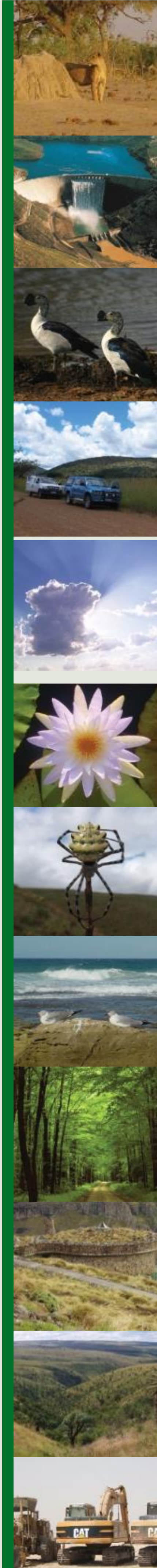

ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

# ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

For an Exploration Right Application

PREPARED ON BEHALF OF:
MOTUOANE GAS (PTY) LTD.

AS PER CHAPTER 4 OF GN R982 OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998) AND IN SUPPORT OF SECTION 79 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (ACT 28 OF 2002)

PASA REFERENCE NUMBER: 12/3/315 ER

EIMS REFERENCE NUMBER: 1133

20 YEARS
1993 - 2013

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Leaders in Environmental Management

# MOTUOANE EXPLORATION RIGHT APPLICATION

## ENVIRONMENTAL IMPACT REPORT

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# TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# APPENDICES

**Appendix A: EAP CV and Declaration**

**Appendix B: Project Affected Properties**

**Appendix C: Project Maps**

**Appendix D: Public Participation**

**Appendix E: Specialist Reports**

**Appendix F: Impact Assessment Matrix**

**Appendix G: Specialist Declaration**

**Appendix H: Final Rehabilitation, Decommission and Closure Plan**

# ABBREVIATIONS

| | | |
|---|---|---|
| 2D | : | Two-dimensional |
| BID | : | Background Information Document |
| CBA | : | Critical Biodiversity Area |
| CESA | : | Critical Ecological Support Area |
| CLO | : | Community Liaison Officer |
| CMA | : | Catchment Management Agency |
| CR | : | Critically Rare |
| CSIR | : | Council for Scientific and Industrial Research |
| DEA | : | Department of Environmental Affairs |
| DMR | : | Department of Mineral Resources |
| DWA | : | Department of Water Affairs |
| DWAF | : | Department of Water Affairs and Forestry |
| DWS | : | Department of Water and Sanitation |
| EA | : | Environmental Authorisation |
| EAP | : | Environmental Assessment Practitioner |
| EC | : | Electrical Conductivity |
| EC | : | Environmental Coordinator |
| ECA | : | Environmental Conservation Act |
| ECA | : | Environmental Conservation Act |
| ECO | : | Environmental Control Officer |
| EIA | : | Environmental Impact Assessment |
| EIMS | : | Environmental Impact Management Services (Pty) Ltd. |
| ELWU | : | Existing Lawful Water Use |
| EMP | : | Environmental Management Plan |
| EMPR | : | Environmental Management Program |
| EMS | : | Environmental Management System |
| EN | : | Endangered |
| EPF | : | Exploration and Production Forum |
| ER | : | Environmental Risk |

ESMS : Environmental and Social Management System

ESO : Environmental Site Officer

EWP : Exploration Work Programme

GA : General authorisation

GA : General Authorisation

GNR : Government Notice Regulation

GPS : Global Positioning System

HIA : Heritage Impact Assessment

I&AP's : Interested and Affected Parties

IDP : Integrated Development Plan

IEP : Integrated Energy Plan

iLEH : Irene Lea Environmental and Hydrogeology

KZN : KwaZulu Natal

KZNSCP: KwaZulu-Natal Systematic Conservation Plan

LC : Leachable concentration

MAE : Mean Annual Evaporation

MAP : Mean Annual Precipitation

MCF : Midlands Conservation Forum

MPRDA: Mineral and Petroleum Resources Development Act

NAAQS: National Ambient Air Quality Standards

NEMA : National Environmental Management Act

NEMAQA: National Environmental Management: Air Quality Act

NEMBA: National Environmental Management: Biodiversity Act

NEMWA: National Environmental Management: Waste Act

NGDB : National Groundwater Database

NHRA : National Heritage Resources Act

NHRA : National Heritage Resources Act

NT : Not threatened

PASA : Petroleum Agency South Africa

PPP : Public Participation Process

| | |
|---|---|
| Pri. Sci. Nat.: | Professional Natural Scientist |
| Ptn : | Portion |
| RE : | Remaining Extent |
| SAHRA : | South African Heritage Resources Agency |
| SAHRIS: | South African Heritage Resources Information System |
| SANS : | South African National Standards |
| TC : | Total concentration |
| TDS : | Total Dissolved Solids |
| TOPS : | Threatened and Protected Species |
| VU : | Vulnerable |
| WMA : | Water Management Area |
| WRC : | Water Research Commission |
| WUL : | Water Use Licence |

# EXECUTIVE SUMMARY

## INTRODUCTION AND PROJECT DESCRIPTION

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 proposed Motuoane Hennenman Exploration Right project, if approved, will allow Motuoane to determine if there is an economically viable hydrocarbon resource 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 environmental impact 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 1st of June 2016 with an initial notification and call to register for a period of 30 days, ending on the 30th of June 2016. The scoping report was 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 this commenting periods were captured in an Issues and Response included in the scoping report for consideration and decision making purposes.

The scoping report was accepted by PASA on 22 September 2016 and the instruction was given to the applicant to proceed with the EIA and EMPR. This EIA Report, including an EMPR, has been compiled and has been presented for public comment as part of this EIA process during which time further stakeholder engagement was undertaken.

The compilation of the EIA and EMPR for the proposed Motuoane Hennenman Exploration Right 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 assessment of impacts for all project phases and the provision of suitable technical management/mitigation measures to be implemented.

In accordance with the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) an application for Environmental Authorisation (EA) must be submitted to the PASA in support of the application for an exploration right. 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. Additionally, I&AP's must be notified and consulted.

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 data management
- Geological and geophysical logging
- Geotechnical and soil sampling
- Diamond core drilling

# PURPOSE OF THIS DOCUMENT

This document represents the Environmental Impact Report (EIR) and Environmental Management Programme (EMPR) for the proposed Exploration Right Application for hydrocarbons in the District Municipalities of Fezile Dabi and Lejweleputsa of Hennenman by Motuoane Energy (Pty) Ltd (hereafter referred to as Motuoane Energy

The EMPR contains the following information:

- A description of the work programme and proposed activities;
- An assessment of the potential positive and negative impacts of the proposed activities; and
- An Environmental Management Plan to manage and/or mitigate potential negative impacts.

The EMPR aims to present management measures that will eliminate, offset or reduce adverse environmental impacts, as well as to provide the framework from environmental monitoring. The primary purpose of the EMPR is to ensure that negative environmental impacts of the proposed project are effectively managed within acceptable limits and that the positive impacts are enhanced.

## ENVIRONMENTAL SPECIALIST STUDIES

Three specialist studies were undertaken to address the key issues that required further investigation, namely the impact on ecology and wetlands, surface 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 8.1). Specialists also recommended appropriate mitigation / control or optimisation measures to minimise potential negative impacts or enhance potential benefits, respectively. The specialists appointed for this project included:

- Ecology and Wetlands – David Hoare Consulting cc
- Geohydrology – Exigo Sustainability (Pty) Ltd
- Heritage – PGS Heritage

## SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT FINDINGS

A screening assessment was undertaken to identify all the potential risks and impacts associated with each exploration activity. The background information and specialist studies were consulted as well as a screening of all the activities underway and planned for the exploration to ensure that all of the potential impacts have been identified. Each of the identified risks and impacts were assessed using the EIMS impact assessment methodology described in the body of the report. The assessment criteria include the nature, extent, duration, magnitude/intensity, reversibility, probability, public response, cumulative impact, and irreplaceable loss of resources.

The environmental specialist studies that were undertaken for the proposed project, determined that a number of sensitive features exist within the exploration area. In terms of site sensitivities, the most sensitive features which will require protection on site may be summarised as follows:

- Critical Biodiversity Areas;
- Ecologically Sensitive Areas;
- Heritage sites (including graveyards and historical structures); and
- Watercourses, wetlands, aquifers and dams.

With regard to the various impacts identified during the course of this EIA, Table 1 below provides a summary of the outcome of risks identified during the EIA, and the associated significance rankings following the implementation of suitable mitigation.

**Table 1: Summary of the risks and impacts identified and associated significance ratings subsequent to the implementation of mitigation measures.**

| Identified by | Impact | Significance post-mitigation |
|---|---|---|
| **Geohydrology** | Disturbance of local hydraulic head (water level) | Medium (Negative) |
| | Hydraulic head decline due to drilling water supply | Low (Negative) |
| | Surface water contamination | Medium (Negative) |
| | Contamination of Groundwater | Low (Negative) |
| | Impact on wetland/ drainage lines | Low (Negative) |
| | Linking aquifers in drilling process | Low (Negative) |
| **Ecology and Wetlands** | Habitat loss/destruction | Low (Negative) |
| | Loss of or damage to wetlands | Low (Negative) |
| | Habitat fragmentation & edge effects | Low (Negative) |
| | Displacement of faunal species | Low (Negative) |
| | Blockage of seasonal & dispersal movements | Low (Negative) |
| | Flora direct & indirect mortality | Low (Negative) |
| | Fauna direct & indirect mortality | Low (Negative) |
| | Pollution of habitats | Low (Negative) |
| | Introduction/invasion by alien (non-native) species | Low (Negative) |
| **Heritage** | Disturbance/ destruction of sections of the Battle of Zand River | Low (Negative) |
| | Disturbance/ destruction of sections of the Boer positions at Boschrand | Low (Negative) |
| | Disturbance/ destruction of black concentration camps | Low (Negative) |

| Identified by | Impact | Significance post-mitigation |
|---|---|---|
| | Disturbance/ destruction of archaeological sites | Low (Negative) |
| | Disturbance/ destruction of historical buildings and structures | Low (Negative) |
| | Disturbance/ destruction of graves and cemeteries | Medium (Negative) |
| | Disturbance/ destruction of unmarked graves | Low (Negative) |
| | Disturbance / Destruction of HEN 1 | Medium (Negative) |
| | Disturbance / Destruction of Possible Stillborn Graves at HEN 2 | Low (Negative) |
| | Disturbance / Destruction of HEN 3 | Medium (Negative) |
| | Disturbance / Destruction of National Monuments and Monuments | Low (Negative) |
| | Disturbance / Destruction of Palaeontology | Medium (Negative) |
| **EAP, I&AP's** | Interference with Existing Land Uses | Low (Negative) |
| | Nuisance and Impact on Sense of Place | Low (Negative) |
| | Safety and Security | Low (Negative) |
| | Damage/Disruption of services | Low (Negative) |
| | Impact on Existing Infrastructure | Low (Negative) |
| | Employment Opportunities | Low (Positive) |
| | Perceptions and Expectations | Low (Negative) |
| | Air quality / greenhouse gas emissions | Low (Negative) |
| | Clearance of vegetation | Low (Negative) |
| | Damage to road infrastructure | Low (Negative) |
| | Erosion and sedimentation | Low (Negative) |

| Identified by | Impact | Significance post-mitigation |
|---|---|---|
| | Expropriation of land and displacement of landowners and livestock | Low (Negative) |
| | Fugitive emissions (Dust) | Low (Negative) |
| | Hydrocarbon spills/contamination | Low (Negative) |
| | Noise | Low (Negative) |
| | Reduction in groundwater availability | Low (Negative) |
| | Soil compaction | Low (Negative) |
| | Soil Pollution/Contamination | Low (Negative) |
| | Soil Surface Subsidence | Low (Negative) |

In terms of positive impacts (Job Creation), the exploration programme itself will not contribute significantly to the local economy. Due to the specialised nature of the activity, human resources would primarily be based on technical expertise and associated contractor crews. During the early phases of exploration, potential employment opportunities may arise in ancillary services including transport and civil works.

## EMPR MITIGATION MEASURES

The EMPR has identified appropriate mechanisms for avoidance and mitigation of negative impacts. It is anticipated that the mitigation measures stipulated in the EMPR will result in effective mitigation of the negative impacts. Conversely the implementation of the mitigation measures designed to maximise the positive aspects of the project will result in a positive influence as a result of the exploration activities.

Some of the key mitigation measures which have been identified to promote sound environmental performance are as follows:

- All wetland areas should be avoided by exploration activities, including a suitable buffer zone to minimize or avoid impacts on these areas;
- In order to comply with the National Water Act (Act 36 of 1998), formal wetland delineation should be undertaken in the vicinity of exploration activities (once known) in order to properly determine the boundaries of wetlands, channels and riparian areas on site;
- A Rehabilitation Programme should be established before commencing exploration. 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;

- All permanent facilities must be removed upon closure. This will include the associated equipment, material and waste on site;
- Progressive rehabilitation of disturbed land should be carried out to minimize the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff;
- Traffic and movement over stabilised areas should be controlled (minimised and kept to certain paths), and damage to stabilised areas should be repaired timeously and maintained;
- The total footprint area to be cleared for drilling should be kept to a minimum by demarcating the drilling areas and restricting removal of vegetation to these areas only;
- The placement of drip trays under the drilling rigs should be implemented and recorded to minimize the contamination of waste oil from the drilling rig;
- Oil recovered from the drilling rigs should be collected, stored and disposed of by accredited vendors for recycling;
- Drilling fluids should be biodegradable and should be kept in a lined mud pit or surface container. Proper rehabilitation and off site removal of excess fluids should take place.
- An Integrated Rehabilitation Plan must be developed by a specialist for implementation within one year of the approval of the EMPR. The Plan shall be viewed as a dynamic document and shall be subjected to independent review on an annual basis along with the quantum for financial provision;
- The Applicant shall appoint a suitably qualified and competent Independent Environmental Control Officer (ECO) who shall be tasked with auditing environmental compliance. The ECO shall undertake daily site inspections and prepare audit reports to be submitted to the applicant and contractors. The ECO must preferably have a tertiary qualification in an Environmental Management or appropriate field and experience in the implementation of environmental management specifications;
- The EMPR must be made binding on all contractors, sub-contractors or agents operating on behalf of the Environmental Authorisation Holder;
- Construction/drilling should preferably take place during the dry season;
- Excavations should be open for as short period as practically possible and drilling circulation fluid sumps be cleaned out and rehabilitated. Drilling sumps should preferably not be dug in the ground, but steel or plastic tank sumps be used to eliminate possible soil and shallow aquifer contamination;
- 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 drilling rig and vehicles are done on site;
- Biodegradable or environmentally friendly drilling fluids (polymers) should be used wherever possible. It is essential that the exploration borehole be flushed once the target depth has been reached. This is preferably done by pumping the drilling fluid out once the

drilling fluid breaks down to form thin watery fluid. If the borehole cannot be developed by abstraction of the drilling fluid, e.g. due to full casing to the bottom, then the borehole should be circulated with clean water to enhance break-down of the polymer. Drilling specialists and specialist methodologies should be followed to allow drilling fluids/polymers to be removed from the borehole as far as possible and to prohibit possible bacterial contamination of the borehole and aquifer. The boreholes should be correctly constructed so that no gas leakage occurs;

- As part of mitigation of contamination of groundwater, Chapter 8 and Chapter 9 of the MPRDA R. 527 Regulations for petroleum exploration and production should be adhered to wherever these regulations apply to exploration diamond core drilling;
- After exploration coring has been completed, core samples removed and borehole cleaning has been completed, the boreholes should be fully grouted/cemented with the casing left in correct stratigraphic and aquifer zones as described by the MPRDA Petroleum exploration and production R. 527 Regulations, Chapter 8 and Chapter 9;
- A buffer area of 200 m wide surrounding the cemetery at HEN 1 and HEN 3 must be kept clear of any exploration footprints, whether it be drilling positions, access roads etc.;
- A buffer area of 100 m wide surrounding the farmstead at HEN 2 must be kept clear of any exploration footprints, whether it be drilling positions, access roads etc.;
- The planning of all additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional exploration footprints;
- As soon as any additional exploration footprints are confirmed, a suitably qualified heritage specialist, with expertise in archaeology, must be appointed. Such additional exploration footprints would include all aspects relating to the exploration work;
- The appointed heritage specialist will be responsible for undertaking heritage walkthroughs of the additional exploration footprint areas to identify any heritage sites located there;
- The appointed heritage specialist will be responsible for compiling a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified heritage sites, assessing the impact of the proposed exploration activity(ies) on the identified heritage sites and outlining mitigation measures which may be required;
- The report would be a subsequent heritage impact assessment aimed specifically at the additional exploration footprints, and must be submitted to SAHRA as well;
- No exploration footprints are allowed within a distance of 500 m from the boundaries of the Stone Rampart and Voortrekker Graves at Ventersburg;
- Once the drilling sites are known, the applicant should invite a professional palaeontologist to monitor drilling cores for subsurface fossil remains that may be intersected by the drilling process; and
- The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils if necessary.

# NEED AND DESIRABILITY OF THE PROJECT

The proposed Motuoane Hennenman Exploration Project, if approved, will allow Motuoane Energy to determine if there is an economically viable resource (relevant hydrocarbons) available in the 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 gas resources”. The successful exploitation of these 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. This benefit cannot however be quantified until such time as the exploration phase is completed.

# PART A:

# SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

## 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 Hennenman.

An application for an exploration right for the proposed Motuoane Hennenman Exploration Project was submitted to the Petroleum Agency South Africa (PASA) in terms of section 79 of the Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). PASA accepted the exploration right application in July 2016 and subsequently requested that in accordance with Regulation 16 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014, an application for Environmental Authorisation (EA) must be submitted to the PASA in support of the application for an exploration right.

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 of the NEMA. Additionally, I&AP's must be notified and consulted as per Chapter 6 of the NEMA.

In accordance with Regulation 16 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014, an application for Environmental Authorisation (EA) must be submitted to the PASA in support of the application for an exploration right. 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 of the NEMA. Additionally, I&AP's must be notified and consulted as per Chapter 6 of the NEMA.

The report has been compiled in terms of Section 79 of the MPRDA and Section 21 of the NEMA. 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 1st of June 2016 with an initial notification and call to register for a period of 30 days, ending on the 30th of June 2016. The scoping report was 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 were captured in an Issues and Response included in the scoping report as Appendix D for consideration and decision making purposes. PASA accepted the scoping report on 22nd September 2016 and gave the instruction to the applicant to process with the EIA and EMPR. This report and associated appendices constitutes the EIR and EMPr Reports for the Motuoane Hennenman Exploration Right application. This EIR report was made available for public review and comment from the 23rd November 2016 to the 16th January 2017.

## 1.1 REPORT STRUCTURE

Table 2 below provides a summary of the NEMA requirements in terms of Appendix 3 of the EIA regulations (GNR 982), and an indication in which section the supporting information and documentation can be found.

**Table 2: Report Structure**

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| **NEMA Regulation 982 (2014)** | | |
| **Appendix 3(3)(a):** | Details of –<br>(i) The EAP who prepared the report; and<br>(ii) The expertise of the EAP, including a curriculum vitae; | Section 1.2<br>Section 1.3 |
| **Appendix 3(3)(b):** | The location of the activity, including:<br>(i) The 21-digit Surveyor General code of each cadastral land parcel;<br>(ii) Where available, the physical address and farm name; and<br>(iii) Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties; | Section 1.4 |
| **Appendix 3(3)(c):** | A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is –<br>(i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; | Section 1.5 |

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| | (ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken; | |
| **Appendix 3(3)(d):** | A description of the scope of the proposed activity, including –<br>(i) All listed and specified activities triggered and being applied for; and<br>(ii) A description of the associated structures and infrastructure related to the development; | Section 2 |
| **Appendix 3(3)(e):** | A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context; | Section 3 |
| **Appendix 3(3)(f):** | A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location; | Section 4 |
| **Appendix 3(3)(g):** | A motivation for the preferred development footprint within the approved site; | Section 5 |
| **Appendix 3(3)(h):** | A full description of the process followed to reach the proposed development footprint within the approved site, including:<br>(i) Details of the development footprint alternatives considered;<br>(ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; | Section 5<br>Section 5.5<br>Section 6 |

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| | (iii) A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; | Section 6.3 |
| | (iv) The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage, and cultural aspects; | Section 7 |
| | (v) The impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which these impacts –<br>(aa) Can be reversed;<br>(bb) May cause irreplaceable loss of resources; and<br>(cc) Can be avoided, managed or mitigated; | Section 8 |
| | (vi) The methodology used in determining and ranking the nature, significance, consequences, extent duration and probability of potential environmental impacts and risks; | Section 13.2 |
| | (vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological social, economic, heritage and cultural aspects; | |
| | (viii) The possible mitigation measures that could be applied and level of residual risk; | Section 5.6 |
| | (ix) If no alternative development locations for the activity were investigated, the motivation for not considering such; and | |

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| | (x) A concluding statement indicating the preferred alternative development location within the approved site; | |
| **Appendix 3(3)(i):** | A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including –<br>(i) A description of all environmental issues and risks that were identified during the environmental impact assessment process; and<br>(ii) An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures; | Section 8 |
| **Appendix 3(3)(j):** | An assessment of each identified potentially significant impact and risk, including –<br>(i) Cumulative impacts;<br>(ii) The nature, significance and consequence of the impact and risk;<br>(iii) The extent and duration of the impact and risk;<br>(iv) The probability of the impact and risk occurring;<br>(v) The degree to which the impact and risk can be reversed;<br>(vi) The degree to which the impact and risk may cause irreplaceable loss of resources;<br>The degree to which the impact and risk can be mitigated; | Section 8 |

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| **Appendix 3(3)(k):** | Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report; | Section 12 |
| **Appendix 3(3)(l):** | An environmental impact statement which contains –<br>(i) A summary of the key findings of the environmental impact assessment;<br>(ii) A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicting any areas that should be avoided, including buffers; and<br>(iii) A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives; | Section 13 |
| **Appendix 3(3)(m):** | Based on the assessment, and where applicable, recommendations from the specialist reports, the recording of proposed impact management objectives and the impact management outcomes for the development for inclusion in the EMPR as well as for inclusion as conditions of authorisation; | Section 14 |
| **Appendix 3(3)(n):** | The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment; | Section 15 |

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| **Appendix 3(3)(o):** | Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation; | Section 16 |
| **Appendix 3(3)(p):** | A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed; | Section 18 |
| **Appendix 3(3)(q):** | A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation; | Section 19 |
| **Appendix 3(3)(r):** | Here the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised; | Section 20 |
| **Appendix 3(3)(s):** | An undertaking under oath or affirmation by the EAP in relation to:<br>(i) The correctness of the information provided in the reports;<br>(ii) The inclusion of comments and inputs from stakeholders and I&Ps;<br>(iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and<br>(iv) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties; | Section 43 |

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| **Appendix 3(3)(t):** | Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts; | Section 35 |
| **Appendix 3(3)(u):** | An indication of any deviation from the approved scoping report, including the plan of study, including –<br>(i) Any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and<br>(ii) A motivation for the deviation; | Section 22 |
| **Appendix 3(3)(v):** | Any specific information that may be required by the competent authority; and | Section 24 |
| **Appendix 3(3)(w):** | Any other matters required in terms of section 24(4)(a) and (b) of the Act. | Section 25 |
| **Appendix 4(1)(1)(a):** | Details of –<br>(i) The EAP who prepared the EMPR; and<br>(ii) The expertise of that EAP to prepare an EMPR, including a curriculum vitae; | Section 26 |
| **Appendix 4(1)(1)(b):** | A detailed description of the aspects of the activity that are covered by the EMPR as identified by the project description; | Section 32.1 |
| **Appendix 4(1)(1)(c):** | A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the | Section 9 |

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| | preferred site, indicating any areas that any areas that should be avoided, including buffers; | |
| **Appendix 4(1)(1)(d):** | A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified though the environmental impact assessment process for all phases of the development including –<br>(i) Planning and design;<br>(ii) Pre-construction activities;<br>(iii) Construction activities;<br>(iv) Rehabilitation of the environment after construction and where applicable post closure; and<br>(v) Where relevant, operation activities; | Section 34 |
| **Appendix 4(1)(1)(e):** | A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d); | Section 34.3 |
| **Appendix 4(1)(1)(f):** | A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to –<br>(i) Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; | Section 34.3 |

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| | (ii) Comply with any prescribed environmental management standards or practices;<br>(iii) Comply with any applicable provisions of the ac regarding closure, where applicable; and<br>(iv) Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable; | |
| **Appendix 4(1)(1)(g):** | The method of monitoring the implementation of the impact management actions contemplated in paragraph (f); | Section 40 |
| **Appendix 4(1)(1)(h):** | The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f); | Section 40.1<br>Section 42 |
| **Appendix 4(1)(1)(i):** | An indication of the persons who will be responsible for the implementation of the impact management actions; | Section 40.4 |
| **Appendix 4(1)(1)(j):** | The time periods within which the impact management actions contemplated in paragraph (f) must be implemented; | Section 40.5 |
| **Appendix 4(1)(1)(k):** | The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f); | Section 40.1 |
| **Appendix 4(1)(1)(l):** | A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations; | Section 40.6 |

| Environmental Regulation | Description | Section in Report |
| --- | --- | --- |
| **Appendix 4(1)(1)(m):** | An environmental awareness plan describing the manner in which –<br>(i) The applicant intends to inform his or her employees of any environmental risk which may result from their work; and<br>(ii) Risks must be dealt with in order to avoid pollution or the degradation of the environment; and | Section 40.15 |
| **Appendix 4(1)(1)(n):** | Any specific information that may be required by the competent authority. | Section 41 |

## 1.2 DETAILS OF THE EAP

Environmental Impact Management Services (Pty) Ltd (EIMS) has been appointed by Motuoane Energy 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 Hennenman Exploration Project.

