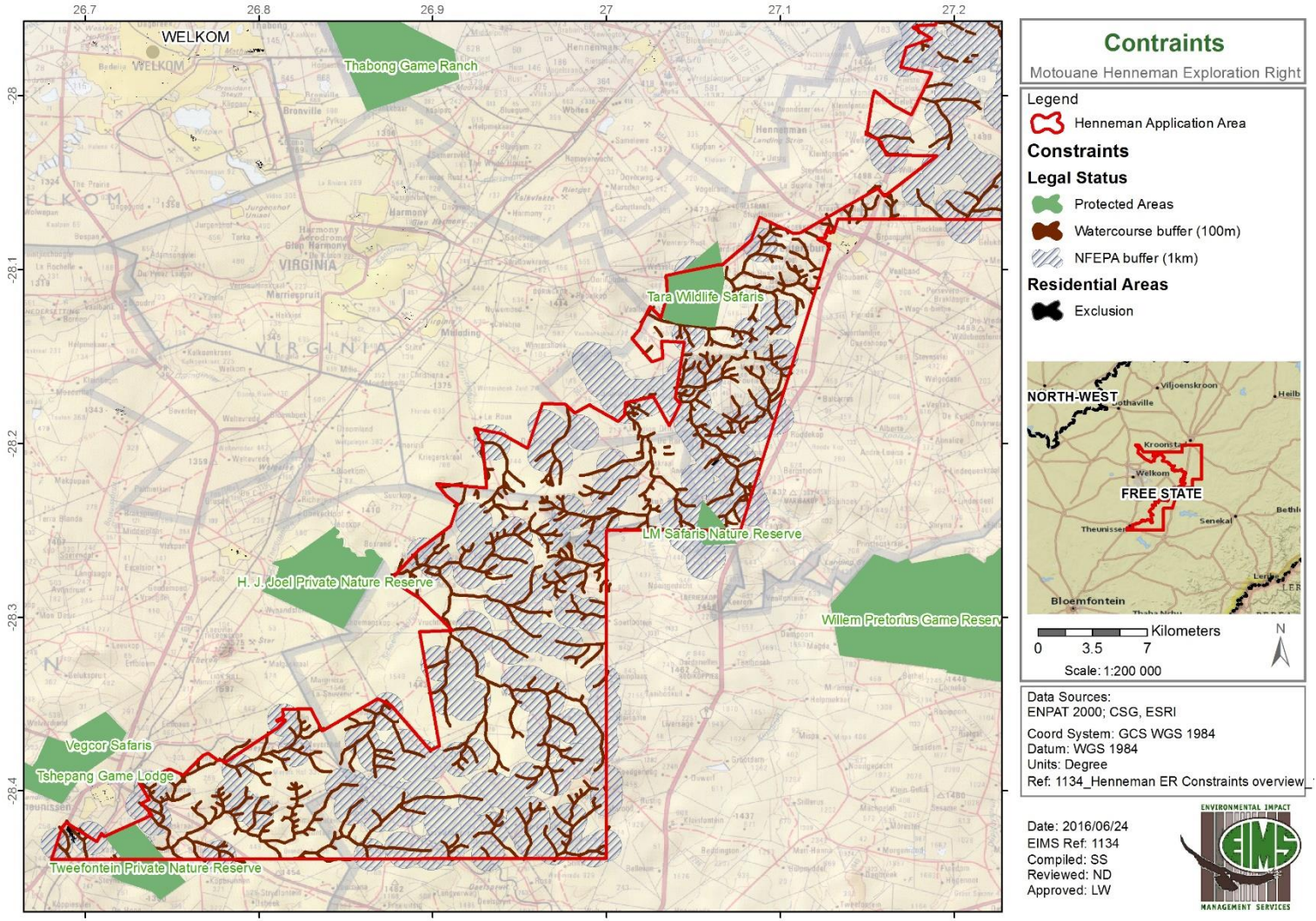

FIGURE 18: CONSTRAINTS MAP (SOUTHERN SECTION).

7.1. ENVIRONMENTAL IMPACT ASSESSMENT

This section aims to identify and assess the potential environmental impacts associated with the proposed exploration activities. This impact assessment will be used to guide the identification and selection of preferred alternatives, and management and mitigation measures, applicable to the proposed activity.

7.1. APPROACH AND METHODOLOGY

This section presents the proposed approach to assessing the identified potential environmental impacts with the aim of determining the relevant environmental significance.

7.1.1. METHOD OF ASSESSING IMPACTS:

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations. The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

7.1.2. DETERMINATION OF ENVIRONMENTAL RISK:

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E+D+M+R) \times N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 15.

TABLE 15: CRITERIA FOR DETERMINING IMPACT CONSEQUENCE

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).

Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined, the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 16.

TABLE 16: PROBABILITY SCORING

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur).

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

ER= C x P

TABLE 17: DETERMINATION OF ENVIRONMENTAL RISK

Consequence						
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 18.

TABLE 18: SIGNIFICANCE CLASSES

Environmental Risk Score	
Value	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

7.1.3. IMPACT PRIORITISATION:

In accordance with the requirements of Appendix 3(3)(j) of the NEMA 2014 EIA Regulations (GNR 982), and further to the assessment criteria presented in the Section above it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and

- The degree to which the impact may cause irreplaceable loss of resources.

In addition, it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

TABLE 19: CRITERIA FOR DETERMINING PRIORITISATION

Public response (PR)		
	Medium (2)	Issue has received a meaningful and justifiable public response.
	High (3)	Issue has received an intense meaningful and justifiable public response.
Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 20. The impact priority is therefore determined as follows:

Priority = PR + CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (Refer to Table 20).

TABLE 20: DETERMINATION OF PRIORITISATION FACTOR

Priority	Ranking	Prioritisation Factor
3	Low	**1**
4	Medium	**1.17**
5	Medium	**1.33**
6	Medium	**1.5**
7	Medium	**1.67**
8	Medium	**1.83**
9	**High**	**2**

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

TABLE 21: FINAL ENVIRONMENTAL SIGNIFICANCE RATING

Environmental Significance Rating	
Value	Description
< -10	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ -10 < -20	Medium negative (i.e. where the impact could influence the decision to develop in the area).
≥ -20	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).

0	No impact
< 10	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 10 < 20	Medium positive (i.e. where the impact could influence the decision to develop in the area).
≥ 20	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

7.2. IDENTIFICATION OF IMPACTS

Potential environmental impacts were identified during the scoping process. These impacts were identified by the EAP, the appointed specialists, as well as the public. Table 22 provides the list of potential impacts identified.

TABLE 22: IDENTIFIED ENVIRONMENTAL IMPACTS

ENVIRONMENTAL ASPECT	POTENTIAL IMPACT
Cultural and Heritage	Disturbance/ Destruction of Sections of the Battle of Zand River. Disturbance/ Destruction of the Boer Position at Boschrand. Disturbance/ Destruction of Black Concentration Camps. Disturbance/Destruction of Archaeological Sites. Disturbance/Destruction of Historic Buildings or Structures. Disturbance/ Destruction of Graves and Cemeteries. Disturbance/ Destruction of Unmarked Graves.
Biodiversity	Loss/ Destruction of Natural Habitat. Habitat Fragmentation and Edge Effects. Displacement of Faunal Species. Blockage of Seasonal and Dispersal Movements. Flora Direct and Indirect Mortality. Fauna Direct and Indirect Mortality. Pollution of Habitats.

Soils and Geology	➢ Loss/ Disturbance of Topsoil (including contamination, erosion and compaction).
Geohydrology/ Groundwater	➢ Contamination of Groundwater (i.e. chemicals, fuel, waste, sedimentation). ➢ Linking of Aquifers in Drilling Process.
Hydrology/ Surface Water	➢ Altered Hydrological Regime. ➢ Surface Water Contamination. ➢ Damage to Wetland/ Drainage Line.
Socio-economic	➢ Reduction in Quantity of Water (i.e. water consumption). ➢ Interference with Existing Land Uses. ➢ Nuisance and Impact on Sense of Place (i.e. noise, dust, etc.). ➢ Safety and Security (i.e. access to properties, theft, fire hazards, etc.). ➢ Damage/ Disruption of services (i.e. water, electricity, etc.). ➢ Impact on Existing Infrastructure (i.e. roads, fences, etc.). ➢ Perceptions and Expectations. ➢ Employment Opportunities.

Without proper mitigation measures and continual environmental management, most of the identified impacts may potentially become cumulative, affecting areas outside of their originally identified zone of impact. The potential cumulative impacts have been identified, evaluated, and mitigation measures suggested which will be updated during the detailed EIA level investigation. The impact identification and calculation methodology employed by all specialists incorporates cumulative impacts in a quantitative manner to determine the final impact score and corresponding rating.

When considering cumulative impacts, it is vitally important to bear in mind the scale at which different impacts occur. There is potential for a cumulative effect at a broad scale, such as regional deterioration of air quality, as well as finer scale effects occurring in the area surrounding the activity. The main impacts which have a cumulative effect on a regional scale are related to the transportation vectors that they act upon. For example, air movement patterns result in localised air quality impacts having a cumulative effect on air quality in the region. Similarly water acts as a vector for distribution of impacts such as contamination across a much wider area than the localised extent of the impacts source. At a finer scale, there are also impacts that have the potential to result in a cumulative effect, although due to the smaller scale at which these operate, the significance of the cumulative impact is lower in the broader context.

7.3. DESCRIPTION AND ASSESSMENT OF IMPACTS

The following potential impacts were identified during the scoping phase assessment. As a result of the scoping phase assessment and the sensitivity mapping exercise, a preferred layout alternative will be identified and will be assessed further in the EIA phase assessment. These preliminary impact calculations will be subject to amendment based on the EIA phase assessment and the results of public consultation undertaken during the EIA phase.