## 1.3 EXPERTISE OF THE EAP

### 1.3.1 QUALIFICATIONS OF THE EAP

In terms of Regulation 13 of the 2014 EIA Regulations (Government Notice R. 982), an independent Environmental Assessment Practitioner (EAP), must be appointed by the applicant to manage the application. EIMS has been appointed by the Applicant as the EAP and is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations and Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

1. Objective and independent;
2. Has expertise in conducting EIA's;
3. Comply with the NEMA, the Regulations and all other applicable legislation;
4. Takes into account all relevant factors relating to the application; and
5. Provides full disclosure to the applicant and the relevant environmental authority.

The EAP's responsible for preparing this EIA Report are Ms. Sonja van de Giessen (Senior Consultant) and Mr Bongani Khupe (Project Manager).

**Mr. 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

**Ms. Sonja van de Giessen** is a Senior Environmental Scientist and holds a Bachelor of Science Honours degree and is currently working towards her Master Degree in Environmental Management.

**Mr. Brian Whitfield** is a senior project manager at EIMS and has been involved in numerous significant projects over the past 12 years that he has been with the firm. He has extensive experience in Project Management as well as with undertaking Environmental Impact Assessments, Environmental Auditing, etc.

The declaration of independence of the EAP and the Curriculum Vitae (indicating the experience with environmental impact assessment and relevant application processes) of the consultants that were involved in the Scoping and EIA process and the compilation of this report are attached as Appendix A

### 1.3.2 SUMMARY OF EAP'S PAST EXPERIENCE

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. Please refer to the EIMS website (www.eims.co.za) for examples of EIA documentation currently available.

Mr. Khupe's 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 energy 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. van de Giessen has more than three years of experience in environmental impact assessments and environmental management. Her core experience and expertise is in the mining industry sector, focusing on Environmental Impact Assessments, Environmental Management Programmes, Water Use Licence Applications and Integrated Water and Waste Management Plans, and Environmental Auditing. Her involvement in such projects varies from project management, to the compilation of technical and environmental documentations and reports. Sonja is registered as a trainee certified natural scientist in the field of environmental science with SACNASP.

### 1.3.3 SPECIALIST CONSULTANTS

Three specialist studies were undertaken to address the key issues that required further investigation, namely the impact on ecology and wetlands, 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 8.1). Specialists also recommended appropriate mitigation / control or optimisation measures to minimise potential negative impacts or enhance potential benefits, respectively. The specialists appointed for the proposed Motuoane Hennenman Exploration Project are indicated in Table 3 below.

**Table 3: 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 |

## 1.4 DESCRIPTION OF THE PROPERTY

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 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, excluding 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.

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.

## 1.5 LOCALITY MAP

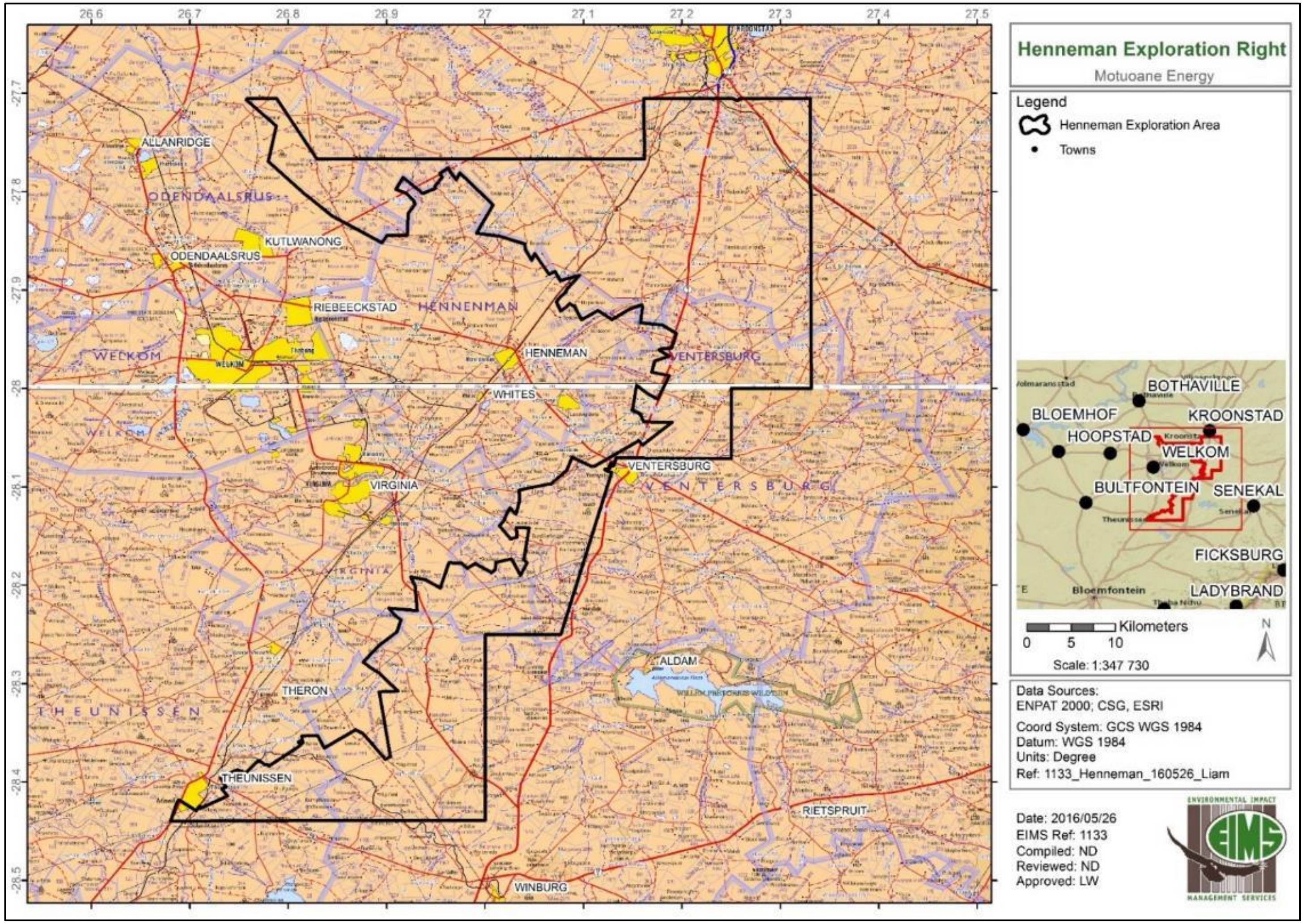


**Figure 1: Locality Map**

# 2 DESCRIPTION AND SCOPE OF THE PROPOSED ACTIVITY

The proposed gas exploration programme will be completed within 3 years and in summary will entail activities as detailed in Table 4 below, based on information presented in the Exploration Works Programme (EWP):

**Table 4: Exploration Activities**

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

Each of the above mentioned activities presented in Table 4 are described in more detail in the subsequent subsections.

## 2.1 LISTED AND SPECIFIED ACTIVITIES

Table 5 overleaf presents the listed activities associated with the proposed exploration project.

**Table 5: Listed activities**

| Name of Activity | Aerial Extent of Activity (Ha) | 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.<br><br>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 | Minimum of 0.27ha and possibly greater than 1ha with access roads included | X | GN R 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 –<br>○ The undertaking of a linear activity; or<br>○ Maintenance purposes undertaken in accordance with a maintenance management plan. |

| | | | | |
|---|---|---|---|---|
| to the drill sites additional area may be cleared | | | | |
| Exploration activities for hydrocarbons. | 149 377 ha | X | GN R 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.<br>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 | Minimum of 0.27ha and possibly greater than 1ha with access roads included | X | GN R 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.<br>(a) In Eastern Cape, Free State, Gauteng, Limpopo, North West and Western Cape Provinces:<br>i. 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<br>ii. Within critical biodiversity areas identified in bioregional plans;<br>iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or estuarine functional zone, |

| | |
|---|---|
| the need for access roads to the drill sites additional area may be cleared. | whichever distance is greater, excluding where such removal will occur behind the development setback line or erven in urban areas; or<br><br>iv. 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.<br><br>(b) In KwaZulu-Natal:<br><br>i. Trans-frontier protected areas managed under international conventions;<br><br>ii. Community Conservation Areas;<br><br>iii. Biodiversity Stewardship Programme Biodiversity Agreement areas;<br><br>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;<br><br>v. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;<br><br>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;<br><br>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;<br><br>viii. A protected area identified in terms of NEMPAA, excluding conservancies;<br><br>ix. World Heritage Sites;<br><br>x. Sites or areas identified in terms of an International Convention;<br><br>xi. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose;<br><br>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<br><br>xiii. In an estuarine functional zone. |

## 2.2 DESCRIPTION OF ACTIVITIES TO BE UNDERTAKEN

The proposed gas exploration programme will be completed within 3 years and in summary will entail activities as detailed in Table 6 below, based on information presented in the Exploration Works Programme (EWP):

**Table 6: Exploration Activities**

| Main Activity/Action/Process | Ancillary Activity |
|---|---|
| **Non-invasive exploration** | Background data collection and data management |
| | Geological and geophysical logging |
| **Invasive exploration** | Geotechnical and soil sampling |
| | Diamond core drilling |

Each of the above mentioned activities presented in Table 6 are described in more detail in the subsequent subsections.

### 2.2.1 NON-INVASIVE EXPLORATION ACTIVITIES

#### 2.2.1.1 BACKGROUND DATA COLLECTION AND DATA MANAGEMENT

During the first year of the exploration right period it is envisaged that potentially affected landowners will be identified and contacted in preparation for the ground exploration activities. Gas emitting boreholes will be sought if they exist, photographed, measured and analysed. Meetings will be set up with mining companies in the vicinity to see if they have had any experience with gas and gas emitting boreholes. Any gas emitting boreholes found will then be mapped.

In order to acquire information from the existing gas wells, wellhead control and measurement equipment will be designed and installed to measure pressure, flow rate and collect gas samples for analysis. In addition, existing gravity/magnetic data will be obtained and analysed and new lines might be flown if required using a light aircraft or drone (this will comply with the necessary CAA restrictions and requirements). Any available cores and cuttings from previous mining/exploration activities will also be analysed. The need to undertake additional aerial gravity/magnetic surveys can only be determined once all available existing data has been reviewed and analysed, however if required, a risk assessment is to be prepared prior to undertaking this activity and compliance with the mitigation measures put forward in the EMPR will be binding on the applicant.

During the second year of exploration geophysical data will be acquired and reprocessed where practical so as to analyse and interpret the data. Surface mapping (surface geological features and outcrops) of the various parts of the exploration area will also commence during the second year. Data from surface mapping along with year one data gathered will be analysed and geological maps prepared.

Reservoir studies using magnetic, geological and geophysical data will be conducted. In addition, analyses (including Isotope work to determine type of gas) on gas samples taken will also be undertaken.

#### 2.2.1.2 GEOLOGICAL AND GEOPHYSICAL LOGGING

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 (surface geological features and outcrops) will be integrated into maps. These activities will be undertaken within the second and third year of exploration.

### 2.2.2 INVASIVE EXPLORATION ACTIVITIES

#### 2.2.2.1 GEOTECHNICAL AND SOIL SAMPLING

Once the magnetic geological and geophysical data has been analysed this information will delineate the areas susceptible for geotechnical and soil sampling. This process involves the removal of small sections of the soil profile using a soil auger (75mm in diameter) drilling to a depth between 15 and 30 centimetres on average but not deeper than 1m. The size of the areas to be sampled will depend on the geological and geophysical data analysis however in the event that reconnaissance sampling is undertaken, this may involve 1km grids (i.e.: sampling in a grid pattern with spacing between sampling of ~1km), followed by higher density surveys of 400m spacing or less. These higher density surveys would be confined to areas of high interest based on the data analysis. 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 analysis to determine the presence of hydrocarbon tracing and microbes.

The duration of the geotechnical and soil sampling will be short term (days to weeks) and localised to areas of interest.

#### 2.2.2.2 DIAMOND CORE DRILLING

During the third year using the data gathered during the preceding two years the first core drill hole will be sited. The intention is to first investigate the “blower” in the northern section of the study area where it is known that gas is currently being emitted from an existing well. A core well will be drilled in the vicinity of this blower in order to obtain more data on the geology and potential hydrocarbons in this area. A further two holes will be drilled, each hole position being guided by the results of the previous hole or alternatively these wells may be sited in other areas of interest within the exploration area. The core from these holes will be logged and geophysical logging carried out on the open holes.

The project will involve the drilling of three (3) wells in locations still to be identified as described above, to a depth of approximately 700 m, commencing with a 203mm hole cased with 152mm casing for the loose top material (conductor casing), followed by 122.6mm hole cased with 114mm casing to isolate ground water (surface/intermediate casing) and finally 96mm cased with 89mm casing for the target formation (production casing). Each borehole will be steel cased and cement plugged to prevent groundwater seepage. Drilling activities are estimated to be one week per hole during which time there will be a drill rig, a service truck and an LDV on site. Intermittent use of a TLB will be used during site establishment and demobilisation. In order to establish the gas contents a mobile desorption laboratory will be established.

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 consisting of drilling foams and Bentonite. 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 plugged entirely or left as is for future analysis. Regardless of which 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.

### 2.2.3 SUPPORTING INFRASTRCUTURE

None of the proposed exploration activities require the establishment of any permanent infrastructure. Sites will be accessed on existing roads or farm tracks as available. Where access is not available access tracks, to accommodate a vehicle, approximately 3.5m wide will be created. These will be rehabilitated accordingly at the end of exploration. 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 with land owners or the local municipality. The daily water requirements for operations will be a maximum of 5000 litres per day.

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).

### 2.2.4 DECOMMISSIOING AND CLOSURE

A rehabilitation plan will be included in the Environmental Management Programme (EMPR). The EMPR 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.

1. **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 exploration wells where applicable, etc.
2. **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.
3. **Re-vegetation**. This involves either reseeding or allowing natural succession depending on the area, climate etc.
4. **Storm water management and erosion control**. Management of storm water and prevention of erosion during rehabilitation. E.g. cut off drains, berms, etc. and erosion control where required.
5. **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 that an application for environmental authorisation must be submitted in accordance with Activity 22 of GN R 983, Listing Notice 1, List of activities and competent authorities identified in terms of Sections 24(2) and 24D, R.983, dated 4 December 2014

The decommissioning of any activity requiring –

I. a closure certificate in terms of Section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or

II. 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.

### 2.2.5 PROPOSED PROJECT SCHEDULING

The proposed project schedule is indicated in the Table 7 below.

**Table 7: Proposed project schedule**

| Exploration Program | | | | |
|---|---|---|---|---|
| | | | | |
| | Background data collection and data management | Geological mapping | Geotechnical and soil sampling | Diamond core drilling |
| **Year 1** | X | | | |
| **Year 2** | X | X | X | |
| **Year 3** | X | X | X | X |

# 3 POLICY AND LEGISLATIVE CONTEXT

A summary of the applicable legislation is provided in Table 8 below. More detail on the legislative framework is presented in Section 3.1 below.

**Table 8: Applicable legislation**

| Applicable Legislation and Guidelines | Reference Where Applied | How does this Development Comply with and Respond to the Legislation and Policy Context |
|---|---|---|
| **National Environmental Management Act (NEMA):**<br><br>**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 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. |
| **Minerals and Petroleum Resources Development Act (MPRDA):**<br><br>**In support of the exploration Right Application submitted by Motuoane the applicant is required to conduct a NEMA Scoping and EIA process in terms of Section 5A and Chapter 79 of the MPRDA.** | This report is prepared as part of the Exploration Right Application under the MPRDA. | In terms of the Mineral and Petroleum Resources Development Act an Exploration Right Application has been applied for. |

## 3.1. APPLICABLE NATIONAL LEGISLATION

The legal framework within which the proposed Motuoane Hennenman Exploration Right 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:

### 3.1.1 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT

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.

### 3.1.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA Environmental Impact Assessment (EIA) regulations, the proponent is required to appoint an environmental assessment practitioner (EAP) to undertake the EIA as well as the public participation process. In South Africa, EIA became a legal requirement in 1997 with the promulgation of regulations under the Environmental Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant environmental authorisation. On 21 April 2006, the Minister of Environmental Affairs and Tourism promulgated regulations in terms of Chapter 5 of the NEMA.

The objective of the Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the activities that have been identified. The purpose of these procedures is to provide the competent authority with adequate information to make decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorized, and that activities which are authorized are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

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 9 below provides a summary of the listed activities associated with the proposed project.

**Table 9: Summary of the listed activities**

| Name of Activity | Aerial Extent of Activity (Ha or $m^2$) | Listed Activity | Applicable Listing Notice |
|---|---|---|---|
| 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 –<br>The undertaking of a linear activity; or<br>Maintenance purposes undertaken in accordance with a maintenance management plan. | 0.27 ha (excluding access roads) | X | GN R 983 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. | 149 377 ha | X | GN R 984 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.<br>(b) In KwaZulu-Natal and Free State:<br>i. Trans-frontier protected areas managed under international conventions;<br>ii. Community Conservation Areas;<br>iii. Biodiversity Stewardship Programme Biodiversity Agreement areas;<br>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;<br>v. Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;<br>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, | 0.27 ha (excluding access roads) | X | GN R 985 of 4 December 2014 |

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|---|---|---|---|---|
| | excluding where such removal will occur behind the development setback line on erven in urban areas;<br>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;<br>viii. A protected area identified in terms of NEMPAA, excluding conservancies;<br>ix. World Heritage Sites;<br>x. Sites or areas identified in terms of an International Convention;<br>xi. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose;<br>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<br>xiii. In an estuarine functional zone. | | | |

### 3.1.3 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 GNR704 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 GNR704 in order to undertaken concurrent rehabilitation. If no pollution potential is revealed by the classification results, no exemption is required. GNR704 also prescribes the design and construction of pollution control dams.

#### 3.1.3.1 CATCHMENT MANAGEMENT STRATEGIES

Catchment Management Agencies (CMAs) are tasked with coordinating the water demands, interests and responsibilities of all relevant government departments, institutions and water users within a specific CMA (DWA, 2012). This is to ensure that on a regional scale, water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons. The main instrument that guides and governs the activities of a CMA is the Catchment Management Strategy (CMS) which, while conforming to relevant legislation and national strategies, provides detailed arrangements for the protection, use, development, conservation, management and control of the region's water resources. The proposed Motuoane Hennenman Exploration project falls under the jurisdiction of the Middle Vaal Water Management Area (WMA).

### 3.1.4 NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT

On 2nd 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 holder’s 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 in the EMPR to be implemented for this project.

Schedule 3: Defined Wastes have been broken down into two categories: Category A being hazardous wastes and category B being general wastes. Under Category A (hazardous wastes) the act makes allowance for “wastes resulting from exploration, mining, quarrying, and physical and chemical treatment of minerals”.

In order to attempt to understand the implications of this it is important to ensure that the definitions of all the relevant terminologies are defined:

- Hazardous waste: means “any waste that contains organic or inorganic elements or compounds that may, owning to the inherent physical, chemical or toxicological characteristic of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles.”
- Residue deposits: means “any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right.”
- Residue stockpile: means “any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act.”

Various regulations have been drafted in support of the NEMWA, as discussed below:

- Proposed Regulations regarding the planning and management of waste from a prospecting, mining, exploration or production operations (2014)
  - Chapter 2, Section 3 states the identification and assessment of any environmental impacts, including those on groundwater, arising from waste must be done as part of

the Environmental Impact Assessment (EIA) conducted in terms of the National Environmental Management Act, 1998 (Act No.107 of 1998) (hereafter referred to as the NEMA). The pollution control barrier system shall be defined by the (a) Waste Classification and Management Regulations (2013); (b) National Norms and Standards for the Assessment of Wastes for Landfill Disposal (2013); and (c) National Norms and Standards for Disposal of Waste to Landfill (2013).

  - Waste Characterisation must be done in terms of physical and chemical composition, as well as content. The classification must be done in terms of the health and safety classification and the environmental classification.

- Proposed Regulations to exclude a waste stream or a portion of a waste stream from the definition of a waste (2014)
  - This regulation will give the holder of the right the opportunity to exclude a waste stream, or a portion of a waste stream from the definition of a waste. Chapter 2, Section 4 of this Regulation, Sub-section (1) states that any portion of a waste generated from a source listed in Category A of Schedule 2 of the NEMWA, may be excluded from being defined as hazardous on demonstration that such portion of waste in non-hazardous in accordance with the Waste Management and Classification Regulations of 2013.
  - The application process will be in the form of a prescribed process and application must be made to the Minister.
  - This Regulation is however not yet in force.
- National Norms and Standards for the assessment of waste for landfill disposal (23 August 2013)
  - These norms and standards prescribe the requirements for the assessment of waste prior to disposal to landfill.
  - The aim of the waste classification tests is to characterise the material to be deposited or stored in terms of the above-mentioned waste classification guidelines set by the Department of Environmental Affairs (DEA).
  - The outcomes of the tests provide the necessary information in terms of:
    - Identification of chemical substances present in the waste; and
    - Determination of the total concentrations (TC) and leachable concentrations (LC) of the elements and chemical substances that have been identified in the waste and that are specified in Section 6 of the above-mentioned Regulations. The obtained TC and LC values of the waste material will be compared to the threshold limits for total concentrations (TCT limits) and leachable concentrations (LCT limits) specified in Section 6 of the above-mentioned Regulations. Based on the TC and LC values of the elements and chemical substances in the waste exceeding the corresponding TCT and LCT limits respectively, the specific type of waste for disposal to landfill will be determined in terms of Section 7 of the Regulations.

### 3.1.5 NATIONAL HERITAGE RESOURCES 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).

The 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.

### 3.1.6 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

### 3.1.7 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 developments 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.

### 3.1.8 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.

### 3.1.9 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 Department of Energy (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 within and outside the Republic;

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

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

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

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

### 3.1.10 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.

### 3.1.11 ENVIRONMENT CONSERVATION ACT

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.

### 3.1.12 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.

### 3.1.13 MINE, HEALTH AND SAFETY ACT

The Mine Health and Safety Act, 1996 (Act No. 29 of 1996) provides for protection of the health and safety of employees and other persons at mines and, for that purpose-

- to promote a culture of health and safety;
- to provide for the enforcement of health and safety measures;
- to provide for appropriate systems of employee, employer and State participation in health and safety matters;
- to establish representative tripartite institutions to review legislation, promote health and enhance properly targeted research;
- to provide for effective monitoring systems and inspections, investigations and inquiries to improve health and safety;
- to promote training and human resources development;
- to regulate employers' and employees' duties to identify hazards and eliminate, control and minimise the risk to health and safety;

- to entrench the right to refuse to work in dangerous conditions; and
- to give effect to the public international law obligations of the Republic relating to mining health and safety;
- and to provide for matters connected therewith.

With specific reference to the Regulations (GN R93 of 1997) published under this Act, the following has reference to this proposed project:

17(6) The employer must take reasonable measures to ensure that the competent person referred to in regulation 17(2)(a) in writing notifies the employer, which notification must be dated, of any workings being advanced to come within: -

(a) a horizontal distance of 100 (one hundred) metres from reserve land, buildings, roads, railways, dams, waste dumps or any other structure whatsoever including structures beyond the mining boundaries, or from any surface, which it may be necessary to protect in order to prevent any significant risk;

(b) 50 (fifty) metres from any excavation, workings, restricted area or any other place where there is, or is likely to be a dangerous accumulation of fluid material, noxious or flammable gas. Such notification must include a sketch plan giving the distance to such place from the nearest survey station.

17(7) The employer must take reasonable measures to ensure that: -

(a) no mining operations are carried out within a horizontal distance of 100 (one hundred) metres from reserve land, buildings, roads, railways, dams, waste dumps, or any other structure whatsoever including such structures beyond the mining boundaries, or any surface, which it may be necessary to protect in order to prevent any significant risk, unless a lesser distance has been determined safe by risk assessment and all restrictions and conditions determined in terms of the risk assessment are complied with;

(b) workings coming within 50 (fifty) metres, from any other excavation, workings, restricted area or any other place where there is, or is likely to be a dangerous accumulation of fluid material, noxious or flammable gas are mined subject to such restrictions and stopped at such positions as determined by risk assessment.

(c) where ground movement, as a result of mining operations, poses significant risk, an effective ground movement monitoring system is in place.

(d) survey records and plans relating to conditions described in paragraphs (a) and (b) above, are made available to the persons doing the risk assessment.

17(8) No person may erect, establish or construct any buildings, roads, railways, dams, waste dumps, reserve land, excavations or any other structures whatsoever within a horizontal distance of 100 (one hundred) metres from workings, unless a lesser distance has been determined safe:-

(a) in the case of the employer, by risk assessment and all restrictions and conditions determined in terms of the risk assessment are complied with; or

(b) in the case of any other person, by a professional geotechnical specialist and all restrictions and conditions determined by him or her or by the Chief Inspector of Mines are complied with.

The Mine Health and Safety Act and associated Regulations will be applicable to the Motuoane Hennenman Exploration Rights project.

## 3.2. 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 they introduce, revise and finalise their policies, regulations and plans, they will incorporate the NDP provisions. For example, the Integrated Energy Plan (IEP), which was due for finalisation and submission to Cabinet for approval during the 2014/15 financial year, would 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 10 provides a summary of the DoE's policies and programmes.

**Table 10: Summary of departmental 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 energy sectors contribution to the GDP, employment, taxes and the balance of payments.<br><br>Part 3 and Part 4 of the policy contain sections involving the management of the environment.<br><br>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. |

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| | 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:<br><br>Objective 5: Minimise emissions from the energy sector;<br><br>Objective 6: Promote energy efficiency in the economy; and<br><br>Objective 8: Promote the conservation of water.<br><br>The following are the key aspects of the plan:<br><br>Energy supply will remain reliant on coal for at least the next two decades.<br><br>Energy supply will be diversified through the increased use of natural gas and renewable energies.<br><br>Investigations into nuclear options as a future new energy source will be continued.<br><br>The use of energy efficiency management and technologies will be promoted.<br><br>Load factors on electricity generation plant to lower levelised lifecycle costs will be maximised.<br><br>Reliance on imported liquid fuels by exploring and developing oil I gas deposits will be lessened.<br><br>Existing oil refineries capacities when appropriate rather than green fields' development will be increased.<br><br>Existing synfuel plants will be maintained and supplemented with natural gas as feedstock.<br><br>New electricity generation will remain coal based with potential for hydro, natural gas and nuclear capacity.<br><br>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 coordinated with provincial and local integrated development programmes will be promoted.<br><br>Policy, legislation and regulation for the promotion of renewable energy and energy efficiency measures and mandatory provision of energy data will be introduced.<br><br>Integrated energy planning will be undertaken on an ongoing basis. |
| **Green Transport Programme** | The “Green Transport Programme” has the following strategic focus areas:<br><br>Piped Compressed Natural Gas (CNG) & refuelling infrastructure;<br><br>Land Fill Gas, and municipal waste harvesting for municipal fleets and public transport;<br><br>Liquid Petroleum Gas (LPG);<br><br>Biodiesel and micro-emulsification technologies and refuelling infrastructure;<br><br>Electric Vehicles (EVs) and recharge infrastructure; and<br><br>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. |

Additional policies that may be applicable throughout the EIA phases are included in Table 11 below.

**Table 11: Summary of additional policies and programmes**

| Policy/Programme | Objectives |
|---|---|
| Integrated Environmental Management Information guideline series:<br>Guideline 4: Strategic Environmental Assessment.<br>Guideline 7: Public Participation.<br>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. |

| | |
|---|---|
| Municipal IDP and SDF | Integrated Development Plans and Spatial Development Frameworks of the local municipalities will be reviewed and relevant details presented in the Scoping and EIA report. |

A summary of the applicable legislation is provided in Table 12 below.

**Table 12: Applicable legislation**

| Applicable Legislation and Guidelines | Reference Where Applied | How does this Development Comply with and Respond to the Legislation and Policy Context |
|---|---|---|
| **National Environmental Management Act (NEMA):**<br><br>**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 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. |
| **Minerals and Petroleum Resources Development Act (MPRDA):**<br><br>**In support of the exploration Right Application submitted by Motuoane the applicant is required to conduct a NEMA Scoping and EIA process in terms of Section 5A and Chapter 79 of the MPRDA.** | This report is prepared as part of the Exploration Right Application under the MPRDA. | In terms of the Mineral and Petroleum Resources Development Act an Exploration Right Application has been applied for. |

# 4 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

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. 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 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 gas resources”. The successful exploitation of these natural resources would contribute to the growth of the economy.

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 currently 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 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.

# 5 MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT

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

## 5.1 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.

### 5.1.1 EXPLORATION RIGHT 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 for the same resource to be held over the same land and, therefore, an application area must be distinct from other similar 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 Hennenman 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.

### 5.1.2 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 manner 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 activities will be proposed on such properties. Figure 2 below indicates the formal protected areas within the Motuoane Hennenman Exploration area.

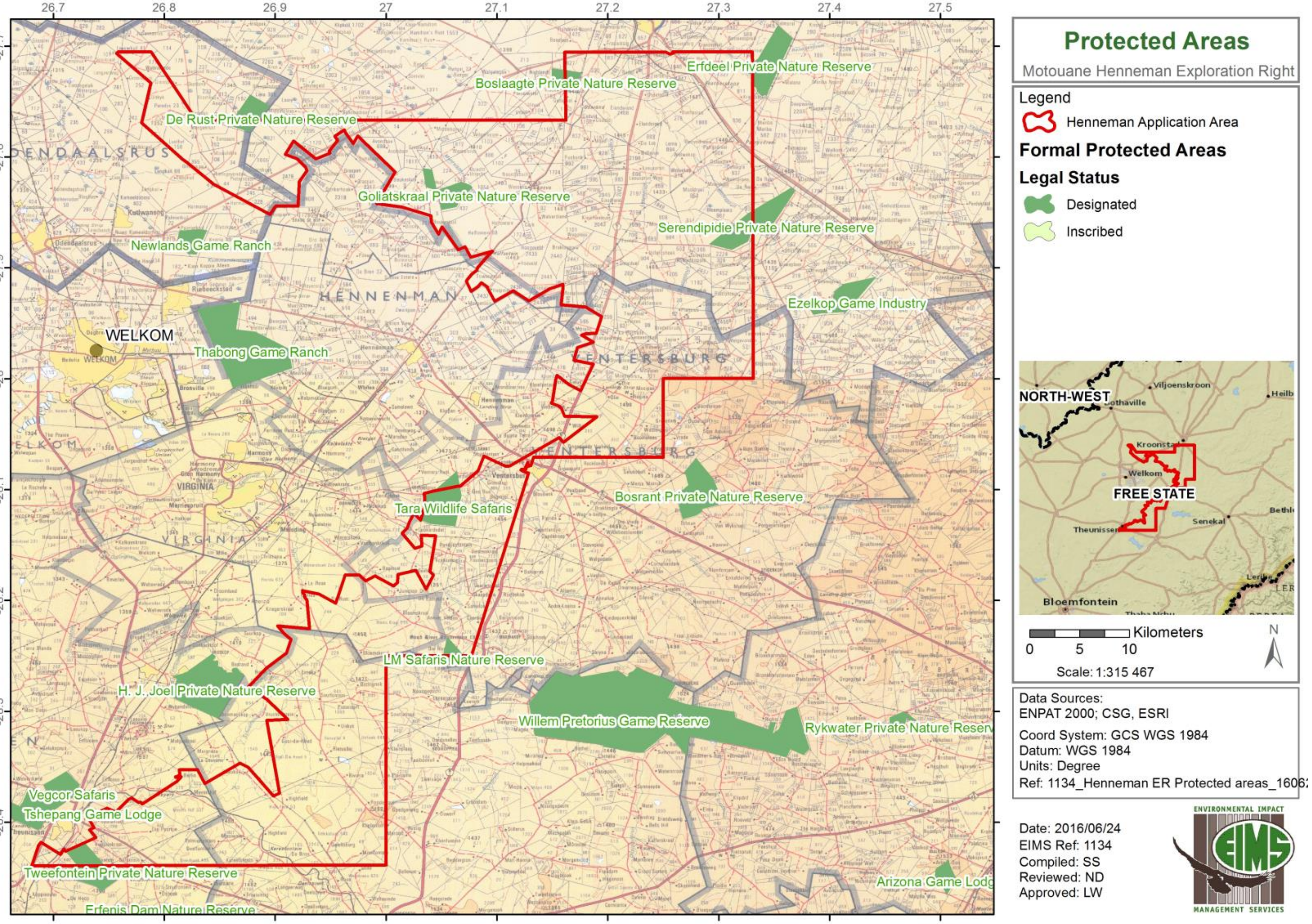


**Figure 2: Formal protected areas within the Motuoane Hennenman Exploration Area**

### 5.1.3 LOCALITY 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.

## 5.2 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.

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.

## 5.3 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 for the same mineral to be held over the same land and, therefore, an application area must be distinct from other similar exploration rights (and applications). Therefore, an exploration area is identified in association with PASA and allocated to a single applicant.

## 5.4 NO GO ALTERNATIVE

This alternative will imply that no exploration takes place and that the environment remains unchanged and unaltered. Within the proposed site for the exploration the dominant farming activities are livestock and mixed farming. There are significant areas that have been altered by previous cultivation 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.

## 5.5 DEVELOPMENT ALTERNATIVES

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 as discussed above are summarised below.

### 5.5.1 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.

In addition, the National Development Plan (2012) (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. 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. Exploration is however required in order to quantify the potential hydrocarbon reserves which would assist the NDP moving forward.

### 5.5.2 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.

### 5.5.3 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 Hennenman 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.

## 5.6 MOST APPROPRIATE ALTERNATIVE GOING FORWARD

The most appropriate development alternative going forward is considered to be Alternative 3: Sensitivity Planning Approach which utilises the Consolidated Sensitivity Map generated (refer to Figure 23, Figure 24 and Figure 25) with I&AP, specialist, and EIMS input as a planning tool. The exact layout of this alternative will be determined and refined prior to the on-site exploration activities through additional specialist input once more detail is known.

# 6 PUBLIC PARTICIPATION PROCESS

The Public Participation Process (PPP) is a requirement of several pieces of South African Legislation and aims to ensure that all relevant Interested and Affected Parties (I&AP's) are consulted, involved and their opinions are taken into account and a record included in the reports submitted to Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed Motuoane Hennenman Exploration right needs to be managed sensitively and according to best practises in order to ensure and promote:

- 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 Motuoane Hennenman Exploration Right;
- Explain the environmental authorisations required;
- Explain the environmental studies already completed and yet 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.

## 6.1 LEGAL COMPLIANCE

The PPP must comply with the two important sets of legislation that require public participation as part of an application for authorisation or approval; namely:

- The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002 - MPRDA); and
- The National Environmental Management Act (Act No. 107 of 1998 - NEMA).

Adherence to the requirements of the above mentioned Acts will allow for an Integrated PPP to be conducted, and in so doing, satisfy the requirement for public participation referenced in the Acts. The details of the Integrated PPP are provided below.

## 6.2 PUBLIC PARTICIPATION METHODOLOGY

The PPP for the proposed Motuoane Hennenman Exploration Right 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&AP's are afforded an opportunity to comment on the project.

### 6.2.1 IDENTIFICATION OF I&AP'S

An initial I&AP database has been compiled from the previous environmental study and Windeed searches. The I&AP database includes amongst others landowners, communities, regulatory authorities and other specialist interest groups. Please see Appendix C for the I&AP database.

#### 6.2.1.1 LIST OF AUTHORITIES IDENTIFIED AND NOTIFIED

The following Government Authorities were notified of the proposed project:

- Catchment Management Agency;
- Department of Environmental Affairs (DEA);
- Department of Water and Sanitation (DWS);
- Fezile Dabi District Municipality;
- Free State Department of Agriculture and Rural Development;
- Free State Department of Cooperative Governance and Traditional Affairs;
- Free State Department of Economic, Small Business Development and Tourism;
- Free State Department of Labour;
- Free State Department of Mineral Resources;
- Free State Department of Police, Roads and Transport;
- Free State Department of Public Works and Infrastructure;
- Free State Department of Social Development;
- Free State Department of Water and Sanitation;
- Lejweleputswa District Municipality;
- Masilonyana Local Municipality;
- Matjhabeng Municipality;
- Moqhaka Local Municipality;
- National Commission on Restitution on Land Rights;
- National Department of Agriculture, Forestry and Fisheries;
- National Department of Mineral Resources;
- National Department of Rural Development;
- National Development Agency;
- National Energy Regulator of South Africa (NERSA); and
- Petroleum Agency South Africa (PASA).

#### 6.2.1.2 List of Key Stakeholders Identified and Notified

The following Key Stakeholders have been identified and notified of the proposed project:

- African Conservation Trust;
- Agricultural Union Virginia;
- Agricultural Unions Theunissen;
- Agricultural Unions Welkom;
- Birdlife South Africa;
- Conservation South Africa;
- Endangered Wildlife Trust;
- Eskom Holding (SOC) Limited;
- Federation for a Sustainable Development; Treasure Karoo Action Group;
- Frack Free SA;
- Grain South Africa;
- Ground Work, Friends of the Earth South Africa;
- Project Africa;
- South African Civil Aviation Authority;
- South African Heritage Resource Agency.
- South African National Road Agency Limited;
- Sustainable Energy & Climate Change Project of Earthlife Africa;
- The Council for Scientific and Industrial Research;
- Transnet;
- Treasure Karoo Action Group;
- Urban Eco Life E-magazine; and
- Wildlife & Environmental Society of South Africa

#### 6.2.1.3 List of Surface Rights/Land Owners Identified and Notified

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. The PPP commenced on the 26th May 2016 with an initial notification and call to register ending on the 30th June 2016. Notification during the initial notification component of the PPP was given in the following manner:

#### 6.2.1.4 REGISTERED LETTERS, FAXES, AND EMAILS

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

The notification letters include 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&AP's to assess/surmise what impact the activities will 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.

#### 6.2.1.5 BACKGROUND INFORMATION DOCUMENT (BID)

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.

#### 6.2.1.6 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.

#### 6.2.1.7 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 to 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.

#### 6.2.1.8 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 Hennenman).

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.

### 6.2.2 AVAILABILITY OF DRAFT SCOPING REPORT NOTIFICATION

The Draft Scoping Report was made available for public review and comment from 11th of July 2016 until 11th of August 2016, for a period of 30 days. The EA application to PASA was submitted in July 2016 and the report was available for 30 days after the submission of the application as per Section 40 of the NEMA. All registered I&AP's were notified of the availability of the scoping report and where to locate it. I&AP's were also informed of the timeframes for comment to be submitted to EIMS.

Notification regarding the availability of the Draft Scoping Report, a component of the PPP, was given in the following manner:

- Notification letters (in English), faxes, and/or emails were distributed to all pre-identified key I&APs, I&APs registered during the initial notification period, as well as adjacent and surrounding landowners;
- Notification letters (in English) faxes, and/or emails were sent to all landowners within the pre-determined impact radius;
- Notification documents included details on the duration of the Scoping Report review period, as well as details on the availability of the report for public review; and
- Copies of the Scoping Report were made available at public areas for perusal and comment by all I&APs. Comment received from I&APs are included in this Issues and Responses Report (IRR) and submitted to PASA for consideration as part of the Final Scoping Report.

Furthermore, copies of the Executive Summary of the Draft Scoping Report were provided in English at the public venues and online with the Draft Scoping Report, as well as the Open Day. Please refer to Appendix C for proof of draft Scoping Report notification.

### 6.2.3 DRAFT SCOPING REPORT OPEN DAY NOTIFICATION

An Open day session was held on the 1st August 2016. Notification regarding the open session was given in the following manner:

- Notification letters (in English) faxes, and/or emails were distributed to all pre-identified key I&APs, I&APs registered during the initial notification period, as well as adjacent and surrounding landowners;
- Notification letters (in English) faxes, and/or emails were sent to all landowners within the pre-determined impact radius;
- Notification documents included details on the venue, date as well as the duration of the Open Day; and
- Copies of the Scoping Report were made available at the Open Day for perusal and comment by all I&APs. Comment received from I&APs during the Open Day were included in the Issues

and Responses Report (IRR) of the Scoping Phase and submitted to PASA for consideration as part of the Final Scoping Report.

Furthermore, copies of the Executive Summary of the Draft Scoping Report were provided in English at the Open Day venue. Please refer to Appendix C for proof of draft Scoping Report notification.

### 6.2.4 ACCEPTANCE OF SCOPING REPORT

Following submission of the Scoping Report in August 2016, in respect of the ER and EA applications, the Petroleum Agency South Africa (PASA) accepted the Scoping Report and advised EIMS to proceed and conduct the Environmental Impact Assessment (EIA) for this project. Notification regarding the acceptance of the scoping report was given via notifications (in English), distributed to all pre-identified key I&APs, I&APs registered during the initial notification period, as well as adjacent and surrounding landowners. Please refer to Appendix C for proof of notification.

### 6.2.5 AVAILABILITY OF DRAFT ENVIRONMENTAL IMPACT REPORT NOTIFICATION

The Draft Environmental Impact Report was made available for public review and comment for a total period of 30 days (excluding the December 2016 holiday period), from the 23rd November 2016 to the 16th January 2016. All registered I&AP's were notified of the availability of the Draft Environmental Impact Report and where to locate it. I&AP's were also informed of the timeframes for comment to be submitted to EIMS.

Notification regarding the availability of the Draft Environmental Impact Report, a component of the PPP, was given in the following manner:

- Notification letters (in English), faxes, and/or emails will be distributed to all pre-identified and registered I&APs, as well as adjacent and surrounding landowners;
- Notification documents will include details on the duration of the Draft Environmental Impact Report review period, as well as details on the availability of the report for public review;
- SMS notification will be sent out to all I&APs with a cellphone number on the I&AP Database; and
- Copies of the Draft Environmental Impact Report were made available at public areas for perusal and comment by all I&APs. Comment received from I&APs has been included in the Issues and Responses Report (IRR) submitted to PASA for consideration as part of the Final Environmental Impact Report.

Furthermore, copies of the Executive Summary of the Draft Environmental Impact Report were provided in English at the public venues and online with the Draft Environmental Impact Report, as well as the Open Day.

### 6.2.6 OPEN DAY SESSIONS

An Open Day was held on the 1st August 2016 at the Nederduits Gereformeerde (NG) Church East in Hennenman to discuss the findings of the Scoping phase. During the Open Day session, informative posters were displayed in the town halls by EIMS (the EAP) prior to the open session and the EAP was available during the public open days for one-on-one discussions and questions from the public. EAP members that were present were: Bongani Khupe, Simmòne Smith, and Nobuhle Hughes. Please refer to Appendix C for the Open Day Minutes and the Attendance Register.

An Open Day was held on the 6th December 2016 at the Nederduits Hervormde Church in Virginia to discuss the findings of the EIA phase. During the Open Day session, informative posters were displayed in the town halls by EIMS (the EAP) prior to the open session and the EAP was available during the public open days for one-on-one discussions and questions from the public. EAP members that were present were: Brian Whitfield and Simmòne Smith. Please refer to Appendix C for the Open Day Minutes and the Attendance Register.

The second Public Open Day will be held during the Environmental Impact Assessment phase to discuss the findings of the Environmental Impact Assessment investigation and to solicit further comment, concerns, suggestions or objections from I&AP's for inclusion into Final Environmental Impact Report. I&AP's will also be provided a period in which to comment on the Draft Environmental Impact / Environmental Management Programme Reports prior to submission to PASA, for their adjudication.

### 6.2.7 ISSUES AND RESPONSES

The issues and responses below are those that have been provided and addressed to date.

#### 6.2.7.1 HOW ISSUES RAISED WERE ADDRESSED

Issues raised were addressed in a transparent manner and included in the compilation of the EIA and EMP for the proposed Motuoane Hennenman Exploration Right in the following manner:

- Issues raised were used quantitatively to calculate the significance of impacts both real and perceived;
- Issues raised were used to provide further suggestions and recommendations with regard to technical management options for impacts; and
- Issues raised were used to develop suitable project alternatives.

I&AP's issues, comments, concerns and other information were used not only to develop the EIA and EMP, but to describe the baseline receiving environment including current land uses as well. All information requests by I&AP's were also honoured by the EAP.

## 6.3 SUMMARY OF ISSUES RAISED BY I&AP'S

The issues and responses included in this report are those that have been received and responded to date. Issues raised were addressed in a transparent manner and are included in the Issues and Responses Report (Appendix D). Table 13 below presents a summary of the comments/issues raised and an indication of where these are addressed in the report or further comment on the issue. Refer to the Issues and Responses Report attached as Appendix D for all comments and concerns raised to date.

**Table 13: Summary of comments/ concerns raised**

| Aspect | PPP Summary | Comment / Location in Report |
|---|---|---|
| **Registration** | Request to be registered, registration acknowledgement and confirmation | 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, | Appendix D |
| **Alternatives** | Renewable energy options | Section 5 |
| **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 6.2.7, Appendix D |
| **Heritage** | SAHRA application procedures, damage to cultural, heritage and historical features (structures, graves, etc.) | Section 7.1, Section 8.2.1, Section 14.2, Section 18.1 |
| **Socio-economic** | Farm/ site access, safety and security, compensation, land value depreciation, loss of | Section 7, Section 8, Section 14, Section 18 |

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| | employment, veldfires, contractor liability, social benefits, health concerns | |
| **Ecology and wetlands** | Impact on biodiversity (fauna and flora), impact on wetlands, | Section 7, Section 8, Section 14, Section 18 |
| **Existing infrastructure** | Transnet infrastructure, Eskom infrastructure, impact on roads and farm infrastructure, | Section 7, Section 8, Section 14, Section 18 |
| **Existing land uses** | Impact on agricultural/ farming activities | Section 7, Section 8, Section 14, Section 18 |
| **Groundwater and surface water** | Groundwater contamination, water consumption (quantity), water conservation | Section 7, Section 8, Section 14, Section 18 |
| **Air pollution** | Air pollution, greenhouse gases, fossil fuels, climate change | Section 7, Section 8, Section 14, Section 18 |
| **Land claims** | Existing land claims | Section 7, Section 8, Section 14, Section 18 |

# 7 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT ALTERNATIVES

The following section provides information about the cultural and heritage baseline of the proposed Motuoane Hennenman exploration area. Information in this section was sourced from the heritage EIA 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 EIA report by PGS Heritage.