7.3.1. PRELIMINARY IMPACTS ON HERITAGE RESOURCES

This section presents the preliminary potential impacts identified with regard to heritage resources. While five project phases exist (Planning, Construction, Operation, Decommissioning and Rehabilitation and Closure), only impacts associated with the Construction Phase are included here. The reason for this is that no impacts are anticipated on the identified heritage resources during the other phases of the project. Please also note that although palaeontology was raised as a possible concern, its exact significance within the study area is not presently known. A palaeontologist will be appointed during the EIA phase to address this aspect.

The following construction phase preliminary impacts (as well as their impact rating) on heritage resources were identified during scoping:

A) Disturbance/ Destruction of Sections of the Battle of Zand River

During the archival and historical desktop study evidence was found that a significant component of the Battle of Zand River (7 – 10 May 1900) occurred within the study area. The Junction Drift, located either within the study area or very close it its boundary, was used by the forces of General Ian Hamilton to cross over the Zand River. The Boer forces under General Louis Botha occupied a low ridge north of the river stretching from Doornkop in the west to Baskop in the east. The central and eastern sections of this ridge was attacked by the British infantry, and the Boer positions were eventually overrun. These significant aspects of the Battle of Zand River occurred within the present study area and thus the proposed exploration activities may potentially impact on this historical resource.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Disturbance/ Destruction of Sections of the Battle of Zand River	Construction	-14.25	-8.50	-9.92

Proposed Preliminary Mitigation

Where possible, this area should be avoided in the placement of development footprints. Furthermore, archaeological field surveys of the proposed development footprint areas during the Heritage Impact Assessment should identify any tangible remains of the battle and the associated Heritage Impact Assessment (HIA) to address any perceived significant impacts on this battle and its associated tangible remains.

Additionally, the EIA field assessments must be augmented by further archival and historical research, especially should any of the development footprints be proposed within 1 000 m of the identified sensitive area. If required, further mitigation measures will be outlined in the HIA.

B) Disturbance/ Destruction of the Boer Position historical features at Boschrand

After the defeat of the Boer forces along the Zand River, they entrenched themselves on both sides of the railway line on a ridge known as Boschrand. While no battle took place here, some historic references indicate that the Boer position included trenches. One historic reference also suggests that an artillery duel took place between the Boer position at Boschrand and the British forces to the south. The said historical features within the study area may be impacted by the proposed exploration activities.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Disturbance/ Destruction of the Boer Position historical features at Boschrand	Construction	-12.75	-7.50	-8.75

Proposed Preliminary Mitigation

Archaeological field surveys of the proposed development footprint areas during the HIA should identify any tangible remains of these activities. These surveys should be augmented by further archival desktop study work on the exact location of the Boer position at Boschrand. Should archaeological sites be identified, suitable mitigation measures will be outlined in the HIA.

C) Disturbance/ Destruction of Black Concentration Camps

During the same war, the British military authorities established three black concentration camps within the study area at the following railway sidings: Holfontein (partially located within the study area), Geneva, and Boschrand. The latter two camps comprised two of the three largest black concentration camps built by the British during the war (the third camp being Honing Spruit) and the combined population of these three largest camps were 7 000 people. The proposed exploration activities may be located within the historical Holfontein concentration camp site.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Disturbance/ Destruction of Black Concentration Camps	Construction	-15.00	-9.00	-10.50

Proposed Preliminary Mitigation

The areas included in the heritage sensitivity maps should ideally be avoided during the placement of development footprints. Archaeological and heritage field surveys of the development footprint areas must be undertaken once the preferred exploration alternatives have been established. Additionally, such field assessments must be augmented by further archival and historical research, especially should any of the development footprints be proposed within 1 000 m of the identified sensitive area. If required, further mitigation measures will be outlined in the HIA.

D) Disturbance/ Destruction of Archaeological Sites

The historical and archaeological background study has revealed that both Stone Age and Late Iron Age sites are known from within the study area. One Stone Age site had previously been identified on the farm Le Roux, whereas the extensive research project of Tim Maggs (1976) had revealed the existence of a number of so-called Type Z and Type V stonewalled settlements from within the study area. During the Google Earth scan, a total of 15 such Late Iron Age stonewalled sites were identified and their positions recorded. These features of historical significance may be impacted upon by the proposed exploration activities.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Disturbance/ Destruction of Archaeological Sites	Construction	-18.00	-12.00	-14.00

Proposed Preliminary Mitigation

The recorded localities of these archaeological sites as recorded on the heritage sensitivity maps should ideally be avoided during the placement of development footprint areas. All proposed development footprints will have to be assessed in the field by way of archaeological field surveys to identify any archaeological sites and features which may be located within those footprint areas. These studies will be required to determine the significance of each site and to assess the possible development impacts on each of them during the Heritage Impact Assessment phase. If required, further mitigation measures will be outlined in the Heritage Impact Assessment Report.

E) Disturbance/ Destruction of Historic Buildings or Structures

The existence of historic buildings and structures within the study area was revealed during the desktop study, when the first edition topographic sheets were found to depict a large number of historic buildings and structures. These depicted structures include farmhouses, farm structures such as sheds and wagon sheds as well as farmworker accommodation. An assessment of previous archaeological and heritage studies from within the study area has revealed the presence of one such a historic structure within the study area. Once development footprints are defined, such footprint areas be assessed through an archaeological field surveys and an architectural historian to ascertain if any historic buildings or structures are located within the development

footprint areas. If these buildings and/ or structures are confirmed within the study are, they may be impacted upon by the exploration activities.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Disturbance/ Destruction of Historic Buildings or Structures	Construction	-12.75	-7.00	-8.17

Proposed Preliminary Mitigation

Once development footprints are defined, such footprint areas will have to be assessed in the field by way of archaeological field surveys to identify any historic buildings or structures which may be located within the development footprint areas. Additionally, an assessment by an architectural historian of each historic building and structure located within or near such footprint areas will also have to be undertaken. These studies will be required to determine significance of each building or structure and will assess the possible development impacts on each of them during the Heritage Impact Assessment phase. At the same time appropriate mitigation measures will also be outlined.

F) Disturbance/ Destruction of Graves and Cemeteries

The existence of graves and cemeteries has been confirmed during the desktop study work, with the presence of 32 cemeteries within the study area revealed during an assessment of historic topographic maps sheets. The possibility that even more cemeteries may be located within the study area is a distinct possibility. Any marked graves and cemeteries located within the development footprint areas will be confirmed once the development footprints are defined. Should graves and cemeteries be confirmed on site and in particular within the preferred exploration footprint, impact on these features will trigger various pieces of legislation that protect them.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Disturbance/ Destruction of Graves and Cemeteries	Construction	-20.00	-13.50	-15.75

Proposed Preliminary Mitigation

The recorded localities of these cemeteries as depicted on the heritage sensitivity maps should ideally be avoided during the placement of development footprint areas. Any marked graves and cemeteries located within the preferred development footprint areas will be identified during the archaeological walkthroughs of the footprint areas. Cemeteries and grave sites are protected by various legislations and the best option would be the in situ preservation of the sites. Should this not be possible, a standard grave relocation process (including a detailed social consultation process) must be undertaken.

G) Disturbance/ Destruction of Unmarked Graves

An evaluation of the available historic maps has revealed a significant number of historic homesteads of black African communities within the study area. The presence of these features raises another heritage concern, that of unmarked stillborn babies. In terms of black African tradition, stillborn babies were often buried in unmarked graves underneath or adjacent to the homesteads of their parents. Such unmarked graves may be present within the study area and will may be impacted by the proposed exploration activities.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Disturbance/ Destruction of Unmarked Graves	Construction	-15.00	-9.00	-10.50

Proposed preliminary Mitigation

Cemeteries and grave sites are protected by various legislations and the best option would be social consultation with the former (or present) residents of this area to assess whether any such unmarked graves are located within the final study area for the Heritage Impact Assessment. This mitigation measure must be supported by archaeological monitoring of the development activities.

7.3.2. PRELIMINARY IMPACTS ON ECOLOGY

The following preliminary impacts on the ecological resources within the study area were identified and assessed for the various project phases (planning and design, construction, operation, decommissioning, and rehabilitation and closure). No impacts on the ecological receiving environment have been identified that will occur during the Planning and Design Phase, Decommissioning Phase, and the Rehabilitation and Closure Phase.

Below are the construction and operational phase preliminary impacts on ecological resources identified during scoping, as well as their impact rating.

A) Loss/ Destruction of Natural Habitat

The proposed activities on site will lead to localised damage to an area approximately 30 m x 30 m per well with a total of 3 exploration wells across the entire study area. There will possibly also be damage to habitats associated with travelling from existing access routes to sites selected for wells. The overall loss of habitat is, however, expected to be quite a small proportion of the total habitat within the study area. However, where this is within patches of Endangered habitat, it may be significant.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Loss/ Destruction of Natural Habitat	Construction	-12.00	-6.75	-9.00

Proposed Preliminary Mitigation

Undertake exploration activities in previously disturbed places and/or habitats with a lower sensitivity score; Rehabilitate disturbed areas as soon as possible; and Control alien plants.

B) Habitat Fragmentation and Edge Effects

Due to the existing fragmentation of natural habitat, limited fragmentation and edge effects are expected.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Habitat Fragmentation and Edge effects	Construction	-5.00	-2.00	-2.67

Proposed Preliminary Mitigation

Undertake activities in previously disturbed areas and/or habitats with lower sensitivity; Where possible locate activities on the boundaries of existing disturbance; Use existing access roads as much as possible; and Rehabilitate disturbed areas as soon as possible.

C) Displacement of Faunal Species

The proposed exploration activities on site will lead to localised damage to an estimated 30 m x 30 m per well and a total of 3 exploration wells across the entire study area. There will possibly also be damage to habitats associated with travelling from existing access routes to sites selected for wells. The overall loss of habitat is, however, expected to be quite a small proportion of the total habitat within the study area. Loss of faunal habitat will therefore be very low.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Displacement of Faunal Species	Construction Operation	-4.00	-1.50	-1.50

Proposed Preliminary Mitigation

Where possible undertake exploration activities in previously disturbed places and/or habitats with a lower sensitivity score; and Rehabilitate disturbed areas as soon as possible.

D) Blockage of Seasonal and Dispersal Movements

Proposed exploration activities will result in insignificant loss of habitat, especially migration corridors. Habitat fragmentation is also expected to be minimal.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Blockage of Seasonal and Dispersal Movements	Construction Operation	-3.00	-1.50	-1.50

Proposed Preliminary Mitigation

Where possible undertake activities in previously disturbed areas and/or habitats with lower sensitivity; Where possible locate activities on the boundaries of existing disturbance; Use existing access roads as much as possible; and Rehabilitate disturbed areas as soon as possible.

E) Flora Direct and Indirect Mortality

There are various plant species of concern that could potentially be affected by the proposed activities on site. The exact location of these is unknown relative to the proposed siting of proposed activities.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Flora Direct and Indirect Mortality	Construction	-10.50	-1.00	-1.17

Proposed Preliminary Mitigation

Where possible, walk-through survey of local site prior to activity to be undertaken; Search and rescue of species of concern (if any); Obtain permits for any listed/protected species found on site; Where possible undertake activities in previously disturbed areas and/or habitats with lower sensitivity; Where possible locate activities on the boundaries of existing disturbance; and Use existing access roads as much as possible.

F) Fauna Direct and Indirect Mortality

There are risks to fauna, for example illegal hunting/poaching as well as threats from movement of machinery. During construction, relatively sedentary species may suffer direct mortality. The assessment is based on a worst-case scenario affecting species of the highest conservation status.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Fauna Direct and Indirect Mortality	Construction	-6.00	-3.00	-4.00

Proposed Preliminary Mitigation

Where possible undertake site-specific walk-through surveys for potential species of concern; Where possible undertake activities in previously disturbed areas and/or habitats with lower sensitivity; and Where possible locate activities on the boundaries of existing disturbance; Use existing access roads as much as possible.

G) Pollution of Habitats

There is a possibility that drilling activities could result in pollution being introduced into natural habitats.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Pollution of Habitats	Construction Operation	-9.75	-1.00	-1.33

Proposed Preliminary Mitigation

Manage all waste sources emanating from proposed activities in line with legal requirements; Maintain minimum distances from aquatic and wetland habitats.as per legal requirements; and Where possible undertake activities in previously disturbed areas and/or habitats with lower sensitivity.

H) Introduction/ Invasion by Alien Species

Disturbing activities on site will favour alien plants in places. In most cases, it is in the interests of the landowner to control infestations.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Introduction/ Invasion by Alien Species	Operation	-2.50	-2.00	-2.67

Proposed Preliminary Mitigation

Where possible undertake activities in previously disturbed areas and/or habitats with lower sensitivity; Where possible locate activities on the boundaries of existing disturbance; Use existing access roads as much as

possible; Rehabilitate disturbed areas as soon as possible; Manage alien plants within close proximity to exploration activities; and Compile an alien plant management plan.

7.3.2.1. GENERAL ECOLOGY MITIGATION MEASURES

Although site specific preliminary mitigation measures are proposed above for each identified and assessed impact, there are generic mitigation measures that are to be considered regardless of the site specific conditions with regards to ecology and these are presented below.

- *Locate activities judiciously*: The sensitivity map should guide activities in terms of avoiding sensitive habitats. If possible, sensitive areas should be completely avoided. It is preferable to undertake activities in previously disturbed areas, areas with secondary vegetation, areas with degraded vegetation and areas with habitats of lower sensitivity. Wherever possible, use existing access roads and minimize creation of new tracks through natural habitats. Where activities cannot avoid natural habitats, they should be undertaken as close to an existing disturbance as possible to minimise edge effects and fragmentation.
- *Rehabilitation programme*: Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments.
- *Botanical walk-through survey*: For each proposed drilling site, a pre-activity walk-through survey should be undertaken to list the identity and location of all listed and protected species. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. If possible, areas of concentrations of species of concern should be avoided.
- *Obtain permits for protected plants*: It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants.
- *Search and rescue*: Search and rescue operation of all listed species within the activity footprint. For each individual plant that is rescued, the plant must be photographed before removal, tagged with a unique number or code and a latitude longitude position recorded using a hand-held GPS device. The plants must be planted into a container to be housed within a temporary nursery on site or immediately planted into the target habitat. If planted into natural habitat, the position must be marked to aid in future monitoring of that plant. Rescued plants housed in temporary nursery may be used in one of two ways: (1) transplanted into suitable natural habitats near to where they were rescued, or (2) used for replanting in rehabilitation areas. Receiver sites must be matched as closely as possible with the origin of the plants and, where possible, be placed as near as possible to where they originated.

- *Alien plant management plan*: It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species within the environment directly affected by the proposed activities, especially within the riparian habitat. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally responsible for the control of alien species on their properties. The protection of our natural systems from invasive species is further strengthened within Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). This programme should include monitoring procedures.
- *Undertake regular monitoring*: Monitoring should be undertaken to evaluate the success of mitigation measures.

7.3.3. PRELIMINARY IMPACTS ON GEOHYDROLOGY

The following preliminary impacts on the geohydrological resources within the study area were identified and assessed for the various project phases (planning and design, construction, operation, decommissioning, and rehabilitation and closure). No impacts on the geohydrological receiving environment have been identified that will occur during the Planning and Design Phase and the Decommissioning Phase.

Below are the preliminary impacts on geohydrological resources for the construction, operational, and rehabilitation and closure phases identified during scoping, as well as their impact rating according to the methodology described above.

A) Contamination of Groundwater (i.e. chemicals, fuel, wastes, sedimentation)

The alluvial and shallow weathered aquifers are vulnerable to surface sources of contamination. Groundwater contamination may therefore occur as a result of hydrocarbon (oil and diesel) spills within the drill pads and other surface activities. The alluvial aquifer will be especially vulnerable to such impacts, due to the shallow groundwater table, expected high permeability and the unconfined nature of such aquifers. Contamination of the Karoo aquifers as a result of hydrocarbon exploration could occur as a result of vertical leakage of hydrocarbons and/or saline water along faulty cement seals in exploration wells, casing, or even fracture zones to the shallow aquifers as a result of faulty well construction.

The permeability of the different geological lithologies will play a role in the possibility and extent of groundwater contamination in Karoo aquifer. The role of dolerite intrusions is therefore of specific significance. For this reason, it is important to establish whether or not exploration wells target dolerite intrusions into which private water boreholes have been drilled.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Contamination of Groundwater (i.e. chemicals, fuel, waste, sedimentation)	Construction Operation Rehabilitation and Closure	-13.00	-6.00	-10.00

Proposed Preliminary Mitigation

Due to drilling fluids used for exploration drilling, contamination of groundwater is a concern. The best drilling fluid option should be selected during construction towards minimising the potential for groundwater contamination and the exploration wells should be constructed such no gas or oil leakage occurs during the operational phase. Sound groundwater management measures need to be developed based on the results of the impact assessment.

B) Linking of Aquifers from Drilling Process

Linking of aquifers from drilling activities could occur as a result of faulty well construction.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Linking of Aquifers from Drilling Process	Construction	-7.50	-5.00	-6.7

Proposed Preliminary Mitigation

The approved drilling methods should be used and a qualified and experienced drilling contractor should be appointed to minimise the risk of affecting shallow aquifers. During drilling, a casing should be installed in the exploration well in line with the MPRDA regulations regarding well design and construction.

7.3.3.1. MITIGATION MEASURES FOR GENERIC GEOHYDROLOGY IMPACTS

Although site specific preliminary mitigation measures are proposed above for each identified and assessed impact, there are generic mitigation measures that are to be considered regardless of the site specific conditions with regards to geohydrology and hydrology and these are presented below.

- In order to avoid erosion and siltation of surface water features the following needs to be taken into consideration:
  - Construction should preferably take place during the dry season.
  - Excavations or exposed surfaces should be open for as short period as practically possible.

- Unpaved areas should be vegetated as soon as practically possible.

- In order to avoid oil, grease and diesel spillages from construction vehicles the following needs to be taken into consideration:
  - Construction vehicles and machines must be maintained properly to ensure that oil spillages are kept at a minimum.
  - Spill trays must be provided if refuelling of construction vehicles are done on site.
- To avoid flooding of construction areas (drill sites and associated infrastructure) the following needs to be taken into consideration:
  - Where possible construction should preferably take place during the dry season.
  - The construction camp should be constructed on high ground and outside the 1:100-year flood line.
- To prevent pollution of groundwater/ surface water due to sanitation facilities the following needs to be taken into consideration:
  - The construction camp should be constructed outside the 1:100-year flood line.
  - Chemical sanitary facilities must be provided for construction workers. Construction workers should only be allowed to use temporary chemical toilets on the site. Chemical toilets shall not be within close proximity of the drainage system. Frequent maintenance should include the removal without spillages.
- To prevent ground- and surface-water pollution due to storage of chemicals and construction materials the following needs to be taken into consideration:
  - Adequate fuel containment facilities to be used during construction phase.
  - The use of all materials, fuels and chemicals which could potentially leach into underground water must be controlled.
  - All materials, fuels and chemicals must be stored in a specific and secured area to prevent pollution from spillages and leakages
  - No uncontrolled discharges from the construction camp shall be permitted.
  - Chemical storage areas should be sufficiently contained, and the use of chemicals should be controlled.
- To prevent spillages from fuel storage facilities the following needs to be taken into consideration:
  - Adequate fuel containment facilities to be used during construction phase.
  - The use of all materials, fuels and chemicals which could potentially leach into underground water must be controlled.