## 7.1 CULTURAL ATTRIBUTES AND BASELINE ENVIRONMENT

### 7.1.1 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).

### 7.1.2 SITE SPECIFIC DESCRIPTION

Table 14 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 14: Archaeological and Historical Overview of the Study Area and Surrounding Landscape**

| DATE | DESCRIPTION |
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| **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 | |

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| in erosion gulley's 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.<br>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).<br>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.<br>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. |

<table>
<tr><th colspan="2">The Study Area during the Iron Age</th></tr>
<tr><td colspan="2"> 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. </td></tr>
<tr><td>AD 1700 – AD 1840</td><td> 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 upright stones and are usually paved with flat stones. Unlike Type V settlements (see below), corbelled huts 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 </td></tr>
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| | excavated by Tim Maggs during the 1970s as part of his overall research project alluded to above (Maggs, 1976).<br><br>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).<br><br>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.<br><br>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.<br><br>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). |

<table>
<tr><td>1820s</td><td>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.<br><br>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).<br><br>The Ngwane followed closely on the Hlubi and further augmented the unrest and warfare along the southern Highveld (Legassick, 2010).<br><br>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.<br><br>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.</td></tr>
<tr><td colspan="2">The Early Colonial Period</td></tr>
<tr><td colspan="2">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).</td></tr>
<tr><td>1804</td><td>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</td></tr>
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| | 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).<br><br>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.<br><br>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).<br><br>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).<br><br>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 |

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| | 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.<br><br>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).<br><br>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.<br><br>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).<br><br>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 |

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| | signing of the Orange River Convention in 1854 did the same to the Basotho and Griqua.<br><br>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).<br><br>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.<br><br>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 |

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| | 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).<br><br>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.<br><br>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 –<br><br>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.<br><br>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.<br><br>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 |

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| | General Louis Botha and a similarly large force in the surroundings of Kroonstad (Maurice & Grant, 1906).<br><br>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).<br><br>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).<br><br>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.<br><br>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.<br><br>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 |

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| | 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.<br><br>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.<br><br>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.<br><br>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.<br><br>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. |

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| | 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.<br><br>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.<br><br>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. |

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| | 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 maneuver 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).<br><br>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.<br><br>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.<br><br>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 |

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| | 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.<br><br>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.<br><br>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.<br><br>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, |

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| | 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. | |

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| 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).<br><br>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).<br><br>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).<br><br>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 |

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| | 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).<br><br>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 –<br><br>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).<br><br>The discoveries of payable gold at Uitsig and St. Helena created significant excitement amongst mining companies and investors, and increasing numbers of |

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| | prospecting options and eventually mines were acquired and developed. The Free State gold rush had begun.<br><br>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 –<br><br>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).<br><br>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.<br><br>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 |

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| | 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).<br>Virginia is located 11.6 km north-west of the present study area. |

### 7.1.3 KEY HERITAGE SENSITIVITIES

All the relevant heritage sensitive aspects identified for the project is summarised in heritage sensitivity maps (refer to Figure 3, Figure 4, Figure 5 and Figure 6). These maps provide a zoned depiction of the study area wherein areas of varying heritage sensitivity are indicated. These maps will be used in conjunction with the other specialist field sensitivity maps to identify key sensitivities and minimise adverse impacts due to the exploration activities on these areas.

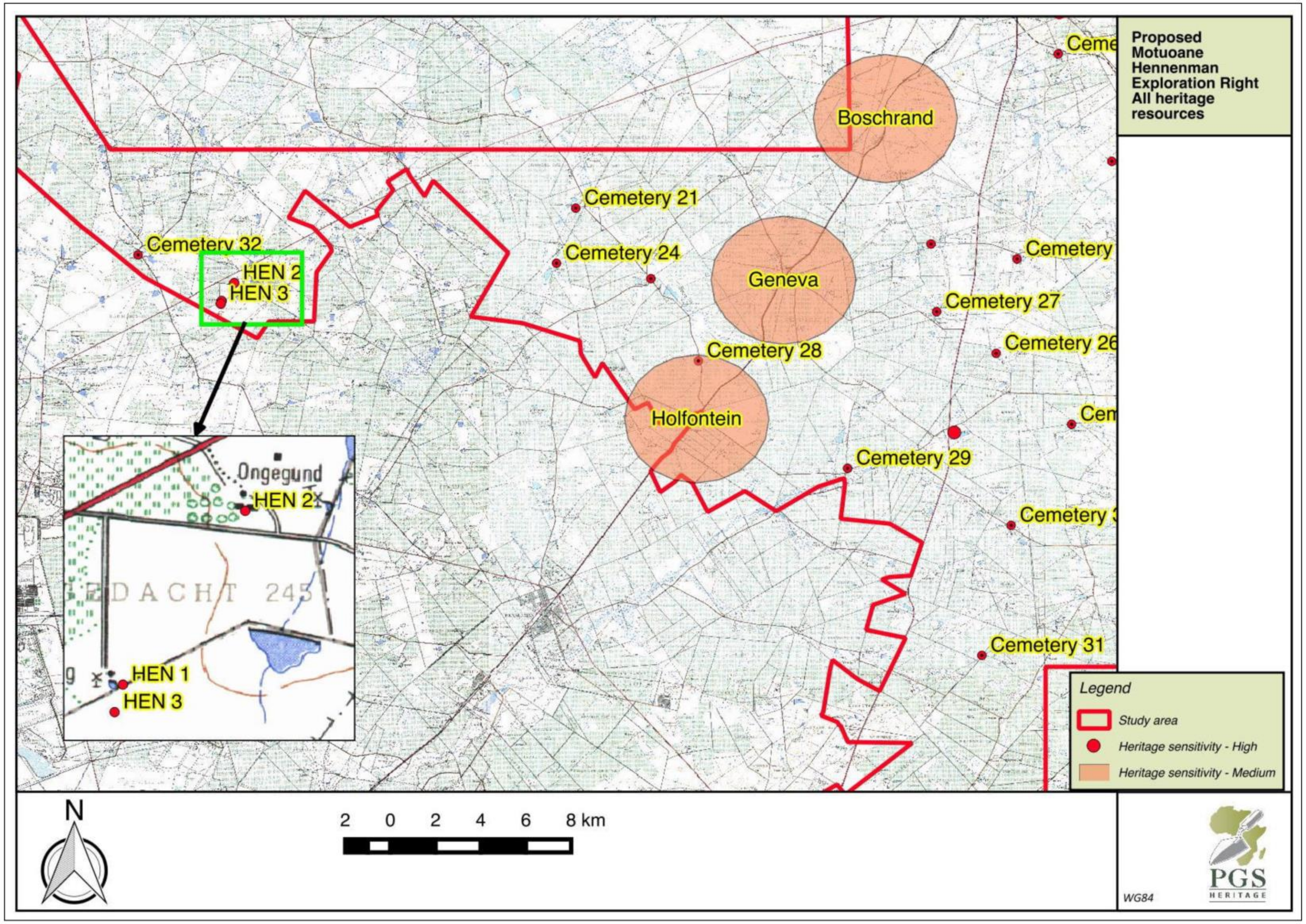


**Figure 3: Map depicting the combined heritage sensitivities for the north-western component of the study area**

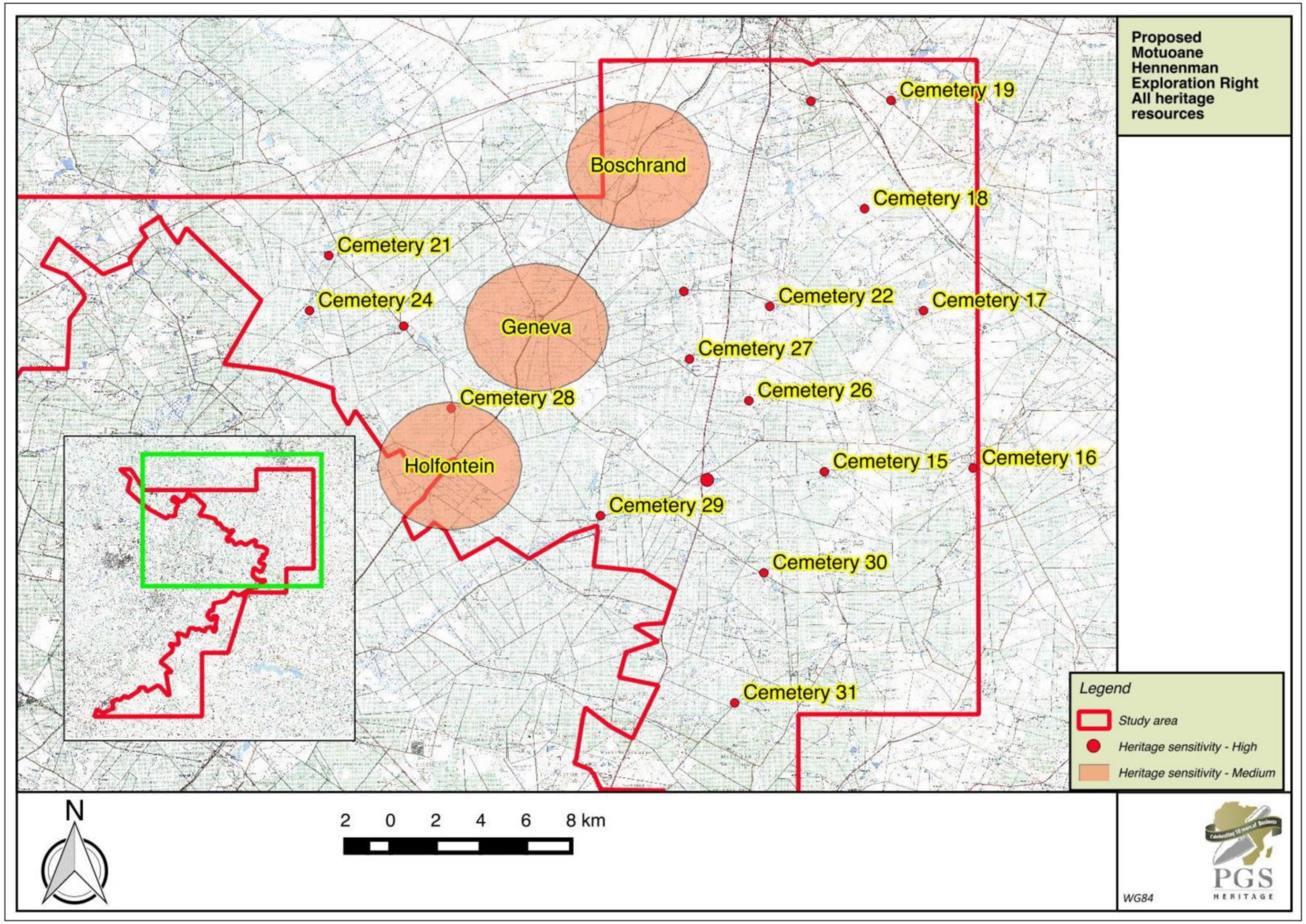


**Figure 4: Map depicting the combined heritage sensitivities for the north-eastern component of the study area**

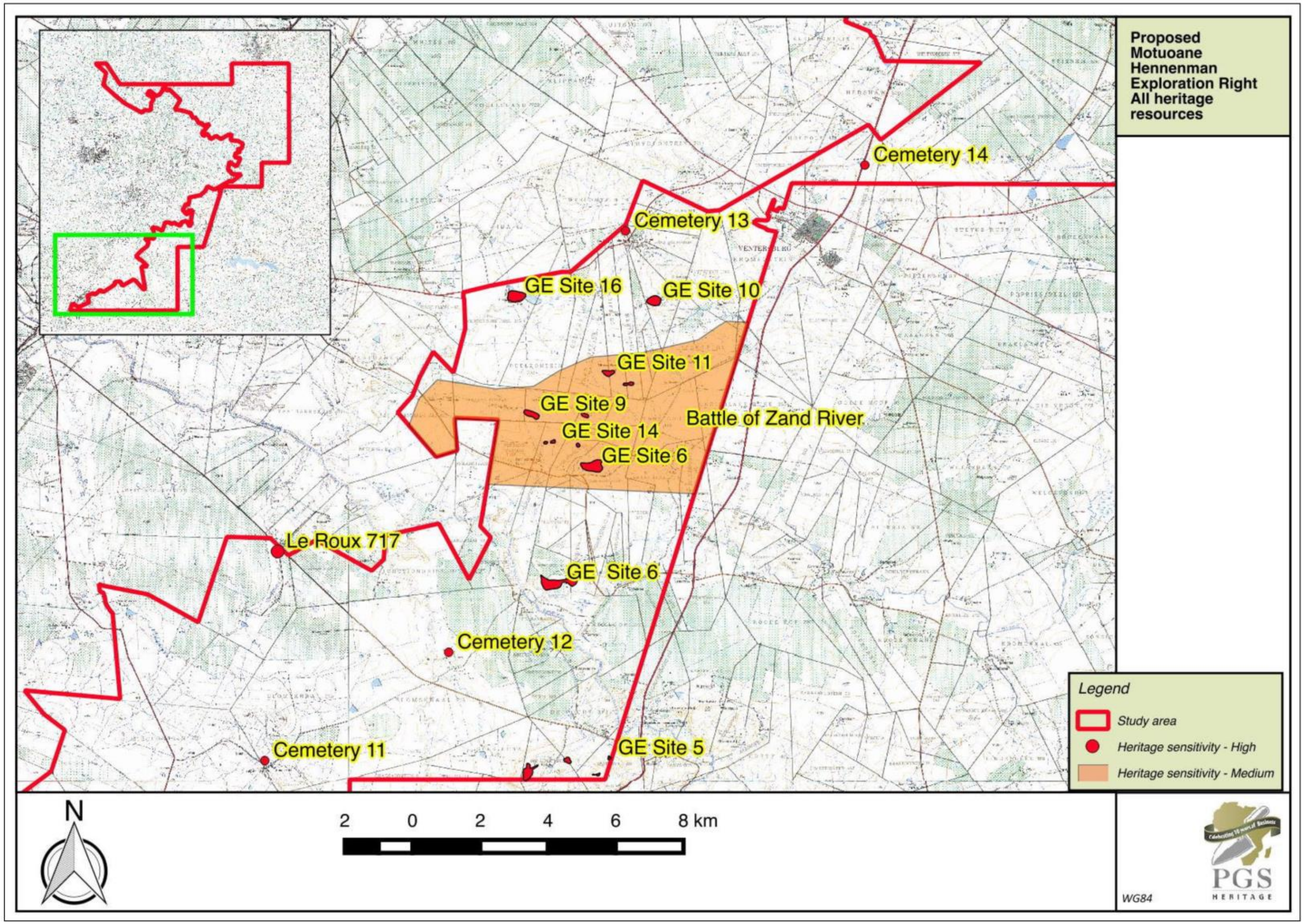


**Figure 5: Map depicting the combined heritage sensitivities for the central component of the study area**

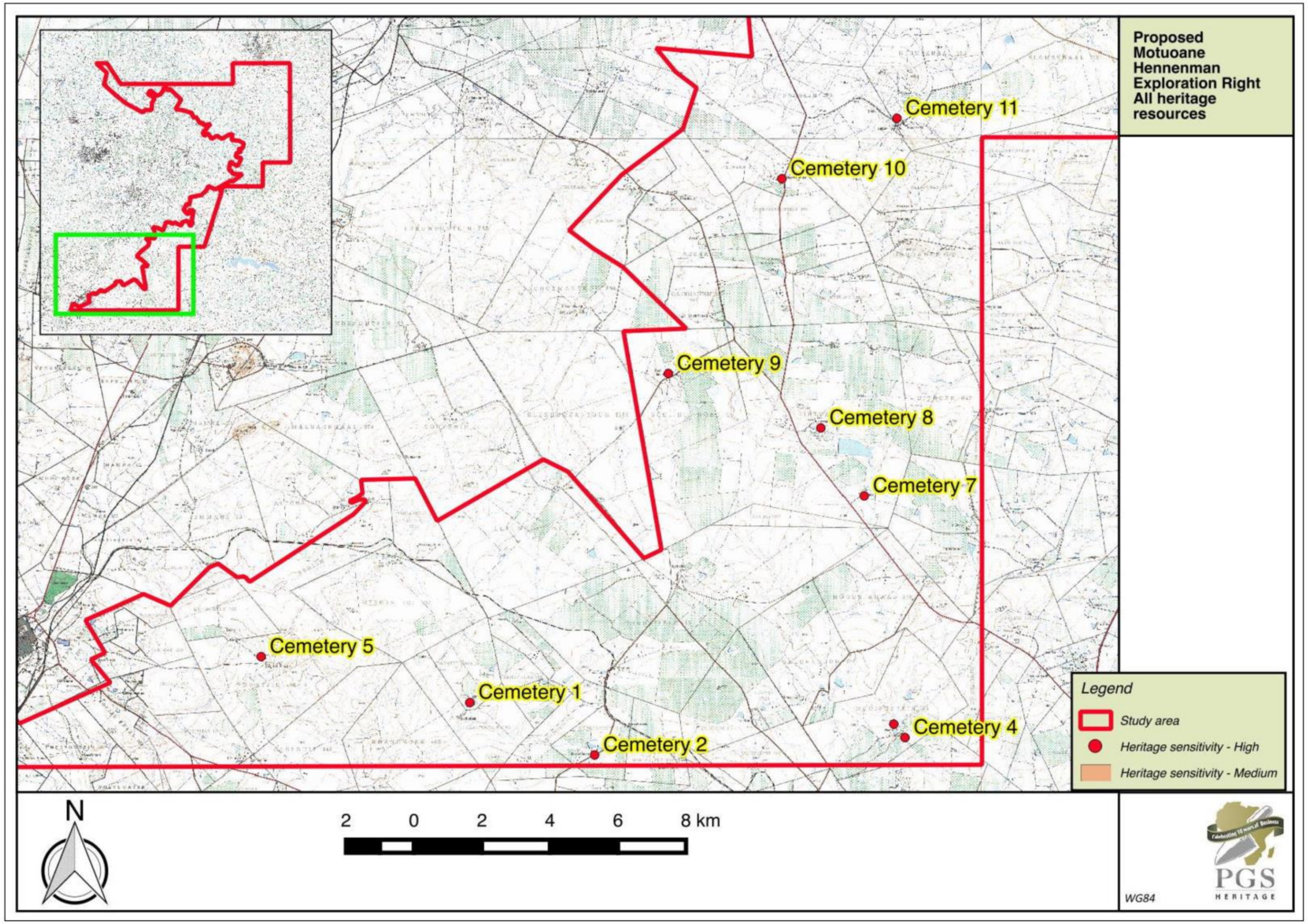


**Figure 6: Map depicting the combined heritage sensitivities for the southern end of the study area**

## 7.2 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.

The following, Table 15**,** presents a summary of the socio-economic aspects that may be influenced by the proposed project.

**Table 15: 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%.<br>IsiXhosa – 12.3%.<br>Afrikaans – 12.3%.<br>English – 3.6%.<br>Other – 7.8%. | Sesotho – 66.9%.<br>IsiXhosa – 10.8%.<br>Afrikaans – 9.6%.<br>Setswana – 6.9%.<br>Other – 5.8%. | Sesotho – 74.6%.<br>Afrikaans – 13.6%<br>IsiXhosa – 3.9%.<br>English – 2.5%<br>Other – 5.4% |

| Aspect | Matjhabeng Local Municipality | Masilonyana Local Municipality | Moqhaka Local Municipality |
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| **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.<br><br>Although the majority of the population enrolls in educational facilities only 18.1% are able to complete matric, compared to 11.6% in 2001.<br><br>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:<br><br>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 exist 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<br>- 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.<br><br>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.<br><br>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.<br><br>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.<br><br>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 | 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.<br><br>57.7% of households have access to piped water either in their |

| Aspect | Matjhabeng Local Municipality | Masilonyana Local Municipality | Moqhaka Local Municipality |
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| | service provider in terms of Water Service Act, and supply 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.<br><br>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. | | dwelling or in the yard. Only 1% of households do not have access to piped water.<br><br>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 were 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.<br><br>The other challenge that came with expansion of service has been the capacity of waste water treatment plants and pump stations. As | 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 |
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| | indicated above there are 12 treatment plants and 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.<br><br>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.<br><br>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, Hennenman, 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.<br>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%.<br>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 Hennenman is dominated by manufacturing 41%, agriculture 17%, trade 10%, and finance 10%.<br>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 Masilo, Tshepong (Verkeerdevlei) and resuscitating the | 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:<br>- Mining (42.9%);<br>- Community services (20.4%); and<br>- Trade (11.7%).<br>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. | 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.<br><br>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.<br><br>The hunting and guesthouse industries displayed an exceedingly rapid growth the past few years. |

### 7.2.1 KEY SENSITIVITIES

The key sensitivities include:

- High unemployment rate.
- Main employment sectors are agriculture and industry.
- The main land use currently is commercial agriculture.

## 7.3 GEOLOGY AND TOPOGRAPHY

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

### 7.3.1 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.

<u>KAROO SUPERGROUP</u>

Deposition of sediments of the Karoo Supergroup commenced approximately 2400Ma after the deposition of Ventersdorp Supergroup. In the Hennenman 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 Hennenman area. Large areas of the Karoo Supergroup were intruded by dolerite sills and dykes.

<u>VENTERSDORP SUPERGROUP</u>

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 i.e. 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 was 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.

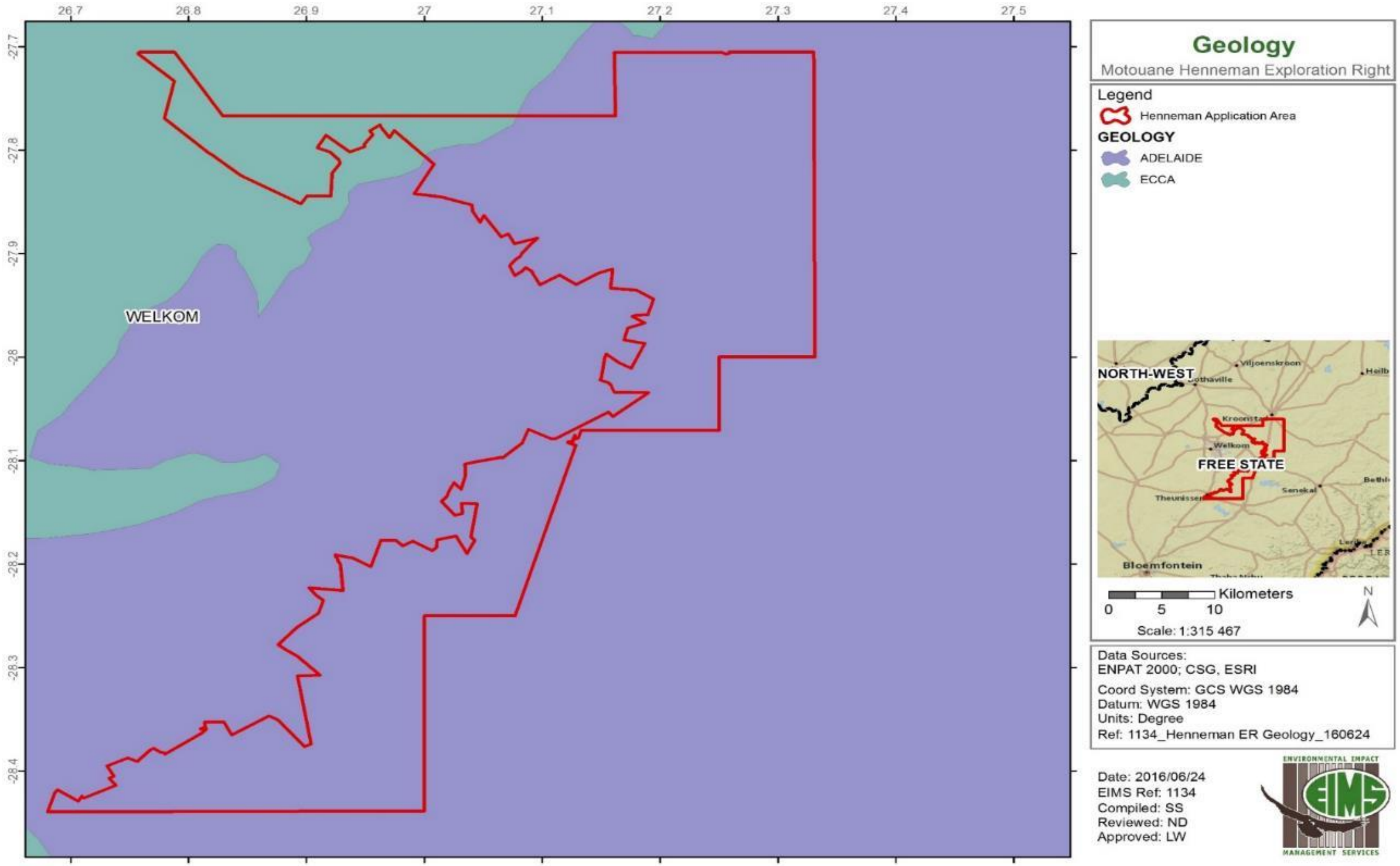


**Figure 7: Geology within and around study area**

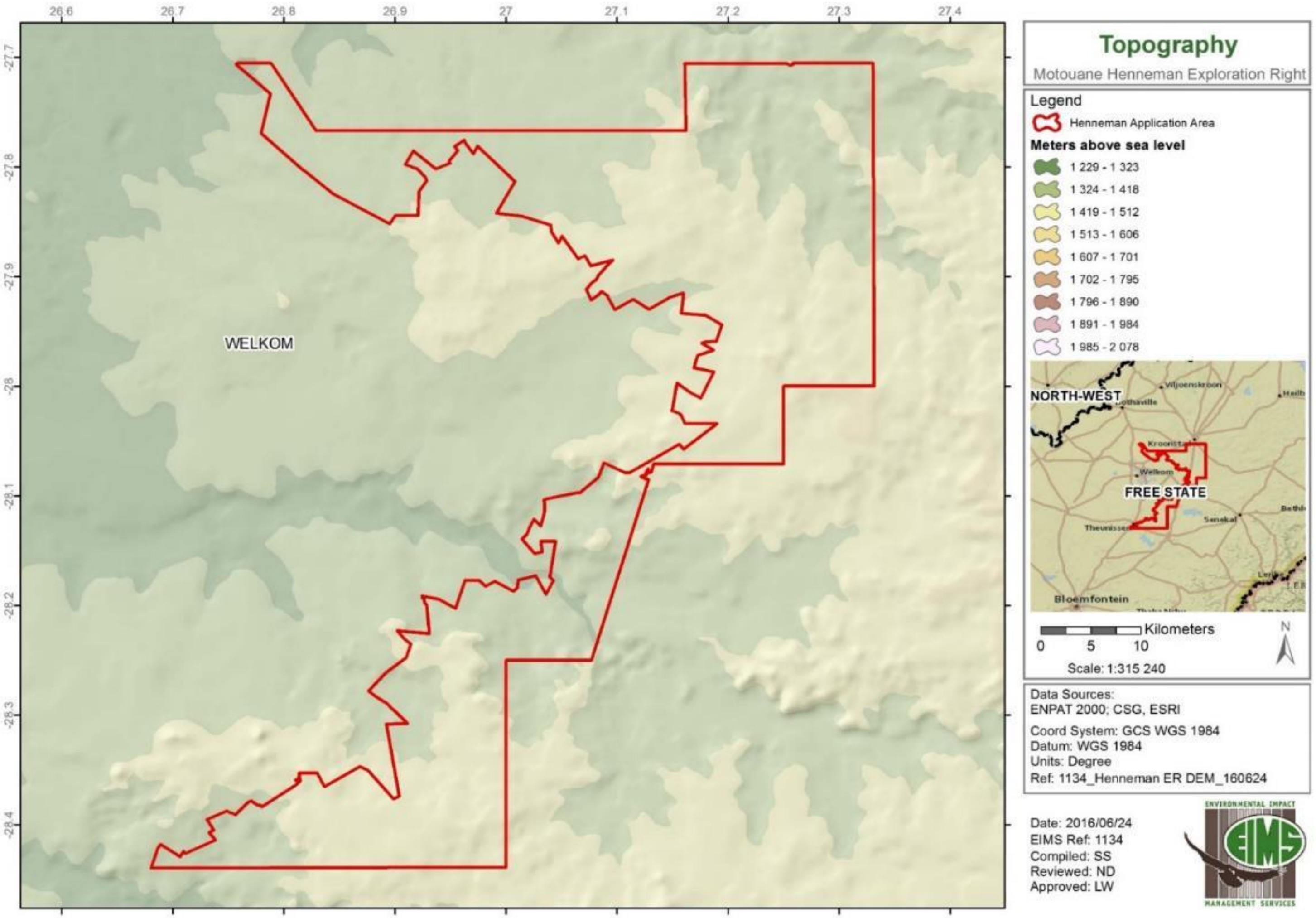


**Figure 8: Topography of study area**

## 7.4 CLIMATE

Climate can be defined as weather conditions that have occurred over a long period of time in an area. Dominant climatic features that climate is centred around are temperature, rainfall, wind and evaporation. These climatic features can affect the exploration environment in a number of ways:

- Influence erosion;
- Influence vegetation growth, which affects rehabilitation planning;
- System monitoring of ground water availability;
- Evaporation rates influence vegetation growth;
- Air temperature can influence air dispersion through atmospheric stability and mixing layers; and
- Wind speed and direction can influence erosion and the dispersion of potential atmospheric pollutants.