- All materials, fuels and chemicals must be stored in a specific and secured area to prevent pollution from spillages and leakages.

7.3.4. PRELIMINARY IMPACTS ON HYDROLOGY

The following preliminary impacts on the hydrological resources within the study area were identified and assessed for the various project phases (planning and design, construction, operation, decommissioning, and rehabilitation and closure). No impacts on hydrology have been identified that will occur during the Planning and Design Phase and the Decommissioning Phase.

Below are the preliminary impacts on hydrological resources for the construction, operation, and rehabilitation and closure phases identified during scoping, as well as their impact rating.

A) Altered Hydrological Regime

Surface clearing to establish the drill equipment may impact on the local hydrological regime.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Altered Hydrological Regime	Construction Operation Rehabilitation and Closure	-13.75	-13.75	-16.04

Proposed Preliminary Mitigation

Impact is associated with drilling during construction and should recover after construction phase when exploration ceases.

B) Surface Water Contamination

Due to leakage of drilling fluids or poor storm water management during construction and operational phases, contamination of surface water can occur.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Surface Water Contamination	Construction Operation	-12.00	-5.50	-9.17

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
	Rehabilitation and Closure			

Proposed Preliminary Mitigation

Proper stormwater management should be implemented.

C) Impact on Wetlands/ Drainage Lines

There are numerous wetland and drainage systems within the study area, the location of exploration well may impact on a wetland or drainage line.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Impact on Wetlands/ Drainage Lines	Construction	-5.50	-2.75	-4.13

Proposed Preliminary Mitigation

Where possible, drilling target sites should be outside of these protected and sensitive areas (i.e. wetlands or drainage lines).

7.3.5. PRELIMINARY IMPACTS ON SOILS AND GEOLOGY

The following preliminary impact on the soils and geology within the study area was identified and assessed for the various project phases (planning and design, construction, operation, decommissioning, and rehabilitation and closure). No impacts on soils and geology have been identified for the Planning and Design Phase, Operation Phase, and Decommissioning Phase.

Below is the preliminary impact on soils and geology features during the construction and rehabilitation and closure phases, as well as the impact rating.

A) Loss/ Disturbance of Topsoil (including contamination, erosion and compaction)

During drilling for exploration the compaction of soil from heavy vehicles and machinery travelling off-road as well as operation on site may occur. Erosion from disturbances to soil structure and vegetation cover is also likely. Contamination of soil could also result from hydrocarbon or chemical spillages. With exploration drilling there is also the remote risk that drilling could destabilise certain geological features.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Loss/ Disturbance of Topsoil (including contamination, erosion and compaction).	Construction	-7.50	-4.00	-5.33

Proposed Preliminary Mitigation

The total number of exploration wells drilled will be low across the extent of the study area (maximum of 3 wells). Consideration should be given during planning regarding the avoidance of dolomite areas and any other sites with known underground caverns. Waste, hydrocarbons, and other chemicals should be handled and disposed of adequately to avoid contamination of soil. Erosion control measures should be implemented, and compaction of soil avoided where possible.

7.3.6. SOCIO-ECONOMIC

The following preliminary impacts on the socio-economic environment within the study area were identified and assessed for the various project phases (planning and design, construction, operation, decommissioning, and rehabilitation and closure). No impacts on socio-economics have been identified that will occur during the Planning and Design Phase, Decommissioning Phase, and the Rehabilitation and Closure Phase.

7.3.6.1. PRELIMINARY SOCIO-ECONOMIC IMPACTS

Below are the construction and operational phase preliminary impacts on socio-economic environment identified during scoping, as well as their impact rating.

A) Reduction in Quantity of Water (i.e. Water Consumption)

Exploration drilling activities require water which will be sourced from existing license holders. The utilisation of groundwater for drilling and other associated activities may result in the alteration/ reduction of groundwater levels on site thereby affecting local users.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Reduction in Quantity of Water (i.e. Water Consumption)	Construction	-9.00	-4.00	-6.00

Proposed preliminary Mitigation

Water utilised for the drilling activities should be sourced from a licensed source and consumption should not exceed the licensed thresholds. Pre-construction water levels should be recorded for the water sources and should be monitored regularly to ascertain if the water levels are dropping drastically.

B) Interference with Existing Land Uses

The proposed site for the exploration comprises large areas of cultivation and historical mining activities. The dominant farming activities are livestock and mixed farming. Livestock farming dominates agricultural activity with sheep and cattle being the main livestock bred. Existing land uses might be affected by the proposed exploration activities and in particular during the drilling of the wells.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Interference with Existing Land Uses	Construction	-6.00	-3.50	-4.08

Proposed Preliminary Mitigation

There must be a formal procedure in place on how to report incidents to ensure records of all grievances are kept, and responses are given within a certain time.

As far as possible interference with existing land uses/livelihoods should be avoided. If any interference takes place, the landowner should be compensated for their losses.

C) Nuisance and Impact on Sense of Place (i.e. noise, dust, etc.)

The proposed exploration project will impact on the established sense of place of a particular property. The character of the area would change with the addition of exploration activities. Additional vehicles, increased noise and dust, the removal of vegetation for exploration well site/s, and potential influx of workers will all contribute to the alteration of the sense of place.

Impact	Project	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Nuisance and Impact on Sense of Place (i.e. noise, dust, etc.).	Construction Operation	-6.00	-4.00	-4.67

Proposed Preliminary Mitigation

Noise producing activities should be limited to day-time after 07h00 and 17h00 on week days. Adequate dust suppression measures should be utilized to minimize dust production. There must be a formal procedure in place on how to report incidents to ensure records of all grievances are kept, and responses are given within a certain time.

Sense of place is defined as an individual's personal relationship with their local environment, both social and natural, which the individual experiences in their everyday daily life (Vanclay et al., 2015). It is therefore difficult to mitigate the impact as it is experienced on a personal level. In general, the mitigation measures suggested by the specialist studies should be adhered to.

D) Safety and Security (i.e. access to properties, theft, fire hazards, etc.).

Required access to the property for exploration activities may result in a risk to the safety and security of landowners, lawful occupiers, and community members due to the increase in number of unfamiliar people in the area. Property gates may also be left open resulting in the loss or theft of livestock.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Safety and Security (i.e. access to properties, theft, fire hazards, etc.).	Construction	-6.75	-3.50	-4.08

Proposed Preliminary Mitigation

All contractors and employees should wear photo identification cards. Vehicles should be clearly marked as construction vehicles. Entry and exit points of the site should be controlled.

E) Damage/ Disruption of Services (i.e. water, electricity, sewage, etc.)

Drilling operations have the potential to disrupt or damage services such as water supply or sewage collection pipes if not situated correctly within the study area.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Damage/ Disruption of Services (i.e. water, electricity, sewage, etc.).	Construction	-6.75	-3.00	-3.50

Proposed Preliminary Mitigation

Before the project commences, an asset and services baseline of services that may be affected must be compiled. A copy of the baseline records should be given to each landowner/ service provider, and a master

document kept by the applicant. If any damage occurs it should be reinstated to its pre-project status. Notice of any service interruptions must be given at least a day before the interruption takes place – an SMS or e-mail system can be used for this purpose.

F) Impact on Existing Infrastructure (i.e. roads, fences, etc.)

Activities associated with exploration may impact on existing infrastructure such as increased traffic on the adjacent road network, damage to fences and other local infrastructure.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Impact on Existing Infrastructure (i.e. roads, fences, etc.)	Construction	-7.50	-3.00	-3.50

Proposed preliminary Mitigation

Before the project commences, an asset and infrastructure baseline of any landowner infrastructure that may be affected must be compiled. A copy of the baseline records should be given to each landowner, and a master document kept by the applicant. If any damage occurs it should be reinstated to its pre-project status.

G) Perceptions and Expectations

The proposed project is likely to create great interest, particularly with regards to the potential for employment, perceived safety and security risks, and the exact nature of the proposed project.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Perceptions and Expectations	Construction	-9.75	-6.00	-7.00

Proposed Preliminary Mitigation

Perceptions and expectations must be managed through ongoing, open and transparent communication with affected stakeholders, communities, landowners and occupiers.

H) Employment Opportunities

Employment opportunities for some unskilled, skilled labour as well as providing services during construction (e.g. accommodation, transportation, etc.) may arise from this project. It is important to note that the proposed project footprint is small (3 exploration wells) and some of the activities are specialised and thus the potential for employment is likely to be limited to a few.

Impact	Project Phase	Pre-Mitigation Score	Post-Mitigation Score	Final Significance
Employment Opportunities	Construction	+6.75	+7.50	+7.50

Proposed Preliminary Mitigation

Recruitment for labour or services should be focused in the local area and preference given to the local communities.

7.4. DISCUSSION

The positive implication of the proposed Motuoane Henneman Exploration Right project is the potential discovery of an economically viable hydrocarbon resource. Due to the limited extent and duration of the proposed exploration activities, at this stage the project is not anticipated to have significant negative environmental impacts. Preliminary impact assessment results are such that only one potential impact (disturbance/ destruction of graves and cemeteries) was calculated to be of High impact significance without mitigation. However, the impact can be reduced to Medium impact significance by implementing the proposed mitigation measures. Furthermore, the remaining preliminary impacts resulted in post-mitigation impacts scores that were either Medium or Low.