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 Mucina and Rutherford (2006), Weather South Africa and SA Explorer Climate.

### 7.4.1 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 (Hennenman) and the Mean Annual Precipitation (MAP) was calculated at 612 millimetres per annum (mm/a) over a 36 year period. The 95$^{th}$ percentile is 884 mm/a and the 5$^{th}$ percentile 408 mm/a. Annual rainfall is approximately 450 mm/a, which is considered to be relatively dry for an area of grassland.

## 7.5 ECOLOGY

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 EIA report by David Hoare Consulting cc. Refer to Appendix E3 for the ecology EIA report.

### 7.5.1 FLORA

**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 16 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 16: 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 |

**Protected trees**

Tree species protected under the National Forest Act are listed in Table 17 below. The only species that has a geographical distribution that includes the study area is *Vachellia 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 17: List of protected tree species (National Forests Act)**

| | |
|---|---|
| *Vachellia erioloba* | *Vachellia 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* | |

### 7.5.2 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 report by David Hoare Consulting cc. Refer to Appendix E3 for the ecology report.

### 7.5.3 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 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).

**<u>Reptiles</u>**

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 <u>Giant Dragon Lizard (*Smaug giganteus*)</u>, 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 <u>Striped Harlequin Snake (*Homoroselaps dorsalis*)</u>, 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).

**<u>Birds</u>**

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, and 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.

### 7.5.4 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, and 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 18 and a map of sensitive habitats in terms of the ecological environment is shown in Figure 9.

**Table 18: 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).<br>• Potential habitat for various species of concern. |
| Wetlands | High | • Protected habitats (areas protected according to national / provincial legislation, e.g. National Water Act).<br>• 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).<br>• Potential habitat for various species of concern. |

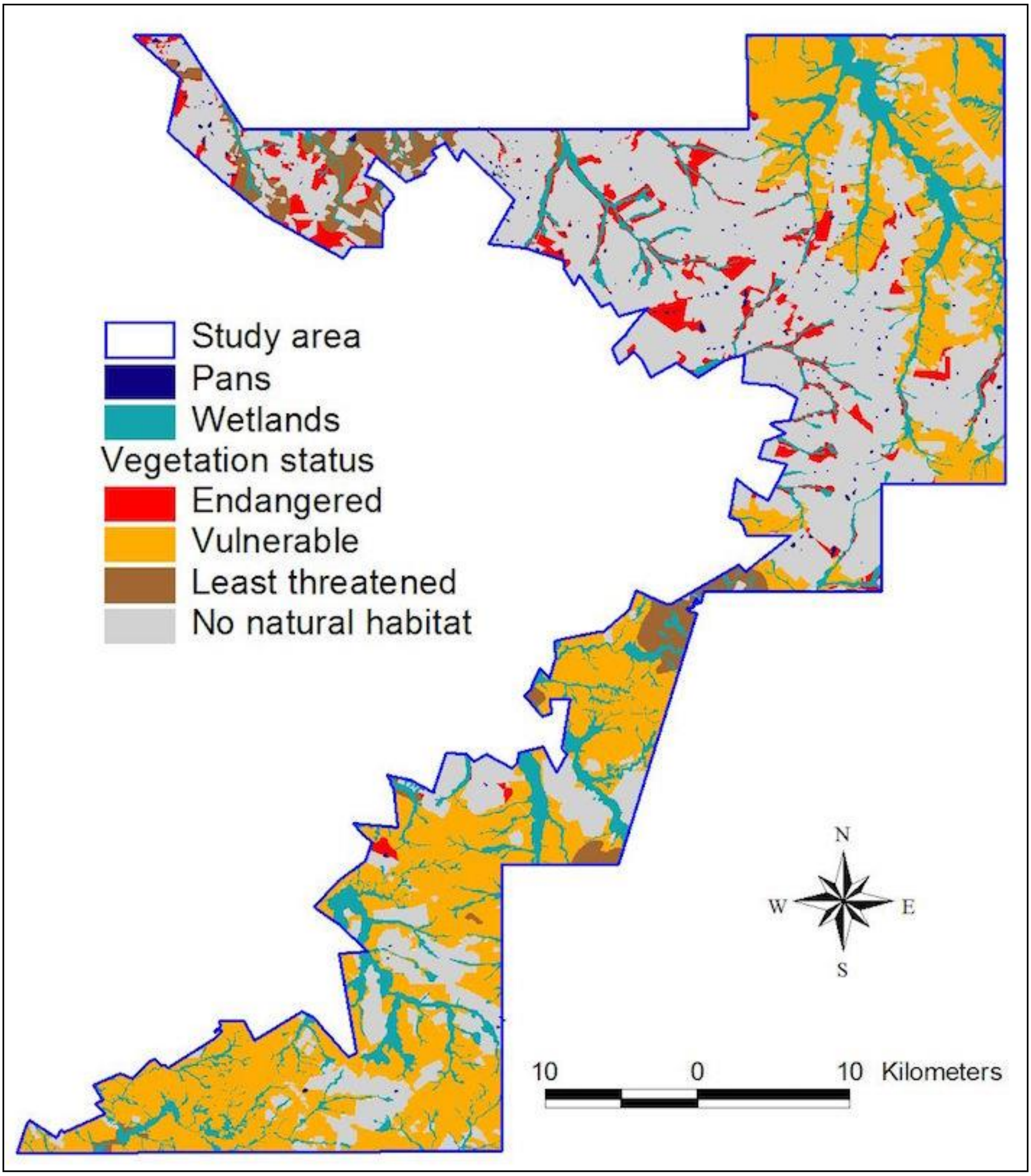


Figure 9: Location of sensitive habitats within the study area

## 7.6 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 reports by David Hoare Consulting cc and Exigo respectively, as well as local municipality IDPs.

### 7.6.1 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

### 7.6.2 SITE SPECIFIC 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 Figure 10 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.

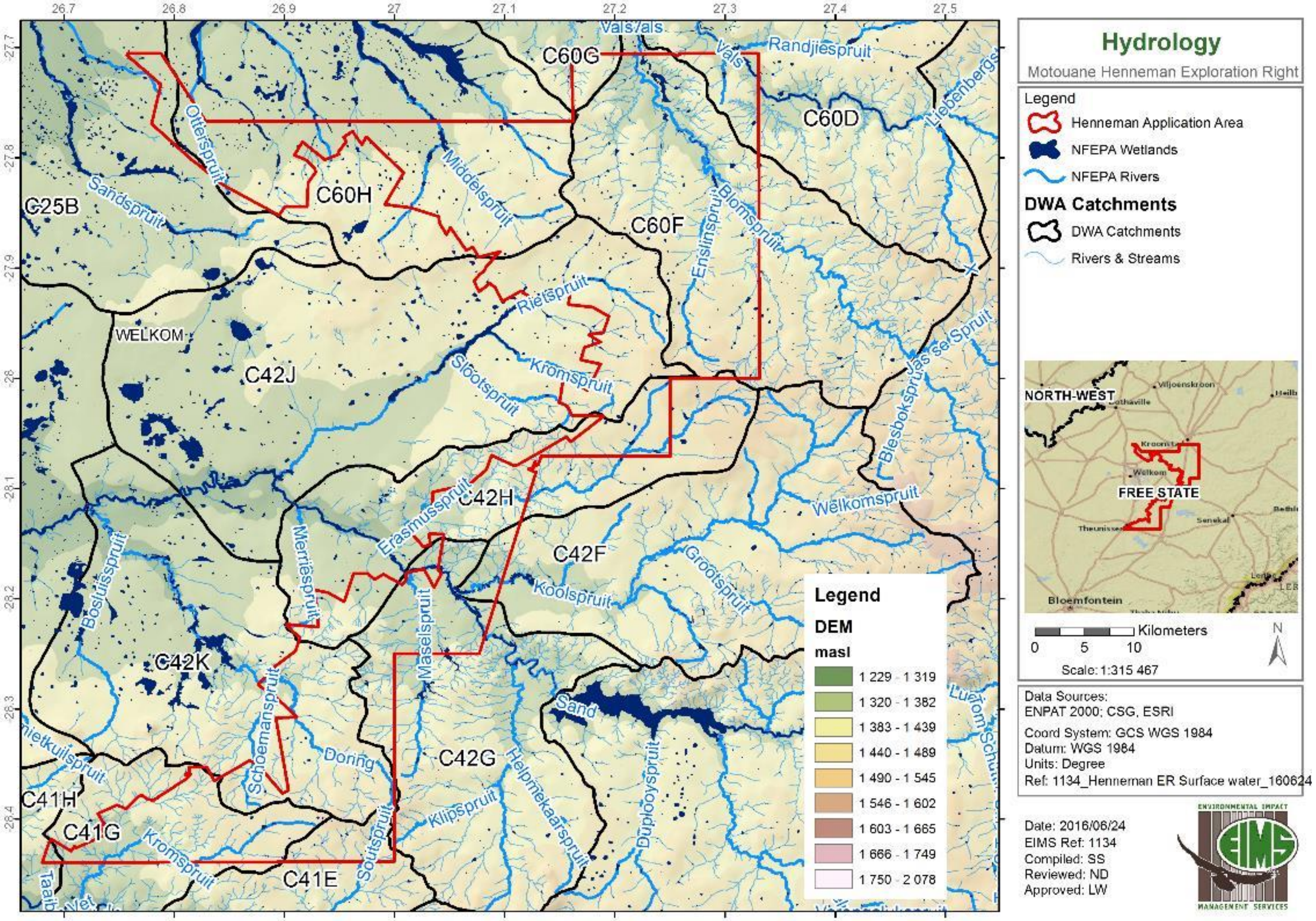


**Figure 10: Hydrology of the study area**

## 7.7 GROUNDWATER

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

### 7.7.1 SITE SPECIFIC DESCRIPTION

The proposed exploration application is located in an area characterised by fractured or secondary porosity 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).

Successful boreholes within these fractured-rock aquifers will typically have a safe yield of 0.5 – 2 L/s, but exceptions may occur where safe yields are > 5 L/s. The former mentioned yields are considered as low to 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 baseflow component to streams and rivers.

The entire site is made up fully or partially of 13 quaternary catchments and located in the Middle Vaal Water Management Area (WMA). No major surface water features are located within the proposed exploration area. The Allemanskraal dam is located 21 km south of Ventersburg, however, 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 Affairs and Sanitation (DWS) GIS data.

**Regional Geology**

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 ~12 km.

The project 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 20 m.

### 7.7.2 NATIONAL GROUNDWATER DATABASE BOREHOLES

Data from the National Groundwater Archive (NGA) indicate that numerous water boreholes have been drilled in the area (refer to Figure 11). 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 12). There are no springs on record.

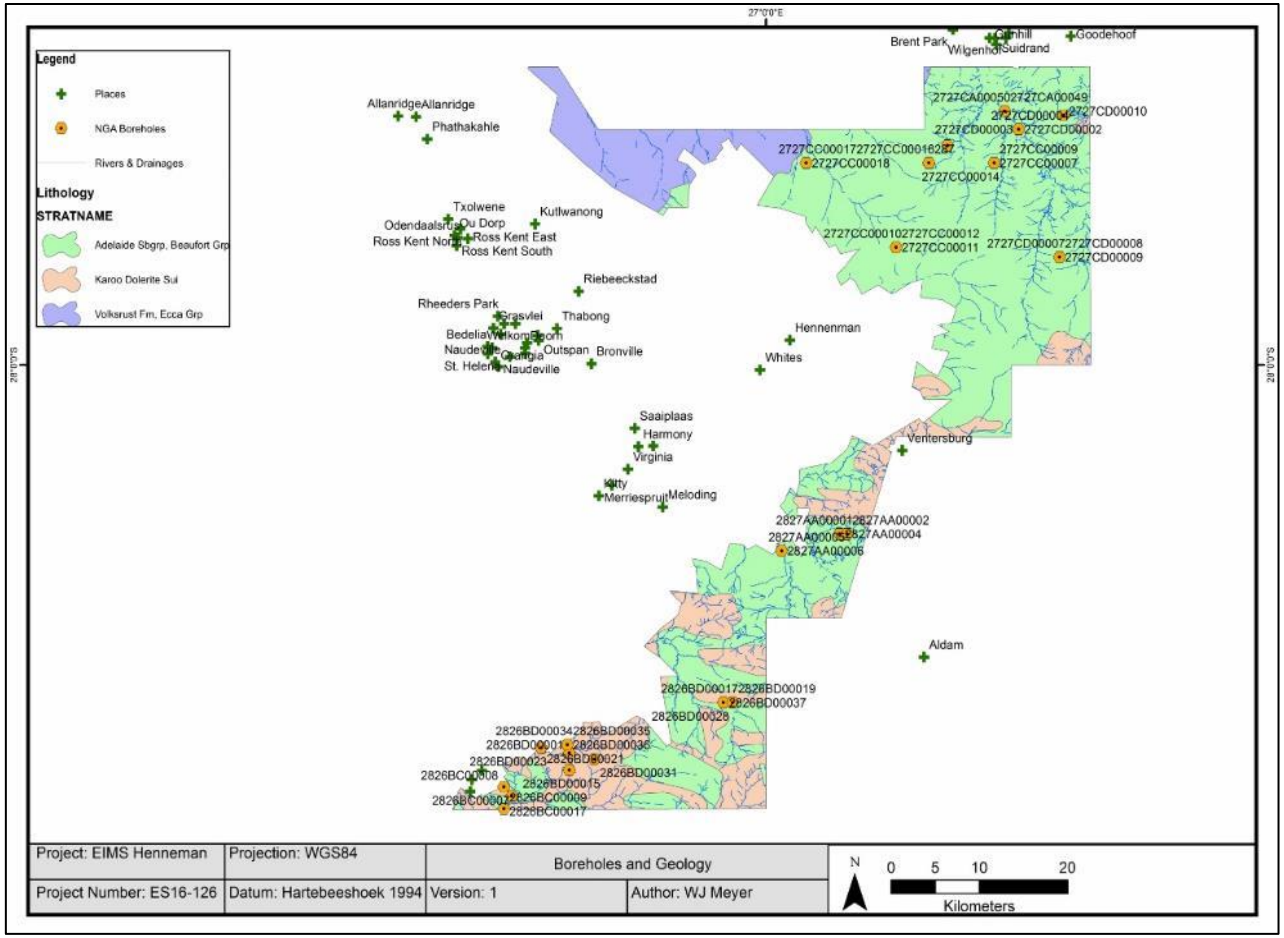


**Figure 11: Geological setting and National groundwater archive (NGA) boreholes**

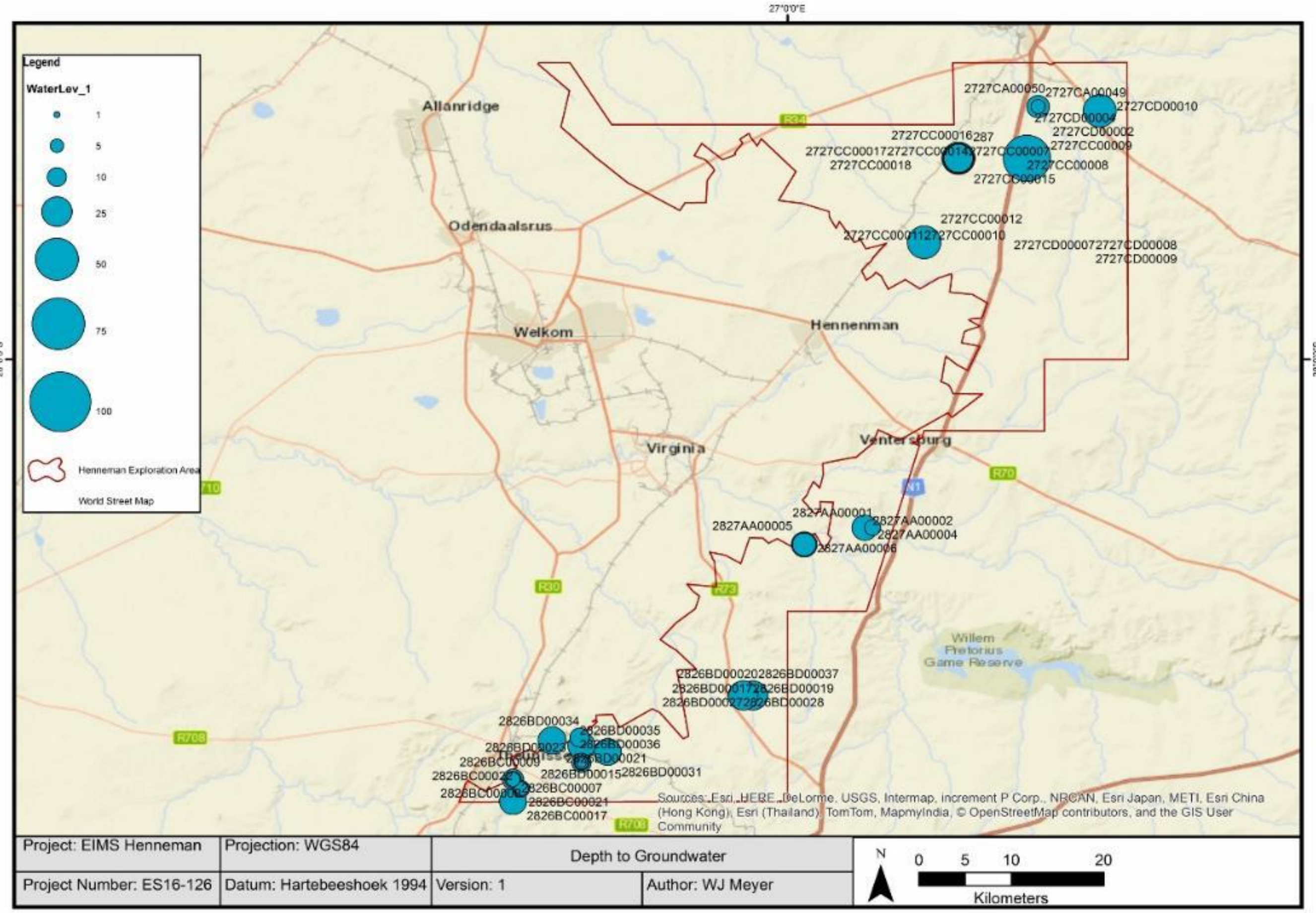


**Figure 12: Depth to groundwater for NGA database boreholes**

### 6.1.1. 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 13 below.

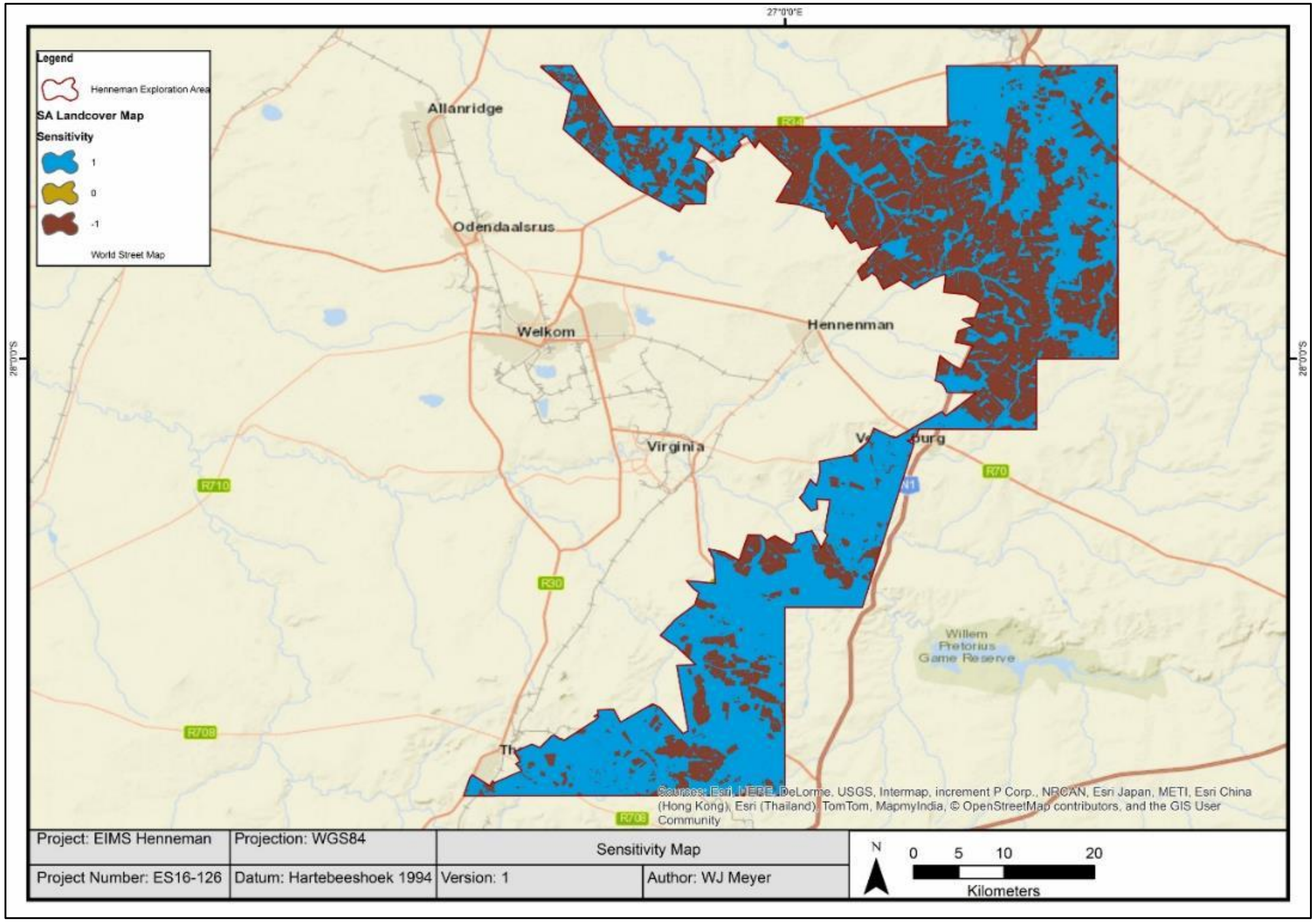


**Figure 13: Geohydrological Sensitivity map for the Motuoane Hennenman Exploration Project**

### 7.7.3 AQUIFERS

Once the exploration areas have been identified, the aquifer should be classified according to Parsons, 1995. This will provide additional insight into the local groundwater regime and the associated sensitivity.