The negative impacts of the proposed exploration activities, most of which are of Medium or Low significance before the proposed mitigation and Low after the implementation of proposed mitigations, will be further assessed during the EIA phase of the project. Potential mitigation measures have been identified and will be refined based on input from the EAP, public consultation, and specialist assessments during the EIA phase of the project. The EMPR will, identify appropriate mechanisms for avoidance and mitigation of the negative impacts and enhancing the positive.

8. PLAN OF STUDY FOR EIA

The section below outlines the proposed plan of study which will be conducted for the various environmental aspects during the EIA Phase. The plans of study have been compiled by the specialist consultants contracted to the project with select input from EIMS. It is also important to note that the plan of study will also be guided by comment obtained from I&APs and other stakeholders during the PPP.

8.1. ALTERNATIVES TO BE CONSIDERED IN EIA

The alternatives considered and discussed in the above sections, including land use, location, and exploration placement alternatives have culminated into the identification of three feasible development alternatives. These three feasible development alternatives are discussed below.

8.1.1. ALTERNATIVE 1: NO GO ALTERNATIVE

This alternative will imply that no exploration takes place and that the environment remains unchanged and unaltered. The proposed site for the exploration comprises large areas of cultivation and historical mining activities. The dominant farming activities are livestock and mixed farming. Livestock farming dominates agricultural activity with sheep and cattle being the main livestock bred. There are significant areas that have been altered by previous cultivation and mining activities, however sections of the site remain as unaltered natural vegetation. If the development should not take place, the verification of a potential viable economic activity in the form of production would not occur.

8.1.2. ALTERNATIVE 2: MAXIMUM EXPLORATION EXTENT

In this alternative, the exploration activities are emphasised. Less restrictive mitigation measures will be used to protect the environmental features, thus allowing for unfettered exploration. This approach will potentially increase the efficacy of the exploration activities at the potential cost of impacting more severely on environmental features. This alternative is likely to increase landscape character changes and impact more on aspects such as hydrology, ecology, wetlands, heritage, and land use, as exploration activities will be more likely to move through these sensitive environmental features.

8.1.3. ALTERNATIVE 3: SENSITIVITY PLANNING APPROACH

This alternative will emphasise resource protection and use stringent mitigation measures to minimise identified adverse impacts. This alternative will use specialist planning and evaluation of the following in order to avoid impacting on consolidated sensitive environmental features:

- Exploration footprint;
- Borehole placement; and
- Soil sampling sites.

This alternative will allow for the proposed Motuoane Henneman exploration activities to be undertaken whilst protecting identified sensitive environmental features as indicated in the consolidated sensitivity map. This

alternative will use the consolidated sensitivity map to assist in the layout and placement of the proposed exploration activities.

8.2. DESCRIPTION OF IMPACTS TO BE ASSESSED IN EIA

The following aspects will be assessed further during the EIA phase investigation to be undertaken:

- Heritage;
- Ecology and Wetlands
- Geohydrology; and
- Socio-economic.

8.3. DESCRIPTION OF SPECIALIST STUDIES

The section below outlines the proposed plan of study which will be conducted for the various environmental aspects during the EIA Phase. The plans of study have been compiled by the specialist consultants contracted to the project with select input from EIMS. It is also important to note that the plan of study will also be guided by comment obtained from I&AP's and other stakeholders during the Public Participation Process

8.3.1. HERITAGE

The following will be required to develop a final HIA to manage the heritage resources within the study area.

PHYSICAL SURVEYING

The fieldwork component will consist of a detailed walk through of the proposed footprint areas and is aimed at locating heritage resources falling within the proposed study area towards refining the scoping heritage sensitivity map. The locations of all heritage resources that are recorded during the survey will be documented using a hand-held GPS. Furthermore, the documentation will reflect a brief qualitative description and statement of significance for each site and include a photographic record of all the sites.

It is important to also note that informal social consultation (i.e. with local community members, residents and knowledgeable individuals) may be undertaken during the fieldwork component. The aim of social consultation is to identify any tangible and intangible resources (i.e. sacred places, myths and indigenous knowledge resources) that may exist.

DELIVERABLES

A report will be written which would include the following components:

- The identification and mapping of all heritage resources in the affected area;
- An assessment of the significance of such resources in terms of the heritage assessment criteria;
- An assessment of the impact of the development of such heritage resources;
- If heritage resources will be adversely affected by the proposed development, consideration of the alternatives; and

- Proposed mitigation of any adverse effects during and after the completion of the proposed development.

POTENTIAL IMPACTS AND FURTHER WORK FOR EIA PHASE

The desktop evaluation of the study area and surrounds has shown that the possibility exists of finding various heritage resources in the proposed study area, including Stone Age sites, Late Iron Age stonewalled settlements, historical structures, graves and cemeteries as well as battlefields. Once the final study area (i.e. exploration well sites) has been defined, this will have to be assessed by way of detailed walkthroughs during the HIA phase of the project. This will allow for an assessment of the actual impact of the proposed development on any heritage sites located there i.e. a footprint area specific heritage impact assessment.

8.3.2. ECOLOGY AND WETLANDS

The following assessments should be undertaken during the EIA phase in order to properly assess potential impacts on the ecological receiving environment by the proposed activity:

- The study area includes a combination of natural areas, degraded areas, secondary vegetation and transformed areas. For all areas within proximity to the proposed activities, a general habitat survey should be undertaken to confirm the status of habitat and to characterise it in terms of condition and species composition and cover.
- The potential presence of plant species of concern must be evaluated within the footprint of proposed activities. There are various plant species of concern that have been evaluated as having a high probability of occurring on site, namely the Vulnerable species, *Bowiea volubilis* subsp. *volubilis*, the Near Threatened species, *Merwilla plumbea* and *Sporobolus oxyphyllus*, the Declining plant species, *Boophane disticha*, *Drimia altissima* and *Hypoxis hemerocallidea*, and the protected species, *Merwilla plumbea* and *Crinum bulbispermum*.
- The potential presence of protected trees on site must be evaluated. There is one protected tree species that could potentially occur on site, depending on the habitat that is affected. Although the probability of this species occurring on site is considered to be low, this should be confirmed in the field.
- The presence of species of concern or habitats that are important for particular species of concern must be evaluated during the EIA phase. Particular attention should be paid to those species classified as threatened (VU, EN or CR), Near Threatened or Critically Rare and which have a high probability of occurring on site or being affected by the proposed activities. There are various animal species currently listed as threatened or protected that are considered to have a medium to high probability of occurring on site, based on habitat suitability, including the Spotted-necked Otter (NT), the African White-tailed Rat (EN), the Giant Bullfrog (protected), the Giant Dragon Lizard (NT), the Striped Harlequin Snake (NT), the African Marsh Harrier (EN), the Yellow-billed Stork (EN), Burchell's Courser (VU), the African Grass Owl (VU), the Secretarybird (VU), the Black Stork (VU), the Maccoa Duck (NT), the Red-footed Falcon (NT), the Greater Painted Snipe (NT) and the Black-winged Pratincole (NT).

The potential presence of suitable habitat should be evaluated during field surveys.

- There is an extensive system of wetlands in the study area, including a range of different wetland habitats. The general presence of wetland habitat within any area affected by the proposed activities must be evaluated.

The following methodology is proposed in order to obtain the information required for assessing impacts on specific features of concern:

GENERAL HABITAT SURVEY

Habitat condition and status can be determined on the basis of a combination of visual surveys, vegetation structure and species composition. The relative composition of the vegetation is a powerful source of information for providing information on the status of vegetation. A general survey should be undertaken in areas within the sensitivities identified during scoping and any new ones identified on site, ensuring that all affected areas are covered. Plant species composition, relative cover and vegetation structure data should be collected at selected sites in order to characterise habitats properly. Photographs will also be taken as a visual reference. A floristic list will be compiled. Any unknown species will be identified using published field guides, expert knowledge or via collection of appropriate plant material.

FLORA SURVEY FOR PLANT SPECIES OF CONCERN

A targeted survey for plant species of concern must be undertaken within the identified sensitive areas and nearby areas of all proposed activities. It is crucial for this survey that the footprint is known. Habitat requirements and flowering times of all species are relatively well-known, but could vary from published information. There is also the possibility that other species of concern could occur on site that were not on any database, but that occur on site. A general flora survey should therefore be included to ensure that no additional species of concern occur on site. For any species that are encountered, the exact locality and number of individuals must be recorded. Photographs must be taken to confirm the identity of the species. The survey will be a visual survey on foot, with the purpose of identifying the flora of the site. The timing of the survey depends on the best time for detecting these species.

PROTECTED TREE SURVEY

A targeted survey for protected trees must be undertaken within the identified sensitive areas and nearby areas of all proposed activities. It is crucial for this that the footprint is known. For this survey, the exact location of each individual must be recorded.

FAUNAL SURVEY

A habitat survey will be undertaken during mid- to late summer (where possible) when the vegetation has grown sufficiently to be able to assess habitat suitability for the various species of concern that could potentially occur on site. Attention will be paid to the suitability of habitat for foraging, roosting and breeding. The intention is to make a more informed decision on the importance of the site for the various faunal species of concern that

could potentially occur on site. If any species of concern are seen on site then GPS co-ordinates of individuals will be obtained, as well as observations on numbers and behaviour.

WETLAND HABITAT SURVEY

Once the area affected by the proposed activities is identified, including access routes and downslope areas, a survey must be undertaken of wetland habitats that could potentially be affected. These wetland areas should be characterised in terms of species composition, habitat type, general condition and sensitivity/vulnerability to damage by the proposed activities. Habitat mapping should be enhanced during these field surveys.

ALIEN PLANT SURVEY

A list will be compiled of any alien plant species that occur in the general area. This includes any species listed according to the Conservation of Agricultural Resources Act and the National Environmental Management: Biodiversity Act.

8.3.3. GEOHYDROLOGY

A geohydrological specialist study will be undertaken as part of the Impact Assessment phase to investigate the key potential issues identified during scoping. These investigations will be involve the following:

- Review proposed exploration area i.e. climate, rainfall, geology and hydrogeology.
- Update sensitivity of locations with detailed desk assessment and overview of location.
- Update of report and impact matrix.
- Detailed hydrocensus in a 3km radius around the exploration site once identified.
- Identify any sensitive receptors (i.e. drainages, rivers, wetlands, riparian vegetation, groundwater and surface water users.
- Identify aquifer potential and sensitivity.
- Update geological model and define aquifer characteristics i.e. porous, fractured, confined, layered etc.

8.4. ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

8.4.1. METHOD OF ASSESSING IMPACT SIGNIFICANCE

Method of Assessing Impacts:

The impact assessment methodology is guided by the requirements of the NEMA EIA Regulations (2014). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for

irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

Determination of Environmental Risk:

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E+D+M+R) \times N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 23.

TABLE 23: CRITERIA FOR DETERMINING IMPACT CONSEQUENCE

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),

Aspect	Score	Definition
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 24.

TABLE 24: PROBABILITY SCORING

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),

	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

ER= C x P

TABLE 25: DETERMINATION OF ENVIRONMENTAL RISK

Consequence						
	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 26.

TABLE 26: SIGNIFICANCE CLASSES

Environmental Risk Score	
Value	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

Impact Prioritisation:

In accordance with the requirements of Appendix 3(3)(j) of the NEMA 2014 EIA Regulations (GNR 982), and further to the assessment criteria presented in the Section above it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

In addition, it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

TABLE 27: CRITERIA FOR DETERMINING PRIORITISATION

Public response (PR)	Low (1)	Issue not raised in public response.
	Medium (2)	Issue has received a meaningful and justifiable public response.
	High (3)	Issue has received an intense meaningful and justifiable public response.
Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.

	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 27. The impact priority is therefore determined as follows:

Priority = PR + CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (Refer to Table 28).

TABLE 28: DETERMINATION OF PRIORITISATION FACTOR

Priority	Ranking	Prioritisation Factor
3	Low	**1**
4	Medium	**1.17**
5	Medium	**1.33**
6	Medium	**1.5**
7	Medium	**1.67**
8	Medium	**1.83**
9	**High**	**2**

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

TABLE 29: FINAL ENVIRONMENTAL SIGNIFICANCE RATING

Environmental Significance Rating	
Value	Description
< -10	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).

≥ -10 < -20	Medium negative (i.e. where the impact could influence the decision to develop in the area).
≥ -20	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
0	No impact
< 10	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 10 < 20	Medium positive (i.e. where the impact could influence the decision to develop in the area).
≥ 20	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

8.4.2. EVALUATION OF IMPACTS AND MITIGATION MEASURES

The significance of environmental impacts will be rated before and after the implementation of mitigation measures. These mitigation measures may be existing measures or additional measures that may arise from the impact assessment and specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of the mitigation. The proposed method for the assessment of environmental issues is set out in the table below. This assessment methodology enables the assessment of environmental issues including: the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

The specialist studies will recommend practicable mitigation measures or management actions that effectively minimise or eliminate negative impacts, enhance beneficial impacts, and assist project design. If appropriate, the studies will differentiate between essential mitigation measures, which must be implemented and optional mitigation measures, which are recommended (“nice-to-haves”).

8.4.3. PUBLIC CONSULTATION PROCESS IN ENVIRONMENTAL IMPACT ASSESSMENT

An overview of the proposed public participation process to be followed for the EIA phase is provided below. Forecast dates provided below may change as the project progresses but authority submission deadlines will be strictly adhered to. The commenting periods that will be provided to an I&APs will be thirty (30) days long. Two commenting periods will be provided during the project for the:

- One for the Scoping Report; and
- One for the EIA Report and EMPr.

Feedback from I&APs has been and will be solicited through the following means:

- Public Open Days;
- Advertisements;

- Site Notices and Posters;
- Registered Letters;
- Faxes and e-mails;
- Completion of the comment sheet/ questionnaires provided; and
- Any other communication with EIMS.

The public participation process was initiated on the 27th May 2016 with an initial notification and call to register. The 30 day commenting and review period of the Scoping Report will take place between the 11th of July 2016 and the 11th of August 2016. All comments received during the initial call to register and Scoping Report comment periods will be included in the final Scoping Report submission to the authorities.

The dates of the review and commenting period for the draft EIA report and associated EMPr will be determined at a later date and communicated to all registered I&APs.

8.4.4. CONSULTATION PROCESS WITH COMPETENT AUTHORITY

The conditions of the scoping approval from the competent authority will be implemented through the EIA process. A site visit and meeting with the competent authority shall be held, if requested. PASA will be invited to all public-feedback meetings/ open days to be held. The EIA Report and EMPr will be submitted to PASA in both draft and final formats.

8.4.5. DESCRIPTION OF THE EIA TASKS

The plan of study in terms of certain aspects is detailed in the above sections, and is summarised below. The following tasks will be undertaken as part of the EIA phase of the project:

- Specialist studies:
  - Heritage Impact Assessment study.
  - Ecology Impact Assessment study.
  - Geohydrology Impact Assessment study.
- Public consultation:
  - Notification regarding availability of EIA Report and EMPr.
  - Open Day (EIA Phase).
- Authority consultation:
  - Consultation with PASA and the commenting authorities.
  - Authorities meeting to provide authorities with project related information and obtain their feedback (if requested).
- Document compilation:
  - The EIA Report and EMPr will be compiled in line with the requirements of Appendix 3 and 4 of the EIA Regulations (2014).
  - The EIA Report and EMPr will be made available for public comment for a period of 30 days.
  - The EIA Report and EMPr will be finalised and submitted to the competent authority (the PASA).

8.5. METHOD OF ASSESSING FINANCIAL PROVISION

In terms of Section 24P of NEMA, an applicant for an EA relating to exploration must, before the Minister of Mineral Resources issues the EA, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts.

Motuoane would ensure appropriate insurance cover is in place prior to any work being undertaken in the exploration licence area. Motuoane would discuss and conclude the nature and quantum of the financial provision required for the management and remediation of environmental damage with PASA prior to any exploration activities being undertaken. The proposed nature and quantum of the financial provision will be presented in the EIA phase of this project.

9. OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

This scoping report forms proof that an investigation as required by Section 24(4)(b)(i) of the NEMA is being undertaken for the proposed Motuoane Henneman Exploration Right Project. The EIA/EMPR will further assess the preferred alternatives as identified in this report.

10. ASSUMPTIONS, LIMITATIONS AND GAPS IN KNOWLEDGE

Certain assumptions, limitations, and uncertainties are associated with the Scoping Phase studies. These are detailed for each aspect below.

10.1. HERITAGE

The following assumptions and limitations with regard to the present study exist:

- The aim of the Heritage Scoping Report is to identify the possible types of heritage resources that might be present in the study area, as well as possible hotspots for the locality of such resources. From this, the possible impacts from mining and ancillary activities must be predicted. It must be noted that the findings of this report will require confirmation by undertaking a physical survey as part of the final evaluation of the development footprints during the EIA Phase. Since the current information is based only on a literature and archival search and investigation of other desktop resources (maps and satellite imagery), this report can certainly not be seen as at the level required for a HIR.
- Due to the massive extent of the study area assessed for this Heritage Scoping Report (approximately 149 866 hectares), it is clear that not all possible heritage sites located within the study area could be included in this report. A case in point of this would be the large number of possible heritage buildings and structures (farmhouses, farm buildings and farmworker accommodation) depicted on the First Edition Topographical Map Sheets. Due to their large number, the massive extent of the study area and temporal constraints, these numerous possible heritage sites were not included in the findings of this report. Fieldwork focussed on the development footprints during the EIA phase would address this aspect.
- Due to the massive extent of the study area, this Heritage Scoping Report does not include any findings or assessments relating to palaeontological heritage. Once the EIA phases commences the palaeontological significance of the actual footprint areas will be assessed by way of a palaeontological desktop study, subsequent to which further mitigation measures may be required.
- The archaeological and historical study has revealed that after the Battle of Zand River in May 1900, the retreating Boer forces entrenched themselves on both sides of the railway line on a ridge known as Boschrand. While no battle ensued here, one available reference indicates that an artillery duel did take place between the Boer forces holding the ridge and the British forces south of the ridge. Although a ridge with the name of Boschrand was identified on the available topographic sheets and a railway siding of the same name identified nearby, the exact geographic locality of the Boer position could not be established with any certainty as the depicted Boschrand ridge runs parallel to the railway line and not across it. As a result, this aspect of the history of the study area could not be depicted on the heritage sensitivity maps.

10.2. ECOLOGY

The following assumptions, limitations and gaps in knowledge apply to this assessment:

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be located in an area where it was not formerly known to exist.
- Lists of threatened, rare and sensitive species are dynamic in the sense that new information is collected on a continuous basis, information does not necessarily become quickly available in the public domain and important information is sometimes only available from obscure or restricted sources. There is therefore the possibility that species of concern for the site have not been detected from general literature sources. The latest available information was used for this assessment.
- Animal species, especially birds, are mostly highly mobile and often migrate seasonally. Any field assessment of relatively short duration is therefore unlikely to record anything more than the most common species that happen to be on site at the time of the survey. Such field surveys are generally a poor reflection of the overall diversity of species that could potentially occur on site.
- This study excludes any assessment of invertebrates.
- This study does not constitute a formal wetland study. If any wetlands occur on site, their description is in terms of them being unique habitats and/or containing a unique species composition, but does not constitute a legally determined wetland boundary.
- It is difficult to accurately map secondary grasslands from aerial imagery and areas currently mapped as natural may possibly be secondary. The only way to accurately map such degradation is through extensive field-based surveys where plant species composition can be used to confirm whether an area is secondary or not. The budget and timeframes associated with this assessment are inadequate for undertaking such a detailed study. Uncertainty surrounding the location of secondary grasslands therefore remains.