### 7.7.4 AMBIENT GROUNDWATER QUALITY (HYDROCENSUS)

A hydrocensus survey was performed to determine the background and baseline groundwater conditions within the exploration right area. A detailed hydrocensus was performed in a 3 km radius around the "Hennenman blower" as one of the expected exploration target areas as well as a regional spot hydrocensus to obtain a regional representation of the groundwater quality and levels.

#### 7.7.4.1 GROUNDWATER LEVELS

A total of 40 boreholes were surveyed during the hydrocensus with a total of 20 groundwater levels measured (dry boreholes excluded). Within the Hennenman blower hydrocensus target area (13 boreholes), the shallowest groundwater level measured was 2.55 metres below collar height (mbch), the deepest groundwater level 51.62 mbch, and a mean groundwater level of 18.7 mbch calculated (n = 8). Within the target area, two boreholes were obstructed and three boreholes were dry.

In the regional hydrocensus, i.e. all boreholes outside 3 km radius, a total of 27 boreholes were surveyed. Regionally (12 water levels measured), the shallowest groundwater level measured was 2.95 metres below collar height (mbch), the deepest groundwater level 44.6 mbch, and a mean groundwater level of 15.0 mbch calculated (n = 12). Within the target area, five boreholes were obstructed, six boreholes had no access and two boreholes were dry.

#### 7.7.4.2 GROUNDWATER QUALITY

The groundwater qualities of 10 selected boreholes from the hydrocensus were sent to a SANAS accredited laboratory and analysed. The results are shown in Figure 14 below and more detailed results are available in the attached geohydrological specialist report.

The aquifers and groundwater sampled are generally of good water quality with regards to macro- and trace-element chemistry. Ninety percent of the boreholes have electrical conductivity (EC) values of < 170 milli-Siemens/metre (mS/m). This implies that the groundwaters sampled do not have increased solids or salts dissolved in it. BH3 is the only borehole where EC exceeds the SANS 241 EC limit, with an EC value of 183 mS/m. This is not a significant exceedance.

The groundwater types found in the Exploration area are mostly calcium-bicarbonate type groundwaters. This is presumably due to the calcium carbonate ($CaCO_3$) found in the natural cementing material of sedimentary rocks. Sedimentary rocks are the dominant rock type found in the Free State. The sedimentary rock strata in the Free State are predominantly part of the Karoo Supergroup stratigraphic sequence of rocks.

BH34 and BH38 have increased levels of nitrate (NO3 as N) which are attributed to contamination from agricultural activities such as cattle pens/ feed lots. Extensive fertiliser use is also probability.

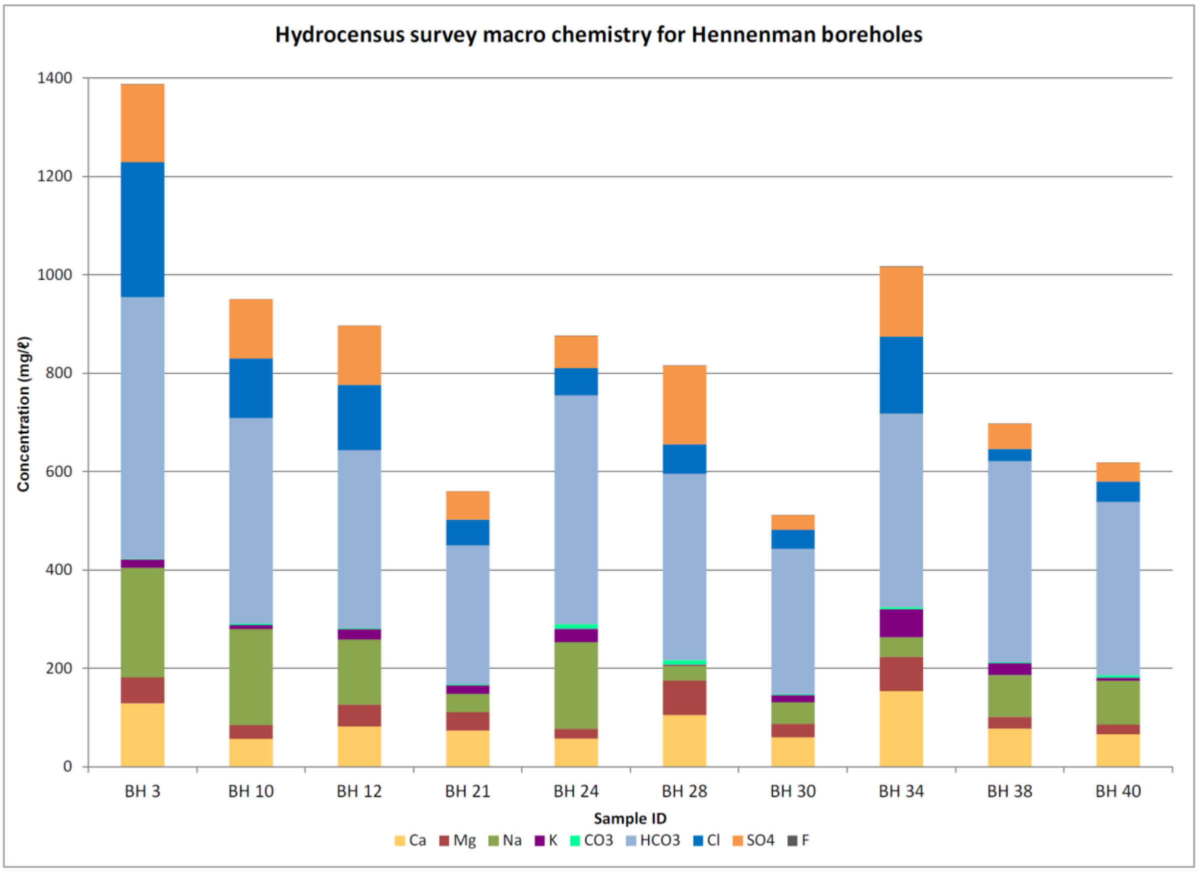


**Figure 14: Macro-element groundwater chemistry for hydrocensus boreholes**

## 7.8 CURRENT 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 EIA report by David Hoare Consulting cc. Refer to Appendix E3 for the ecology EIA report.

### 7.8.1 SITE SPECIFIC 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 15). 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 15, but the general pattern is correct.

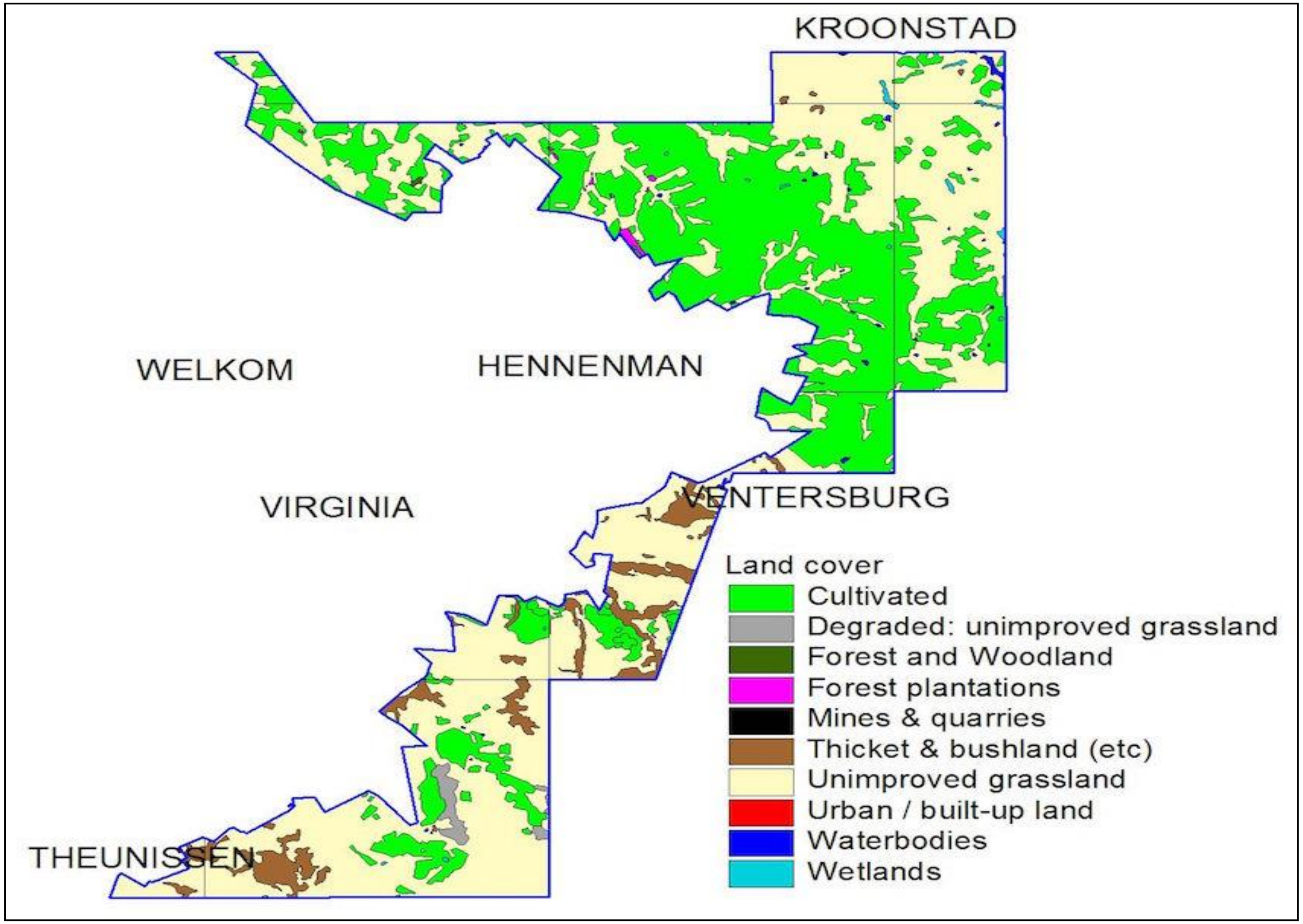


**Figure 15: Land cover of the study area, as depicted in the National Landcover Map of South Africa (Fairbanks et al. 2000)**

### 6.1.1. 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 16.

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 <u>Least Threatened</u>, 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).

<u>HIGHVELD SALT PANS</u>

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 <u>Least Threatened</u>, 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).

<u>WINBURG GRASSY SHRUBLAND</u>

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 <u>Least Threatened</u>, 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.

<u>BLOEMFONTEIN KARROID SHRUBLAND</u>

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 <u>Least Threatened</u>, 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.

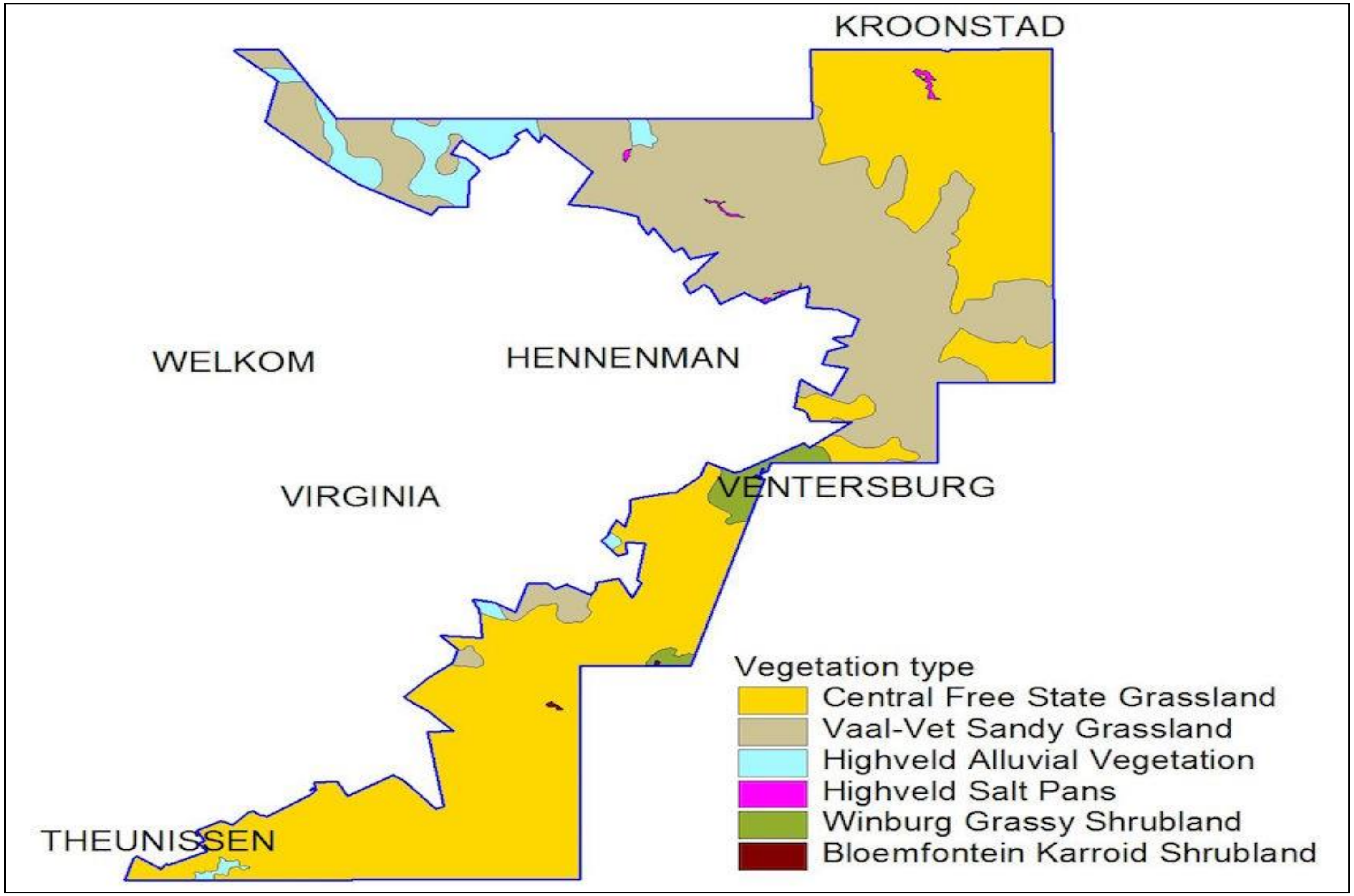


**Figure 16: Regional vegetation types of the study area (Mucina et al. 2005**

## 7.9 SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON SITE

Specific environmental features and infrastructure on site include wetlands, rivers, tarred regional roads, farm access roads and dirt tracks, Transnet and Eskom servitudes, farmhouses and associated buildings, pipelines, etc. Figure 17 below presents the land cover and associated environmental features within and adjacent to the application area. Furthermore, the figures below present legal constraints such as NFEPA wetlands, protected areas and watercourse buffers, as well as residential areas that must be taken into consideration for the Motuoane Hennenman Exploration Right.

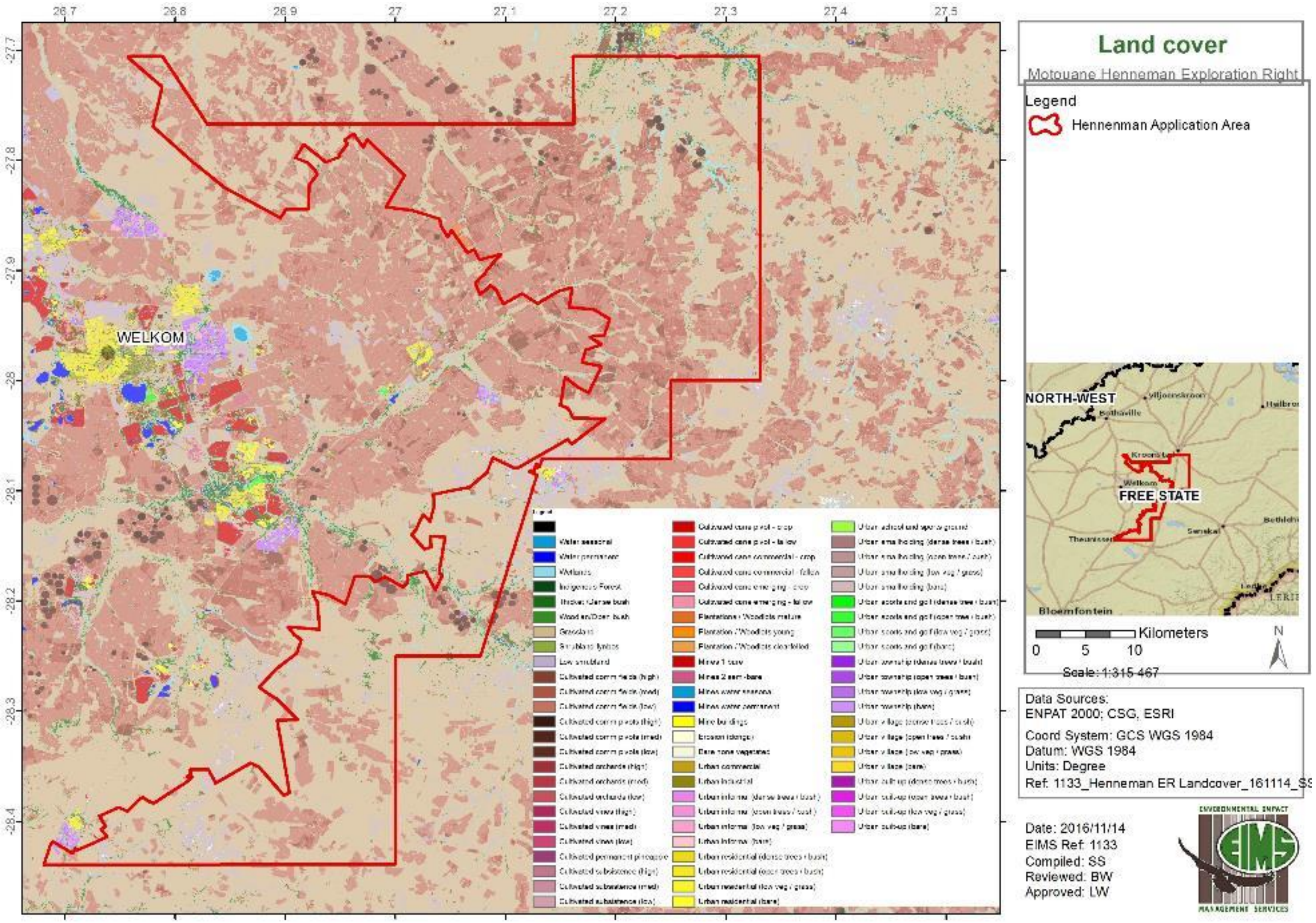


**Figure 17: Land cover**

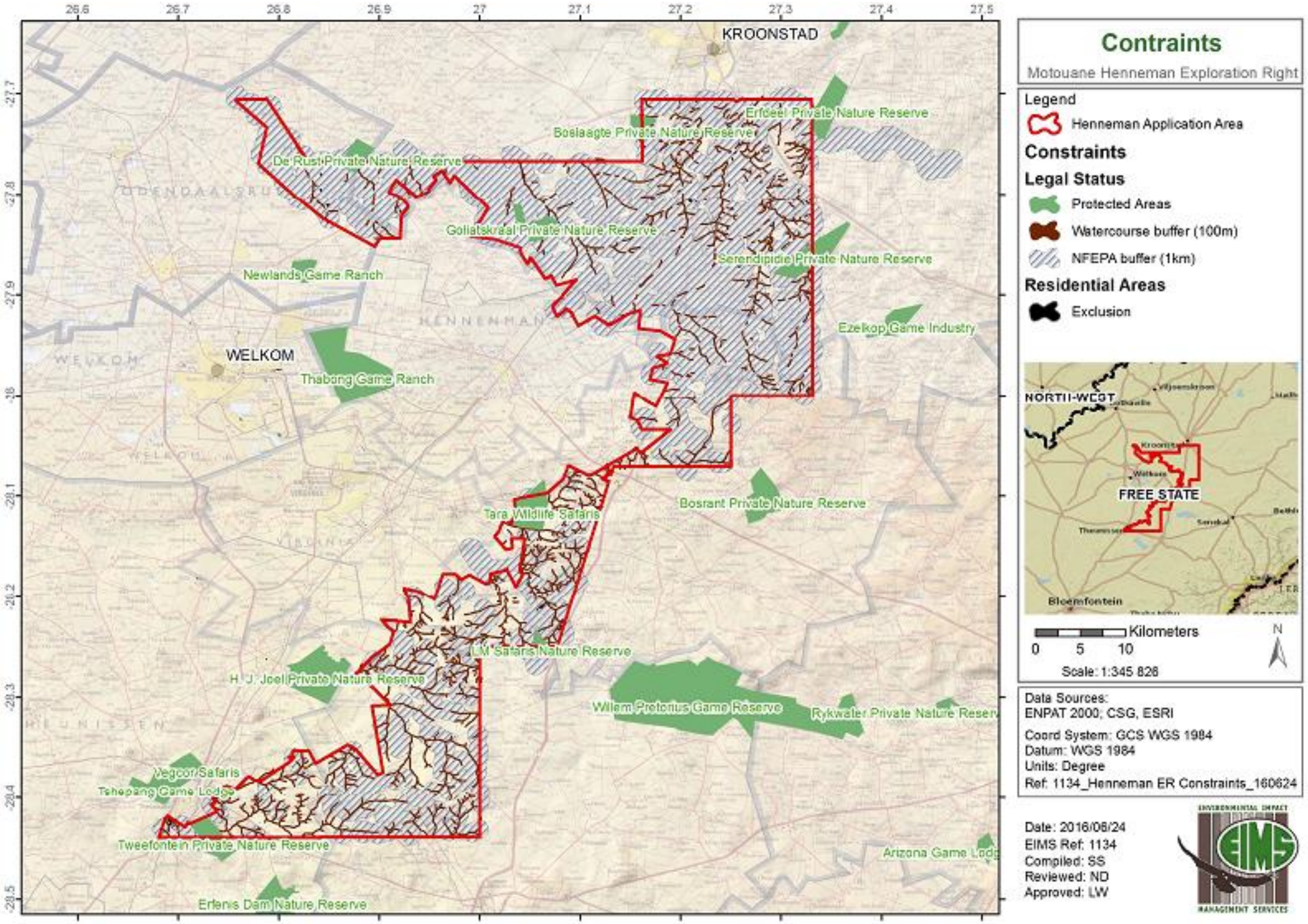


Figure 17: Legal and residential constraints for the Motuoane Hennenman Exploration Right

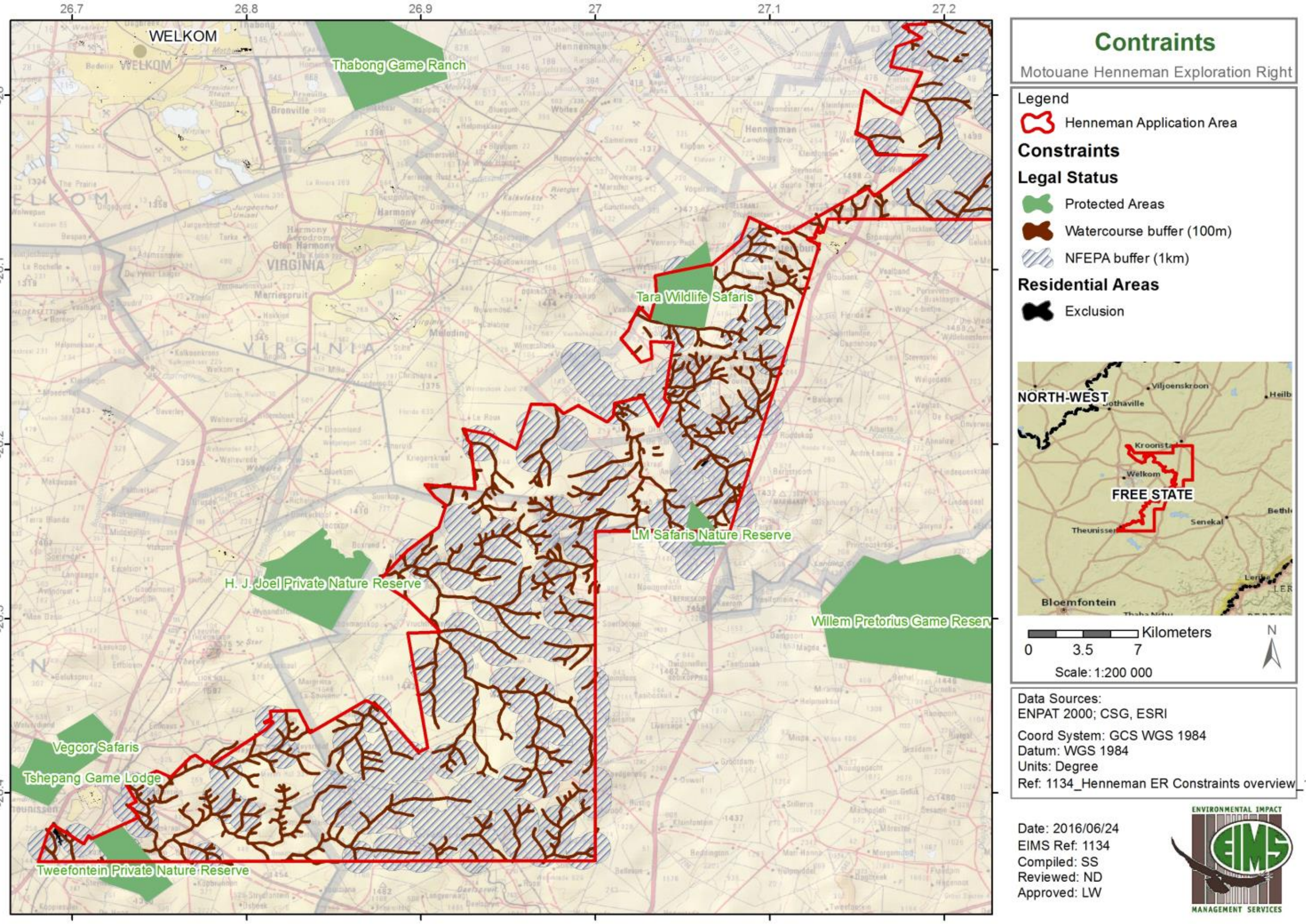


**Figure 18: Legal and residential constraints within the southern section of the Motuoane Hennenman Exploration Right**

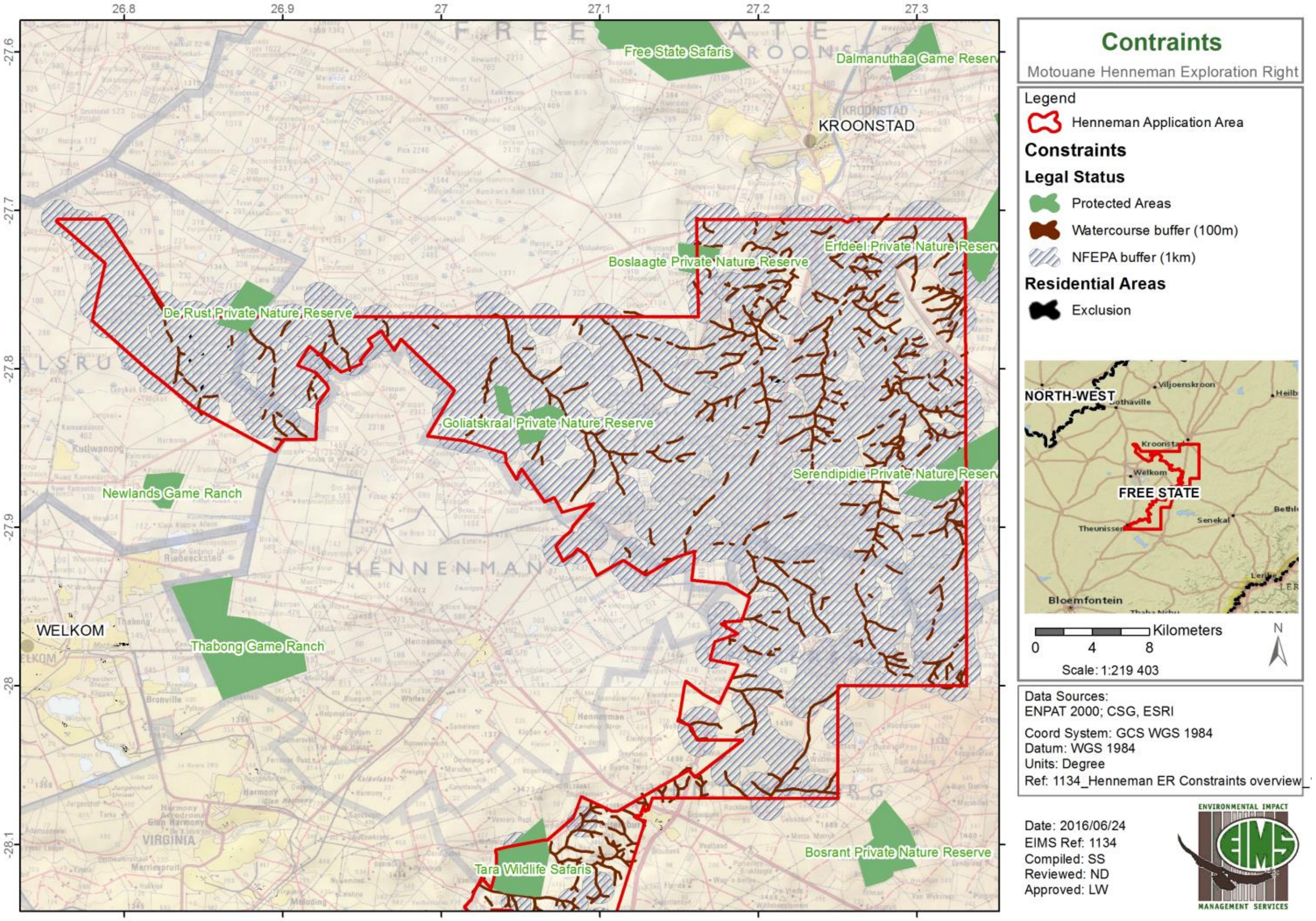


**Figure 19**: Legal and residential constraints within the northern section of the Motuoane Hennenman Exploration Right

# 8 IMPACT ASSESSMENT

The following impacts and risk per environmental aspect have been identified for each project phase:

**Table 19: Summary of the risks and impacts identified**

| Aspect | Impact |
|---|---|
| **Planning phase** | |
| Project planning is predominantly desktop based, thus no significant impacts are anticipated | |
| **Construction/Exploration phase** | |
| **Social** | Interference with existing land use |
| | Nuisance and impact on sense of place |
| | Safety and Security |
| | Damage/disruption of service |
| | Perceptions and expectations |
| | Damage to road infrastructure |
| | Expropriation of land and displacement of landowners and livestock |
| | Impact on existing infrastructure |
| | Employment opportunities |
| | Air quality/ Greenhouse gas emissions |
| | Contamination of groundwater |
| | Soil pollution/contamination |
| | Soil instability and pollution |
| **Heritage** | Disturbance/ destruction of sections of the Battle of Zand River |
| | Disturbance/ destruction of sections of the Boer positions at Boschrand |
| | Disturbance/ destruction of black concentration camps |
| | Disturbance/ destruction of archaeological sites |
| | Disturbance/ destruction of historical buildings and structures |
| | Disturbance/ destruction of graves and cemeteries |
| | Disturbance/ destruction of unmarked graves |
| **Ecology and Wetlands** | Loss/destruction of natural habitat |
| | Habitat fragmentation and edge effect |
| | Displacement of faunal species |
| | Blockage of seasonal and dispersal movements |
| | Flora direct and indirect mortality |
| | Fauna direct and indirect mortality |
| | Clearance of vegetation |
| | Pollution of habitats |
| | Introduction/invasion by alien species |
| **Surface water** | Erosion and sedimentation |
| | Impact on wetlands/drainage lines |
| | Surface water contamination |
| **Groundwater** | Disturbance of local hydraulic head (water level) |
| | Hydraulic head decline due to drilling water supply |

| | |
|---|---|
| | Reduction in groundwater availability |
| | Linking aquifers in drilling process |
| | Altered hydrological regime |
| | Hydrocarbon spills/contamination |
| **Topography and Landform** | Soil surface subsidence |
| | Clearance of vegetation |
| | Altered hydrological regime |
| **Soils** | Soil compaction |
| | Soil pollution/contamination |
| | Erosion and sedimentation |
| **Environmental Pollution** | Hydrocarbon spills/contamination |
| **Air Quality** | Fugitive emissions (Dust) |
| | Air quality/greenhouse gas emissions |
| **Noise** | Noise |
| **Decommissioning phase** | |
| **Soils** | Soil compaction |
| | Soil pollution |
| **Surface water** | Surface water contamination |
| **Groundwater** | Groundwater contamination |
| **Environmental pollution** | Pollution of the environment through waste |
| **Health and Safety** | Health and safety of the community |
| **Air quality** | Air quality/greenhouse gas emissions |
| | Dust generation |
| **Social** | Increased traffic |
| | Damage to road infrastructure |
| **Noise** | Noise |
| **Rehabilitation phase** | |
| **Soils** | Erosion |
| | Soil stability and pollution |
| **Surface water** | Surface water contamination |
| | Altered hydrological regime |
| **Groundwater** | Groundwater contamination |
| **Topography and Landform** | Erosion |
| **Ecology** | Loss of biodiversity |
| | Introduction/invasion by alien (non-native) species |
| | Disturbance to wildlife |
| **Social** | Safety and security |
| | Disturbance to communities in vicinity |

## 8.1 THE IMPACT ASSESSMENT METHODOLOGY

The below subsections present the approach to assessing the identified potential environmental impacts with the aim of determining the relevant environmental significance.

### 8.1.1 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).

#### 8.1.1.1 DETERMINATION OF ENVIRONMENTAL RISKS

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 20.

**Table 20: 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 21.

**Table 21: Probability scoring**

| | | |
|---|---|---|
| Probability | 1 | Improbable (the possibility of the impact materializing 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 22: 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 23.

**Table 23: 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.

### 8.1.2 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 24: 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 25. 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 25).

**Table 25: 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 26: 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). |

## 8.2 ASSESSMENT AND EVALUATION OF POTENTIAL PROJECT IMPACTS

This section presents the potential impacts that have been identified during the course of this EIA through input from the public, the specialists as well as those impacts identified by the EAP. The potential impacts relating to the construction and exploration phase, the closure and decommissioning phase as well as the rehabilitation phase, have been separated for ease of reference. Refer to Appendix F for a summary of the full scoring for each of the assessed impacts, as discussed in this Section.

### 8.2.1 CONSTRUCTION AND EXPLORATION PHASE IMPACTS

Below are the construction and operational (exploration) phase impacts as well as their impact rating and mitigation measures.

**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 may be affected by the proposed exploration activities and in particular during the drilling of the wells. The geochemical and soil sampling activities are anticipated to have a very low impact on existing land use.

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

***Proposed 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; and
- 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.

**Nuisance and Impact on Sense of Place**

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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Nuisance and Impact on Sense of Place | -6 | -4 | -4.67 |

***Proposed Mitigation***

- Noise producing activities should be limited to day-time after 07h00 and 17h00 on week days;
- Aerial flying for gravity/magnetic data must be undertaken in accordance with the CAA regulations as well as the affected landowners;
- Adequate dust suppression measures should be utilized to minimize dust production; and
- 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.

**<u>Safety and Security (i.e. access to properties, theft, fire hazards, etc.).</u>**

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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Safety and Security (i.e. access to properties, theft, fire hazards, etc.). | -6.75 | -3.5 | -4.08 |

***Proposed Mitigation***

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

**<u>Damage/ Disruption of Services (i.e. water, electricity, sewage, etc.)</u>**

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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Damage/ Disruption of Services (i.e. water, electricity, sewage, etc.). | -6.75 | -3 | -3.5 |

***Proposed 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; and
- 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.

**<u>Impact on Existing Infrastructure (i.e. roads, fences, etc.)</u>**

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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Impact on Existing Infrastructure (i.e. roads, fences, etc.) | -7.5 | -3 | -3.5 |

***Proposed 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; and
- If any damage occurs, it should be reinstated to its pre-project status.

**<u>Perceptions and Expectations</u>**

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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Perceptions and Expectations | -9.75 | -6 | -7 |

***Proposed Mitigation***

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

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Employment Opportunities | +6.75 | +7.5 | +7.5 |

***Proposed Mitigation***

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

**Air quality / greenhouse gas emissions**

The concerns raised over the possibility of greenhouse gas releases during the exploratory drilling as well as during the decommissioning phase has been raised by the public. The MPRDA regulations provide for stringent measures to be included during the drilling and decommissioning phases which measures have been stipulated in the EMPR. The potential short term releases of greenhouse gasses are not anticipated to significantly impact on the regional or global greenhouse gas emissions and as such this impact is rated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Air quality/ greenhouse gas emissions | -12 | -6.75 | -7.88 |

***Proposed Mitigation***

- Ensure that all mitigation measures as stipulated in the EMPR relating to the core drilling (specifically technical specifications) as well as the MPRDA regulations are adhered to.

**Clearance of vegetation**

The clearance of vegetation is required in order to prepare the drill site. An area of approximately 30x30m will be impacted upon as well as any temporary access roads. No clearance of vegetation is required for the geochemical and soil sampling activity. Due to the small scale of clearing, the short duration thereof and the rehabilitation that will occur, this impact has a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Clearance of vegetation | -10 | -6 | -7 |

Mitigation Measures:

- Minimise clearing to areas that are required for invasive works. Where possible, cut vegetation instead of clearing to minimise soil disturbance;
- Where possible, locate drill sites as close to existing access roads to minimise the extent of vegetation disturbance caused by temporary access roads;
- Rehabilitate all disturbed areas following invasive exploration activities to the conditions that existed prior to exploration.

**Damage to Road Infrastructure**

Activities associated with exploration will result in increased traffic on the adjacent road network which can result in damage to the local road infrastructure. The short duration of increased traffic as a result of the exploration works as well as few vehicle trips (especially heavy vehicles) are not anticipated to have a significant impact on the existing road networks however the applicant must monitor the condition of roads to ensure that any damage caused by the exploration works is adequately rectified.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Damage to Road Infrastructure | -5,5 | -5 | -5 |

***Proposed Mitigation***

- All construction and vehicles using public roads must be in a roadworthy condition and their loads secured. They must adhere to the speed limits and all local, provincial and national regulations with regards to road safety and transport;
- Damage caused to public roads as a result of the construction activities must be repaired in consultation with the relevant municipal authorities.

**Erosion and sedimentation**

As certain areas will be disturbed through clearing, etc., the risk of erosion and sedimentation must be suitably managed. No drilling activities are permitted on or near to watercourses and as such, the risk of sedimentation of watercourses is considered very low. Through the implementation of the proposed mitigation measures, this impact is considered to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Erosion and sedimentation | -6.75 | -3.5 | -3.5 |

***Proposed Mitigation***

- Clearing of vegetation or topsoil must be minimised as far as possible;
- The ECO must continually monitor the activities for erosion/sedimentation and ensure that suitable mitigation measures are implemented where necessary (e.g.: hay bales, silt traps, etc.); and
- All disturbed areas must be suitably rehabilitated on completion of the works to ensure that erosion does not result.

**<u>Expropriation of Land and Displacement of Landowners and Livestock</u>**

At present this impact is not anticipated and is considered improbable. Negotiations with affected landowners must be undertaken and any loss of revenue caused by the exploration works must be reasonably compensated.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Expropriation of Land and Displacement of Landowners and Livestock | -3,5 | -3,25 | -4,33 |

***Proposed Mitigation***

- Prior to accessing any portion of land, the Applicant must enter into formal written agreements with the affected landowner. This formal agreement should additionally stipulate landowner's special conditions which would form a legally binding agreement

**<u>Fugitive emissions (dust)</u>**

The exploration activities as well as travel to and from site may result in the generation of dust. This impact is considered to have a short duration and due to the small scale of the exploration activities and low number of vehicles, this impact is anticipated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Fugitive emissions (dust) | -7.5 | -4 | -4 |

***Proposed Mitigation***

- All vehicles utilising public gravel roads must adhere to the speed limits;
- By minimising the removal of vegetation and topsoil in affected area, this will minimise the potential for dusty conditions; and
- Exploration activities (drill sites) must be located away from dwellings as far as possible.

**Hydrocarbon spills/contamination**

The vehicles and equipment on site would present a risk of hydrocarbon spills with the resultant potential for contamination of soils. Due to the small number of vehicles and short duration of the on-site exploration activities, in conjunction with the mitigation measures put forward, this impact is anticipated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Hydrocarbon spills/contamination | -7.5 | -2.5 | -2.92 |

***Proposed Mitigation***

- Drip trays must be placed under vehicles as directed by the ECO;
- Any spills or leaks must immediately be cleaned up and the contaminated soil suitably disposed of;
- During refuelling of vehicles or equipment, drip trays must be utilised to prevent spills or leaks;
- Spill clean-up equipment must be available on site at all times; and
- In the event of large spills, this must be reported to the authorities and a specialist spill contractor immediately sought to assist with the clean-up.

**Introduction/Invasion by Alien (Non-Native) Species**

Major factors contributing to invasion by alien invader plants includes inter alia high disturbance (such as clearing for construction activities). Exotic species are often more prominent near infrastructural disturbances than further away. Consequences of this may include:

1. loss of indigenous vegetation;
2. change in vegetation structure leading to change in various habitat characteristics;
3. change in plant species composition;
4. change in soil chemical properties;
5. loss of sensitive habitats;
6. loss or disturbance to individuals of rare, endangered, endemic and/or protected species-;
7. fragmentation of sensitive habitats;

8. change in flammability of vegetation, depending on alien species;
9. hydrological impacts due to increased transpiration and runoff; and
10. impairment of wetland function.

There are existing populations of alien plants on site. There is a high possibility that alien plants could be introduced to areas within the footprint of the proposed activities from surrounding areas in the absence of control measures. The potential consequences may be of moderate seriousness for surrounding natural habitats. However, in most cases, it is in the interests of the land owner to control infestations.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Introduction/Invasion by Alien (Non-Native) Species | -2,5 | -2 | -2,33 |

***Proposed Mitigation***

- Undertake activities in previously disturbed areas and/or habitats with lower sensitivity.
- 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.

**<u>Noise</u>**

The onsite exploration activities will pose the potential for noisy conditions due to machinery and vehicles as well as possible noise impacts should the aerial gravity/magnetic surveys be required. The small number of vehicles and temporary exploration works are anticipated to result in a noise impact with a low negative significance. Furthermore, the short duration of the aerial surveys (if required) over any particular property (i.e.: fly-by) and the localised impact is considered to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Noise | -6.75 | -3 | -3 |

***Proposed Mitigation***

- Aerial flying for gravity/magnetic data must be undertaken in accordance with the CAA regulations as well as any reasonable specific requirements of the affected landowners;
- Minimum flight height restrictions include 2500ft above nature reserves and 500ft in open areas unless otherwise agreed to with the CAA and the affected landowners;

- A risk assessment associated with the aerial surveys must be prepared prior to conducting this activity and must include a flight plan with due cognisance of the noise receptors and risks along the flight paths;
- All construction vehicles and machinery must be maintained in good working order; and
- When working or traveling past noise sensitive receptors, no unnecessary hooting or noise should occur.

**Reduction in groundwater availability**

During public consultation, one of the concerns raised is the potential for the exploration activities to result in a reduction in groundwater availability. This is primarily due to the perception that the exploration activities will require large volumes of water. As this exploration application is for conventional exploration and not un-conventional exploration (i.e.: fracking) the water required for drilling would be in the order of $5m^3$ per day. This impact has been rated as low negative significance and the significant public concern in this regard resulted in an increased final score.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Reduction in groundwater availability | -5 | -4.5 | -7.5 |

***Proposed Mitigation***

- No water is to be abstracted from the environment unless prior written agreements with the affected landowner and under approval from the DWS;
- Should the landowner not permit water to be abstracted under his/her existing water allocation, then water is to be trucked in to site and obtained from an approved water supplier; and
- The ECO must maintain records of where water was obtained during the exploration phase.

**Soil compaction**

The exploration activities (drill sites) will result in small scale compaction of soil. These areas will be limited to the areas where these invasive activities occur. Through the implementation of the proposed mitigation measures, this impact is anticipated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Soil compaction | -6 | -4.5 | -4.5 |

***Proposed Mitigation***

- All areas that are compacted as a result of exploration activities must be assessed by the ECO and where necessary, scarifying must take place to loosen the soil.

**Soil pollution/contamination**

The risk of soil pollution and contamination as a result of the on-site exploration activities must be managed on a day to day basis to ensure that following rehabilitation, the disturbed areas are not adversely affected. Through the implementation of the mitigation measures put forward, this impact is considered to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Soil pollution/contamination | -7.5 | -2.5 | -2.92 |

***Proposed Mitigation***

- Drip trays must be placed under vehicles as directed by the ECO;
- All grouting or cement should be "ready-mixed" if possible. Alternatively, any mixing must be completed on a temporary impermeable layer or in a container;
- All pouring of cement or grouting should be completed over a temporary impermeable layer to avoid spillage;
- Cleaning of the chute of the cement truck, if applicable, should be done over a temporary impermeable layer; and
- Any spills or leaks must immediately be cleaned up and the contaminated soil suitably disposed of.

**Soil surface subsidence**

The risk of soil surface subsidence has been identified based on various investigations into the oil and gas industry. This is however specifically applicable to the production phase where large volumes of hydrocarbons are removed or where dewatering of groundwater takes pace. As this is an exploration application and no production will occur, this impact is considered to have a very low significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Soil surface subsidence | -3.25 | -3 | -3 |

***Proposed Mitigation***

- No groundwater dewatering is to take place as part of the exploration activities; and
- No production is permitted to occur during the exploration phase.

**Disturbance / Destruction of HEN 1**

During the heritage specialist site visit, a cemetery comprising three graves was identified within the exploration footprint area located on the southern boundary of the farm Nooitgedacht 245. With suitable mitigation measures in place before the commencement of development, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance is estimated to be of a low medium negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance / Destruction of HEN 1 | -14.25 | -8 | -10.67 |

***Proposed Mitigation***

- A buffer area of 200 m wide surrounding the cemetery must be kept clear of any exploration footprints, whether it be drilling positions, access roads etc.

**<u>Disturbance / Destruction of Possible Stillborn Graves at HEN 2</u>**

During the heritage specialist site visit, the poorly preserved remains of an old farmstead were identified during the site visit at HEN 2. With the structural remains of the farmstead so poorly preserved, the heritage value of these building remains and structures are deemed to be very low. However, the structures from the farmstead include what appears to be farm worker accommodation. In terms of black homesteads as is expected to be the case with the farm worker accommodation, past experience has shown that in some cases stillborn babies were buried in close proximity to the homes of their parents and especially along the sides of the parents' dwelling. While this seems to be especially true for older sites, the possibility that stillborn babies are buried in association with these farm worker structures does exist. Until such time that the presence of stillborn babies at the site has been confirmed or disproved, a worst case scenario must be accepted within which it is assumed that stillborn babies are indeed buried here. As such the site is deemed to be of Medium to High Significance.

With suitable mitigation measures in place before the commencement of development, the expected impact can be mitigated to an even lesser low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance is estimated to be of low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance / Destruction of Possible Stillborn Graves at HEN 2 | -8.5 | -4 | -4.67 |

***Proposed Mitigation***

- A buffer area of 100 m wide surrounding the farmstead must be kept clear of any exploration footprints, whether it be drilling positions, access roads etc.