10.3. SURFACE WATER

The following assumption was made and limitations apply to the study:

- There are no clear regulations for the placement of exploration drilling sites in relation to watercourses, however, the GN704 of the South African NWA (South Africa, 1998) was adopted in the absence of more project-specific regulations as it is a widely-use, conservative and detailed piece of legislation.

10.4. GROUNDWATER

The following assumptions and limitations apply to the geohydrological scoping study/report:

- The entire area was assumed uniform in terms of geological and hydrogeological conditions. Once the sites are known, these characteristics should be updated.
- Locations of exploration boreholes where not available during the time of the baseline and scoping study. Impacts that could typically occur during exploration borehole drilling and drilling of exploration boreholes in sensitive groundwater environment locations where however assessed.
- No groundwater quality for the areas was available from the NGA databases. Samples should be taken to establish an appropriate baseline at each exploration location.
- No drilling process and associated details was provided with regards to fluids potentially used and technique.
- Sensitive areas such as wetlands and drainages should be viewed as off limits when targets are finalised.

10.5. SPATIAL DATA

Due to the large spatial extent of the study area and inherent inaccuracies in national and provincial data sets, some spatial data may not be a true reflection of the “on the ground” status. EIMS has taken all reasonable precautions and measures to minimise any data errors associated with these data sets. In this regard, some areas may be misrepresented though this data. Reasonable attempts will be made to correct these shortcomings during the EIA phase of the study.

11. UNDERTAKINGS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

11.1 UNDERTAKINGS REGARDING CORRECTNESS OF INFORMATION

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

Signature of the EAP

Date:

11.2 UNDERTAKING REGARDING LEVEL OF AGREEMENT

I _____ 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:

12. REFERENCES

AGIS, 2007. Agricultural Geo-Referenced Information System, accessed from www.agis.agric.za on 2 December 2014.

ALEXANDER, G. & MARAIS, J. 2007. A guide to the reptiles of southern Africa. Struik, Cape Town.

BARNES, K.N. (ed.) (2000). The Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

BATES, M.F., BRANCH, W.R., BAUER, A.M., BURGER, M., MARAIS, J., ALEXANDER, G.J. & DE VILLIERS, M.S. (eds). 2014 (reprint 2014). Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Suricata 1. South African National Biodiversity Institute, Pretoria.

BERGH, J.S. 1999. Geskiedenisatlas van Suid-Afrika: die Vier Noordelike Provinsies. Van Schaik, Pretoria.

BRANCH, W.R. (1988) South African Red Data Book—Reptiles and Amphibians. South African National Scientific Programmes Report No. 151.

BROMILOW, C. 2010. Problem plants and alien weeds of South Africa. Briza, Pretoria.

CAMPBELL, PETA. dateDate unknown. Rehabilitation recommendations after alien plant control and Wattle Control. ARC-PPRI publication.

CHANGUION, L. Silence of the Guns: The History of the Long Toms of the Anglo-Boer War. Protea Book House, Pretoria.

CHITTENDEN, H. 2007. Roberts bird guide: a comprehensive field guide to over 950 bird species in southern Africa. John Voelcker Bird Book Fund, Cape Town.

CONANT, S. (1988). Saving Endangered Species by Translocation. Are we tinkering with evolution? BioScience, 38, 254-257.

CONSERVATION BIOLOGY INSTITUTE (2000). Review of potential edge effects on the San Fernando Valley Spineflower (Chorizanthe parryi var. fernandina). Prepared for Ahmanson Land Company, West Covina, California & Beveridge & Diamond, LLP, San Francisco, California.

DE BRUIN, J. C. 1960. Hennenman ('n Gedenkboek). Hennenman: Volkskool.

DE KOCK and M. G. W. 1985. Gister is Verby! 1910-1985: Verhaal van die Ned. Geref. Gemeente Theunissen. P.p 11 – 24.

DE RUITER, D.J., CHURCHILL, S.E., BROPHY, J.K. AND BERGER, L.R. 2011. Regional Survey of Middle Stone Age Fossil Vertebrate Deposits in the Virginia-Theunissen area of the Free State, South Africa in Navorsinge van die Nasionale Museum, vol. 27, part 1.

DEACON, H.J. AND J. DEACON. 1999. Human Beginnings in South Africa: Uncovering the Secrets of the Stone Age. David Philip Publishers. Cape Town.

DENT, M.C., LYNCH, S.D. & SCHULZE, R.E. 1989. Mapping mean annual and other rainfall statistics in southern Africa. Department of Agricultural Engineering, University of Natal. ACRU Report No. 27. Massachusetts: Clark University.

DEPARTMENT OF ENVIRONMENTAL AFFAIRS. DEA National Landcover (TIFF) [Raster] 2015. Available from the Biodiversity GIS website, downloaded on 23 May 2016.

DEPARTMENT OF WATER AFFAIRS (DWA), 1998. Government Gazette No 20119 of June 1999; Government Notice No 704 National Water Act (NWA) 36 of 1998. Referenced as DWA 1998a.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY, 1996. South African Water Quality Guidelines (second edition). Volume 1: Domestic Use.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY, 1996. South African Water Quality Guidelines (second edition). Volume 4: Agricultural Use: Irrigation.

DEPARTMENT OF WATER AFFAIRS AND FORESTRY, 1996. South African Water Quality Guidelines (second edition). Volume 5: Agricultural Use: Livestock Watering.

DREYER, J.J.B. 1990. The Iron Age Prehistory of the Winburg Area, Orange Free State. Unpublished MA Dissertation, University of the Witwatersrand.

DRIVER, A., MAZE, K., ROUGET, M., LOMBARD, A.T., NEL, J., TURPIE, J.K., COWLING, R.M., DESMET, P., GOODMAN, P., HARRIS, J., JONAS, Z., REYERS, B., SINK, K and STRAUSS, T. 2005. National Spatial Biodiversity Assessment 2004: priorities for biodiversity conservation in South Africa. Strelitzia 17. South African National Biodiversity Institute, Pretoria.

DU PREEZ, L. & CARRUTHERS, V. 2009. A complete guide to the frogs of southern Africa. Random House Struik, Cape Town.

DUNCAN, P. 1915. Report of the Select Committee on Rebellion (SC1 ’15) Cape Town, House of Assembly.

ERASMUS, B.J. 2004. On Route in South Africa. Jonathan Ball Publishers, Johannesburg.

FAIRBANKS, D.H.K., THOMPSON, M.W., VINK, D.E., NEWBY, T.S., VAN DEN BERG, H.M & EVERARD, D.A. 2000. The South African Land-Cover Characteristics Database: a synopsis of the landscape. S.Afr.J.Science 96: 69-82.

FELSTAR PUBLISHERS. 1968. Welkom: Capital of the Orange Free State Goldfields. Felstar Publishers (Pty) Ltd, Johannesburg.

FOURIE, W. 2008b. Archaeological Impact Assessments within South African Legislation in South African Archaeological Bulletin, 63(187): 77 – 85.

FREEZE R ALLAN AND CHERRY A JOHN, 1979. “Groundwater”

FRIEDMANN, Y. & DALY, B. (eds.) 2004. The Red Data Book of the Mammals of South Africa: A Conservation Assessment: CBSG Southern Africa, Conservation Breeding Specialist Group (SSC/IUCN), Endangered Wildlife Trust, South Africa.

GELBARD, J.L. & BELNAP, J. 2003. Roads as conduits for exotic plant invasions in a semiarid landscape. Conservation Biology, 17(2), 420-432.

GERMISHUIZEN, G., MEYER, N.L., STEENKAMP, Y and KEITH, M. (eds.) (2006). A checklist of South African plants. Southern African Botanical Diversity Network Report No. 41, SABONET, Pretoria.

GRIFFITH, B., SCOTT, J.M., CARPENTER, J.W. & REED, C. (1989). Translocation as a species conservation tool: Status and strategy. Science, 245, 477 - 480.

HANSEN, M.J. & CLEVENGER, A.P. 2005. THE INFLUENCE OF DISTURBANCE AND HABITAT ON THE PRESENCE OF NON-NATIVE PLANT SPECIES ALONG TRANSPORT CORRIDORS. BIOLOGICAL CONSERVATION, 125, 249-259.

HELME, N. 1974. Thomas Major Cullinan: A Biography. McGraw-Hill Book Company, Johannesburg.

HENDERSON, L. 2001. Alien weeds and invasive plants. Agricultural Research Council.

HENNING, G.A., TERBLANCHE, R.F. and BALL, J.B. 2009. South African Red Data Book: butterflies. SANBI Biodiversity Series 13. South African National Biodiversity Institute, Pretoria.

HENNING, S.F. & HENNING, G.A. 1989. South African Red Data Book - Butterflies. South African National Scientific Programmes No. 158, Foundation for Research Development, CSIR, Pretoria.

HUFFMAN, T.N. 2007. Handbook to the Iron Age: The archaeology of Pre-Colonial Farming Societies in Southern Africa. University of KwaZulu-Natal Press, Scottsville.

IUCN (2001). IUCN Red Data List categories and criteria: Version 3.1. IUCN Species Survival Commission: Gland, Switzerland.

IUCN 2014. The IUCN Red List of Threatened Species. Version 2014.3. <http://www.iucnredlist.org>. Downloaded on 02 December 2014. [for details of threatened Mpumalanga invertebrates as at 2 December 2014 see http://www.iucnredlist.org/search/link/547d71ff-63b06a82]

JOHNSON, J.P. 1910. Geological and Archaeological Notes on Orangia. Longmans, Green & Company, London.

JOHNSON, M.R., VAN VUUREN, C.J., VISSER, J.N.J., COLE, D.I., DE V. WICKENS, H., CHRISTIE, A.D.M., ROBERTS, D.L., BRANDL, G. (2006). Sedimentary rocks of the Karoo supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J. (Eds.). The Geology of South Africa. Geological Society of South Africa, Johannesburg/Council for Geoscience, Pretoria. 461-500.

KUMAN K and R. J. CLARKE. 1986. Florisbad-New Investigations at a Middle Stone Age Hominid Site in South Africa. Geoarchaeology: An International Journal, Vol. 1, No. 2, 103-125 (1986). John Wiley & Sons, Inc.

LANGNER, D. AND A. RAATH. 2014. Die Afrikanerrebellie: 1914-1915. Die Erwe van Ons Vaad're Nr. 6. Kraal Uitgewers, Pretoria.

LEGASSICK, M. 2010. The politics of a South African frontier: the Griqua, the Sotho-Tswana and the missionaries, 1780 – 1840. Basler Afrika Bibliographien, Basel.

LYE, W.F. and C. MURRAY. 1980. Transformations on the Highveld: The Tswana and Southern Sotho. David Phillip, Cape Town.

MACHENS, E.W. 2009. Platinum, Gold and Diamonds: The adventure of Hans Merensky's discoveries. Protea Boekhuis, Pretoria.

MACVICAR, C. N., SCOTNEY, D. M. SKINNER, T. E. NIEHAUS, H. S. & LOUBSER, J. H., 1974. A classification of land (climate, terrain form, soil) primarily for rainfed agriculture. S. Afr. J. Agric. Extension, 3(3): 1-4.

MAGGS, T.M. 1976. Iron Age Communities of the Southern Highveld. (Occasional Publication 2). Pietmaritzburg: Natal Museum.

MARAIS, J. 2004. A complete guide to the snakes of southern Africa. Struik Publishers, Cape Town.

MASON, R.J. 1969. The Oppermansdrif Dam Archaeological Project: Vaal Basin in- The South African Archaeological Bulletin, Vol. 24, No. 95/96, pp. 182-192.

Maurice, J.F. and M.H. Grant. 1906. History of the War in South Africa. Hurst and Blackett, London.

MAYHEW, V. 1982. Reader's Digest: Illustrated Guide to Southern Africa. The Reader's Digest Association.

MECENERO S., BALL J.B., EDGE D.A., HAMER M.L., HENNING G.A., KRÜGER M.A., PRINGLE E.L., TERBLANCHE R.F. & WILLIAMS M.C. (eds) 2013. Conservation Assessment of Butterflies of South Africa, Lesotho and Swaziland: Red List and Atlas. Saftronics (Pty) Ltd., Johannesburg & Animal Demography Unit, Cape Town. 676 pp.

MEINTJIES, J. 1973. The Voortrekkers. Cassell, London.

MILLS, G. & HES, L. 1997. The complete book of southern African mammals. Struik Publishers, Cape Town.

MINTER, L.R., BURGER, M., HARRISON, J.A., BRAACK, H.H., BISHOP, P.J. and KLOEPFER, D. (eds.) 2004. Atlas and Red Data BookofBook of the Frogs of South Africa, Lesotho and Swaziland. SI/MAB Series #9. Smithsonian Institution, Washington, DC.

MONADJEM, A., TAYLOR, P.J., COTTERILL, E.P.D. & SCHOEMAN, M.C. 2010. Bats of southern and central Africa. Wits University Press, Johannesburg.

MUCINA, L. AND RUTHERFORD, M.C. (editors) 2006. Vegetation map of South Africa, Lesotho and Swaziland: an illustrated guide. Strelitzia 19, South African National Biodiversity Institute, Pretoria.

MUCINA, L., HOARE, D.B., Lotter, M.C., du Preez, J., Rutherford, M.C., Scott-Shaw, R., Bredenkamp, G.J., Powrie, L.W., Scott, L., Camp, K.G.T., Cilliers, S.S., Bezuidenhous, H., Mostert. T.H., Siebert, S.S., Winter, P.J.D., Burrows, J.E., Dobson, L., Ward, R.A., Stalmans, M., Oliver, E.G.H., Siebert, F., Schmidt, E., Kobisi, K. & Kose, K. 2006b. Grassland Biome. In: MUCINA, L. & RUTHERFORD, M.C. (editors). The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19, South African National Biodiversity Institute, Pretoria.

MUCINA, L., RUTHERFORD, M.C. AND POWRIE, I.W. (editors) 2005. Vegetation map of South Africa, Lesotho and Swaziland, 1:1 000 000 SCALE SHEET MAPS South African National Biodiversity Institute, Pretoria.

NIENABER, P. J. and LE ROUX, C. J. P. 1982. Vrystaat-Fokus. Pretoria: Sigma Press (Pty) Ltd.

OBERHOLSTER, J.J. 1972. The Historical Monuments of South Africa. The Rembrandt van Rijn Foundation for Culture, Cape Town.

PAKENHAM, T. 1979. The Boer War. Bergvlei: Jonathan Ball Publishers.

PASSMORE, N.I. & CARRUTHERS, V.C. (1995) South African Frogs; a complete guide. Southern Book Publishers and Witwatersrand University Press. Johannesburg.

RAATH, A.W.G. 2007. De La Rey: Die Stryd vir Vryheid. Kraal Uitgewers, Pretoria.

ROSSOUW, L. N.D. Phase 1 Heritage Impact Assessment of a proposed new rehabilitation facility at Odendaalsrust, Free State Province. Prepared for EKO Environmental Consultants.

ROYAL DE L'AFRIQUE CENTRALE, Ser. IN-8o 221: 1-472.

RUTHERFORD, M.C. & WESTFALL, R.H. (1994). Biomes of southern Africa: an objective categorization. Memoirs of the Botanical Survey of South Africa No. 63.

SAMWAYS, M.J. 2006. National Red List of South African Odonata. Odonatologica 35(4): 341-368.

SAMWAYS, M.J. and TAYLOR, S. 2004. Impacts of alien invasive plants on Red-Listed South African dragonflies (Odonata). South African Journal of Science 100: 78-80.

SCHOEMAN, and K. BLOEMFONTEIN: die ontstaan van 'n stad 1846 – 1946. Human & Rousseau, Cape Town.

SHORTEN, J.R. 1970: The Johannesburg Saga. John R. Shorten (Pty) Ltd, Johannesburg.

TARBOTON, W. and TARBOTON, M. 2002. A Fieldguide to the Dragonflies of South Africa. Published by the authors, 95pp.

TARBOTON, W. and TARBOTON, M. 2005. A Fieldguide to the Damselflies of South Africa. Published by the authors, 95pp.

THE MINING MANUAL AND YEARBOOK, 1914.

THE READER'S DIGEST. 1994. Illustrated History of South Africa: The Real Story. The Reader's Digest Association Limited, Cape Town.

TOLLEY, K. & BURGER, M. 2007. Chameleons of southern Africa. Struik Publishers, Cape Town.

UNION OF SOUTH AFRICA, 1916. Report of the Judicial Commission of Enquiry into the Causes of and Circumstances relating to the recent Rebellion in South Africa, December 1916.

VAN DER WALT, J. 2013. Archaeological Scoping Report for the proposed Grootkop Solar Energy facility. Prepared for Savannah Environment (Pty) Ltd.

VAN DER WALT, J. 2013. Archaeological Scoping Report for the Proposed Oryx Solar Energy Facility. Prepared for Savannah Environmental (Pty) Ltd.

VAN SCHOOR, M.C.E. 2007. Christiaan Rudolph de Wet: Krygsman en Volksman. Protea Boekhuis, Pretoria.

VAN WYK, A.E. & SMITH, G.F. 2001. REGIONS OF FLORISTIC ENDEMISM IN SOUTHERN AFRICA. UMDAUS PRESS, HATFIELD.

VICTOR, J.E. & KEITH, M. 2004. THE ORANGE LIST: A SAFETY NET FOR BIODIVERSITY IN SOUTH AFRICA. SOUTH AFRICAN JOURNAL OF SCIENCE 100: 139–141.

VICTOR, J.E. 2006. DATA DEFICIENT FLAGS FOR USE IN THE RED LIST OF SOUTH AFRICAN PLANTS. BOTHALIA 36,1: 85–86.

VISAGIE, J.C. 2011. Voortrekkerstamouers: 1835 – 1845. Protea Boekhuis, Pretoria.

WADLEY, L. 2013. Recognizing complex cognition through innovative technology in Stone Age and Palaeolithic sites in Cambridge Archaeological Journal, 23: 163-183.

WARWICK, P. 1983. Black People and the South African War: 1899 – 1902. Ravan, Johannesburg.

WERNER, K. 2000. The Tiger Beetles of Africa, Volumes 1 and 2, Taita Publishers.

WHISENANT, S.G. (1999). Repairing Damaged Wildlands: A process-orientated, landscape-scale approach. Cambridge University Press. Cambridge

ZAR, J.H. 1996, Biostatistical Analysis, 3rd ed., Prentice-Hall, New Jersey.

Google Earth

GOOGLE EARTH. 6.0.12032 Beta.

Aerial depictions the Heritage Scoping Report are from Google Earth.

World Wide Web References:

www.dwaf.gov.za/wfw/Control/docs/controltables.doc: The Working for Water Programme's website.

www.angloboerwar.com

www.nzetc.victoria.ac.nz

www.sahistory.org.za

www.sahra.org.za

www.sibanyegold.co.za

www.wikipedia.org