**<u>Disturbance / Destruction of HEN 3</u>**

During the heritage specialist site visit, a cemetery comprising three graves was identified within the exploration footprint area on the farm Erfenis 328. With suitable mitigation measures in place before the commencement of development, the expected impact can be mitigated to a low negative impact. On the condition that these mitigation measures are implemented, the final impact risk significance in terms of Alternative 3 on this environmental constraint, is estimated to be of a low Moderate Negative Risk, with a value of -10.67.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance / Destruction of HEN 3 | -14.25 | -8 | -10.67 |

***Proposed Mitigation***

- A buffer area of 200 m wide surrounding the cemetery must be kept clear of any exploration footprints, whether it be drilling positions, access roads etc.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance/ Destruction of Sections of the Battle of Zand River | -12.75 | -7 | -8.17 |

***Proposed Mitigation***

- Archaeological field surveys of the proposed exploration footprint areas should identify any tangible remains of the battle and the associated heritage impact assessment would address any perceived significant impacts on this battle and its associated tangible remains. Additionally, such field assessments must be augmented by further archival and historical research.
- If required, further mitigation measures will be outlined in the Heritage Impact Assessment undertaken for the proposed exploration footprints within a distance of 1 000 m of the identified sensitive area.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance/ Destruction of the Boer Position historical features at Boschrand | -12.75 | -7 | -8.17 |

***Proposed Mitigation***

- Should any exploration footprints be proposed within 5 000 m of the Bosrand railway station, the following mitigation will have to be undertaken:
    - Archaeological field surveys of the proposed development footprint areas identify any tangible remains of these activities.
    - These surveys should be augmented by further archival and historical desktop study work to establish the exact location of the Boer position at Boschrand.
    - Should archaeological sites be identified, suitable mitigation measures will have to be outlined in the Heritage Impact Assessment.

**<u>Disturbance/ Destruction of Black Concentration Camps</u>**

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. With suitable mitigation measures in place before the commencement of development, the expected impact can be mitigated to a low negative impact.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance/ Destruction of Black Concentration Camps | -12.75 | -7 | -8.17 |

***Proposed Mitigation***

- The areas included in the sensitivity maps should ideally be avoided during the placement of exploration footprints. However, should any exploration footprints be proposed within 1 000 m of these identified sensitive areas, the following mitigation will have to be undertaken:
  - Archaeological field surveys of the proposed exploration footprint areas should identify any tangible remains of these heritage features and the associated heritage impact assessment would address any perceived significant impacts on these concentration camps and their associated remains.
  - Additionally, such field assessments must be augmented by further archival and historical research.
  - If required, further mitigation measures will be outlined in the Heritage Impact Assessment undertaken for the proposed exploration footprints within a distance of 1 000 m of the identified sensitive area.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance/ Destruction of Archaeological Sites | -12.75 | -7 | -8.17 |

***Proposed Mitigation***

- The planning of all additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional exploration footprints.
- As soon as any additional exploration footprints are confirmed, a suitably qualified heritage specialist, with expertise in archaeology, must be appointed. Such additional exploration footprints would include all aspects relating to the exploration work.
- The appointed heritage specialist will be responsible for undertaking heritage walkthroughs of the additional exploration footprint areas to identify any heritage sites located there.
- The appointed heritage specialist will be responsible for compiling a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified

heritage sites, assessing the impact of the proposed exploration activity(ies) on the identified heritage sites and outlining mitigation measures which may be required.

- The report would be a subsequent heritage impact assessment aimed specifically at the additional exploration footprints, and must be submitted to SAHRA as well.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance/ Destruction of Historic Buildings or Structures | -12 | -7 | -8.17 |

***Proposed Mitigation***

- The planning of all additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional exploration footprints.
- As soon as any additional exploration footprints are confirmed, a suitably qualified heritage specialist, with expertise in archaeology, must be appointed. Such additional exploration footprints would include all aspects relating to the exploration work.
- The appointed heritage specialist will be responsible for undertaking heritage walkthroughs of the additional exploration footprint areas to identify any heritage sites located there.
- The appointed heritage specialist will be responsible for compiling a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified heritage sites, assessing the impact of the proposed exploration activity(ies) on the identified heritage sites and outlining mitigation measures which may be required.
- The report would be a subsequent heritage impact assessment aimed specifically at the additional exploration footprints, and must be submitted to SAHRA as well.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance/ Destruction of Graves and Cemeteries | -13.5 | -8 | -10.67 |

***Proposed Mitigation***

- The planning of all additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional exploration footprints.
- As soon as any additional exploration footprints are confirmed, a suitably qualified heritage specialist, with expertise in archaeology, must be appointed. Such additional exploration footprints would include all aspects relating to the exploration work.
- The appointed heritage specialist will be responsible for undertaking heritage walkthroughs of the additional exploration footprint areas to identify any heritage sites located there.
- The appointed heritage specialist will be responsible for compiling a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified heritage sites, assessing the impact of the proposed exploration activity(ies) on the identified heritage sites and outlining mitigation measures which may be required.
- The report would be a subsequent heritage impact assessment aimed specifically at the additional exploration footprints, and must be submitted to SAHRA as well.

**Disturbance/ Destruction of Unmarked Stillborn 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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance/ Destruction of Unmarked Graves | -18 | -7.5 | -8.75 |

***Proposed Mitigation***

- The planning of all additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional exploration footprints.
- As soon as any additional exploration footprints are confirmed, a suitably qualified heritage specialist, with expertise in archaeology, must be appointed. Such additional exploration footprints would include all aspects relating to the exploration work.
- The appointed heritage specialist will be responsible for undertaking heritage walkthroughs of the additional exploration footprint areas to identify any heritage sites located there.
- The appointed heritage specialist will be responsible for compiling a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified heritage sites, assessing the impact of the proposed exploration activity(ies) on the identified heritage sites and outlining mitigation measures which may be required.
- The report would be a subsequent heritage impact assessment aimed specifically at the additional exploration footprints, and must be submitted to SAHRA as well.

**<u>Disturbance / Destruction of National Monuments and Monuments</u>**

The presence of Monuments and National Monuments in proximity to the study area was revealed during the Heritage Scoping Study. During the Public Participation Process, three Interested & Affected Parties commented that they have Monuments and/or National Monuments on their farms. Two of these comments mentioned the monument relating to the place where the Sand River Convention was signed in particular.

During the Heritage Impact Assessment, a concerted effort was made to locate all the Monuments and National Monuments known to be situated within the exploration right and exploration footprint areas. A total of four Monuments and National Monuments were identified in proximity to the study area. The original survey diagrams defining the boundaries for two of these heritage sites could be identified. The positions of the other two sites were extracted from subdivision maps. None of the four Monuments and National Monuments were found to be located within either the exploration right or exploration footprint areas. All four the Monuments and National Monuments are listed below, as are the respective distances between the exploration right area and their positions.

- Early Sotho Settlement, Waterval, Sandriviershoogte - 558 m outside the exploration right area;
- Place where the Sand River Convention was signed - 530 m outside the exploration right area;

- Stone Rampart and Voortrekker Graves, Ventersburg - 57 m outside the exploration right area; and
- Matloang Archaeological Site - 1 650 m outside the exploration right area.

From the distances provided above, it is clear that the only possible impact relating to future exploration drilling is expected on the Stone Rampart and Voortrekker Graves, which is located 57 m from the exploration right area.

With suitable mitigation measures in place before the commencement of development, the expected impact can be mitigated to a low negative impact.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance / Destruction of National Monuments and Monuments | -12.75 | -3.5 | -4.08 |

***Proposed Mitigation***

- No exploration footprints are allowed within a distance of 500 m from the boundaries of the Stone Rampart and Voortrekker Graves at Ventersburg.

**<u>Disturbance / Destruction of Palaeontology</u>**

A pedestrian survey of the footprint covering the farms Nooitgedacht No. 245, Erfenis No. 328 and Nieuwjaarsbosch No. 113 indicates that the affected area is underlain by what appears to be the regional boundary between the Volksrust Formation and the overlying Adelaide Subgroup. Green-gray to red-brown mudstone with fine intercalations of sandy material and thin arenaceous partings are exposed near and invariably indurated at the contact of a weathered dolerite intrusion. Bedrock visibility is largely hampered by the low topography terrain, which is capped by a relatively thin veneer of unconsolidated Quaternary-age sediments (windblown sand and residual soils). The superficial overburden is largely degraded by farming activities.

The potential for disturbance or destruction of palaeontological resources is considered potentially high during the Construction and Operational Phases, pending mitigation.

There is no evidence for the accumulation and preservation of intact fossil material within the superficial Quaternary sediments and therefore it is considered unlikely that the proposed development will affect palaeontological heritage resources within the superficial component (Quaternary overburden) due to the disturbed condition of the substrate and the absence of a suitable alluvial context.

Bedrock visibility is largely hampered as a result of the low topography terrain. These rocks are considered to be of moderate to high palaeontological sensitivity, but given the size of the proposed impact area and proposed boreholes size (75.5 mm in diameter on the inside) the chances of impact on palaeontological material is considered low with the caveat that fossil distribution within fossil-bearing rock units may vary significantly (e.g. high or moderate concentration but irregular distribution).

The final impact risk significance is estimated to be medium negative.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Disturbance / Destruction of Palaeontology | -17 | -7.5 | -11.25 |

***Proposed Mitigation***

- Once the drilling sites are known, the applicant should invite a professional palaeontologist to monitor drilling cores for subsurface fossil remains that may be intersected by the drilling process.
- The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils if necessary.

#### 8.2.1.1 Heritage Sensitivity Mapping

All the relevant sources of heritage and palaeontological information have been summarised in a heritage sensitivity maps (refer to Figure 3, Figure 4, Figure 5, Figure 6 contained in Section 7.1.3 and Figure 20 below). These maps provide a zoned depiction of the study area wherein areas of varying heritage and palaeontology sensitivities are indicated.

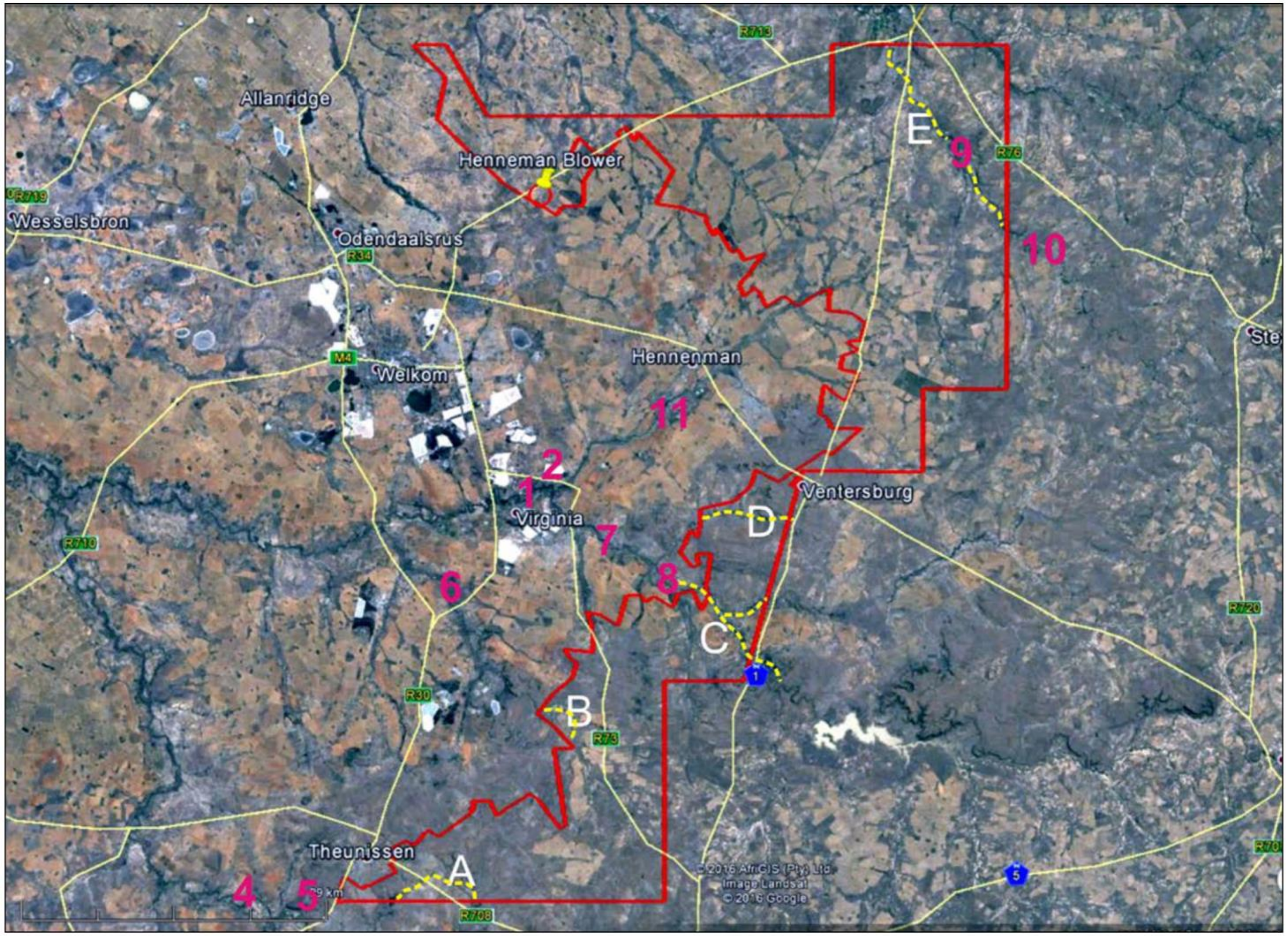


**Figure 20: General map of the Cenozoic palaeontological localities in the region. Highly sensitive alluvial sediments and associated overbank deposits are indicated by the capital letters and yellow lines**

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Loss/ Destruction of Natural Habitat | -12.00 | -6.75 | -9.00 |

***Proposed 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.

**Habitat Fragmentation and Edge Effects**

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

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

***Proposed 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.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Displacement of Faunal Species | -4.00 | -1.50 | -1.50 |

***Proposed 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.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Blockage of Seasonal and Dispersal Movements | -3.00 | -1.50 | -1.50 |

***Proposed 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.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Flora Direct and Indirect Mortality | -10.50 | -1.00 | -1.17 |

***Proposed 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.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Fauna Direct and Indirect Mortality | -6.00 | -3.00 | -4.00 |

***Proposed 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;
- Where possible locate activities on the boundaries of existing disturbance; and
- Use existing access roads as much as possible.

**Pollution of Habitats**

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

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Pollution of Habitats | -9.75 | -1.00 | -1.33 |

***Proposed 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.

**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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Introduction/ Invasion by Alien Species | -2.50 | -2.00 | -2.67 |

***Proposed Mitigation***

- Undertake activities in previously disturbed areas and/or habitats with lower sensitivity;
- 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.

#### 8.2.1.2 General Ecology Mitigation Measures and Sensitivity Mapping

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.

An ecological sensitivity map of the site was produced that identifies areas of high sensitivity that should be avoided during development. This includes wetlands, steep slopes, mesic scarp woodland mountain grassland. Other habitats that are not mapped, but should be treated as sensitive if they are encountered are caves, rock outcrops and cliffs. The ecological and wetland sensitivity map is presented in Figure 21 below.

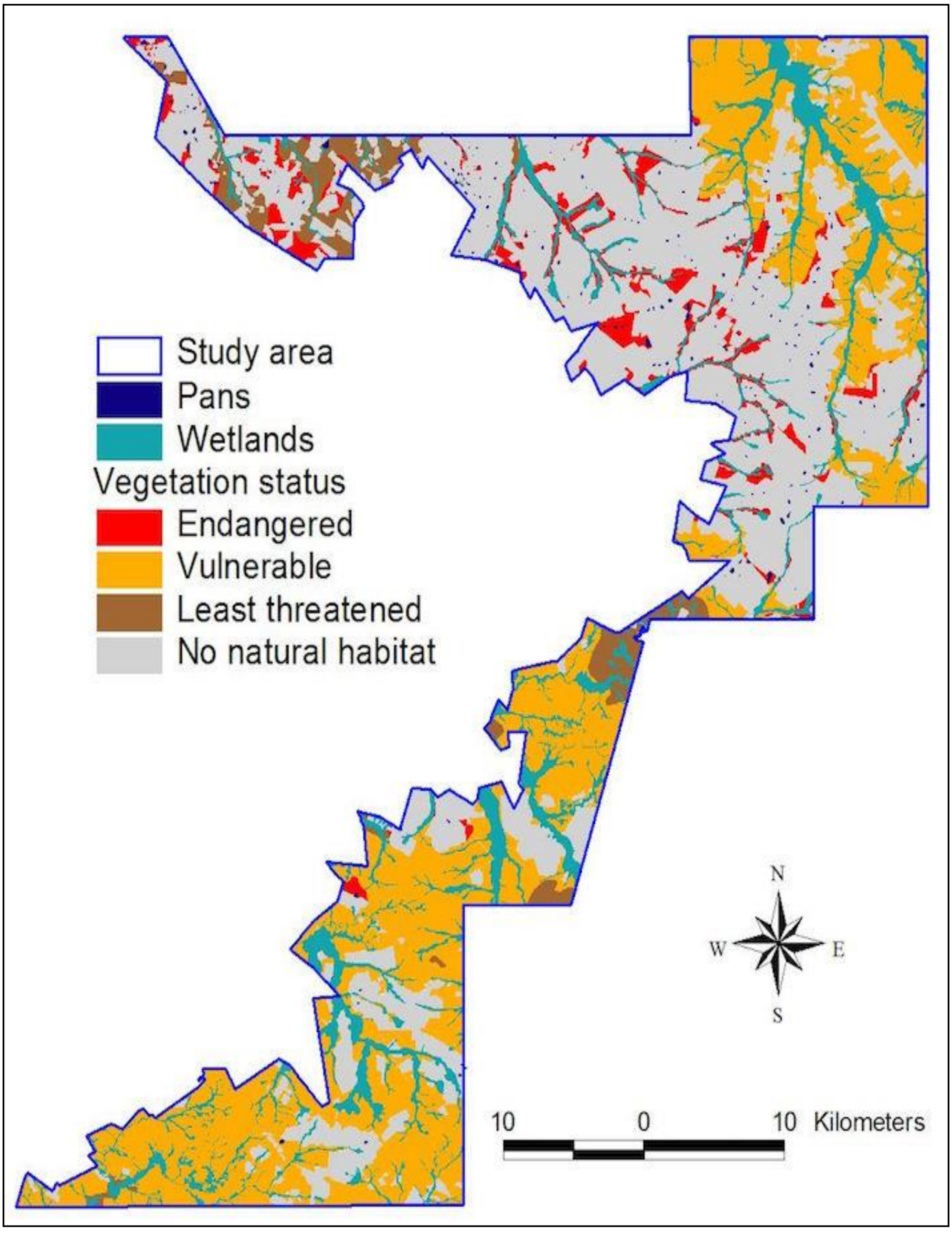


**Figure 21: Ecology and wetland sensitivity map**

**Disturbance of local hydraulic head (water level)**

During the exploration activities, the potential for altered hydraulic regimes (head). The small scale of the impacts that would be perceived would not significantly alter the drainage patters over a large area and if perceived would be of short duration. This will likely be limited to the site and surrounding areas. This impact would likely have a low negative significance and as such have a minimal impact on the existing hydrological regimes in the area.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Altered Hydrological Regime | -10 | -10 | -13.33 |

***Proposed Mitigation***

- Baseline water levels must be determined within the vicinity of the drilling sites; and
- This impact is associated with drilling process and should recover after construction/drilling phase, should abstraction stop.

**Hydraulic head decline due to drilling water supply**

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 | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Hydraulic head decline due to drilling water supply | -6 | -6 | -8 |

***Proposed Mitigation***

- Water utilised for the drilling activities should be sourced from a licensed source and consumption should not exceed the licensed thresholds; and
- 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.

**Surface Water Contamination**

Concerns were raised by the public surrounding the potential for contamination of water resources (including surface water resources). In terms of the relevant legislation, no drilling may take place on or near to surface water features and furthermore, mitigation measures have been put forward to prevent pollution on or near to the drill sites which will prevent contaminated surface water runoff from entering water resources. As such, this impact has been rated with a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Surface Water Contamination | -12 | -5.5 | -11 |

***Proposed Mitigation***

- Ensure that detailed baseline water quality and quantity samples are obtained and analysed for reference purposes;
- Construction/drilling should preferably take place during the dry season.
- Excavations should be open for as short period as practically possible and drilling circulation fluid sumps be cleaned out and rehabilitated;
- 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 drilling rig and vehicles are done on site;
- Chemical sanitary facilities should be provided for drilling crew. 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;
- Adequate fuel containment facilities to be used during exploration phase;
- The use of all materials, fuels and chemicals which could potentially leach into the environment 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 drilling pad or site shall be permitted; and
- Any spills that occur during the exploration phase must immediately be cleaned up and the contaminated soils, etc. suitably disposed of at a registered waste disposal facility.

**Contamination of Groundwater**

A major concern raised by the public is the potential for the exploratory drilling to have an adverse impact on groundwater quality and quantities. The requirement of the MPRDA regulations for the insertion of casing in the underground aquifer zones (as presented in the EMPR) is anticipated to prevent any adverse impacts on groundwater quantity and quality for surrounding groundwater users. Furthermore, a monitoring programme is proposed in the EMPR for the continued monitoring of surface and groundwater quantity and quality. As such, this impact is anticipated to have a low negative significance through the implementation of these mitigation measures.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Contamination of groundwater | -8.25 | -5.25 | -9.63 |

***Proposed Mitigation***

- Ensure that detailed baseline water quality and quantity samples are obtained and analysed for reference purposes;
- Ensure that all mitigation measures as stipulated in the EMPR relating to the diamond core drilling (specifically technical specifications) as well as the MPRDA regulations are adhered to;
- 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;
- The correct type of fluids should be used during the construction phase and the boreholes should be correctly constructed so that no gas leakage occur during the construction or operational phases. Biodegradable drilling fluids should be used wherever possible;
- Excavations should be open for as short period as practically possible and drilling circulation fluid sumps be cleaned out and rehabilitated;
- 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 drilling rig and vehicles are done on site;
- Chemical sanitary facilities should be provided for drilling crew. 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;
- Adequate fuel containment facilities to be used during exploration phase;
- The use of all materials, fuels and chemicals which could potentially leach into the environment 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 drilling pad or site shall be permitted; and
- Any spills that occur during the exploration phase must immediately be cleaned up and the contaminated soils, etc. suitably disposed of at a registered waste disposal facility; and
- Sound groundwater management measures need to be developed based on the results of the impact assessment.

**Impact on Wetland/ Drainage Lines**

A major concern raised by the public is the potential for the exploration activities to have a negative impact on wetland and/or drainage lines. In terms of the relevant legislation, no drilling may take place on or near to wetland and/or drainage lines and furthermore, mitigation measures have been put forward to prevent negative impacts on wetlands and/or drainage lines. As such, this impact has been rated with a low negative significance

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Contamination of groundwater | -5.5 | -2.75 | -4.58 |

***Proposed Mitigation***

- Compliance with the relevant legislation with respect to restrictions on how far drilling may take place with respect to water features. Drilling targets should be explored for outside these protected and sensitive areas.

**Linking of Aquifers in Drilling Process**

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

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Linking of Aquifers in Drilling Process | -7.5 | -5 | -6.75 |

***Proposed 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;
- The correct drilling process should be used and a qualified experienced contractor should be appointed; and
- During drilling, a casing should be installed in the exploration well in line with the MPRDA regulations regarding well design and construction.

#### 8.2.1.3 Generic Geohydrology Mitigation Measures and Sensitivity Mapping

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.
  - Disturbed 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.

Based on the findings of the geohydrology specialist study, a sensitivity map was generated for the geohydrology to be affected by the project. The map is presented in Figure 22 and the components thereof are summarised in Table 27.

**Table 27: Geohydrology sensitivity rating**

| Sensitivity Rating | Description | Weighting | Preference |
|---|---|---|---|
| Least Concern | The inherent feature status and sensitivity is already degraded. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for mining or infrastructure placement. | -1 | Preferrable |
| Low/Poor | The proposed development will have not have a significant effect on the inherent feature status and sensitivity. | 0 | Negotiabl |
| High | The proposed development will negatively influence the current status of the feature. | +1 | Restricted |
| Very High | The proposed development will negatively significantly influence the current status of the feature. | +2 | |

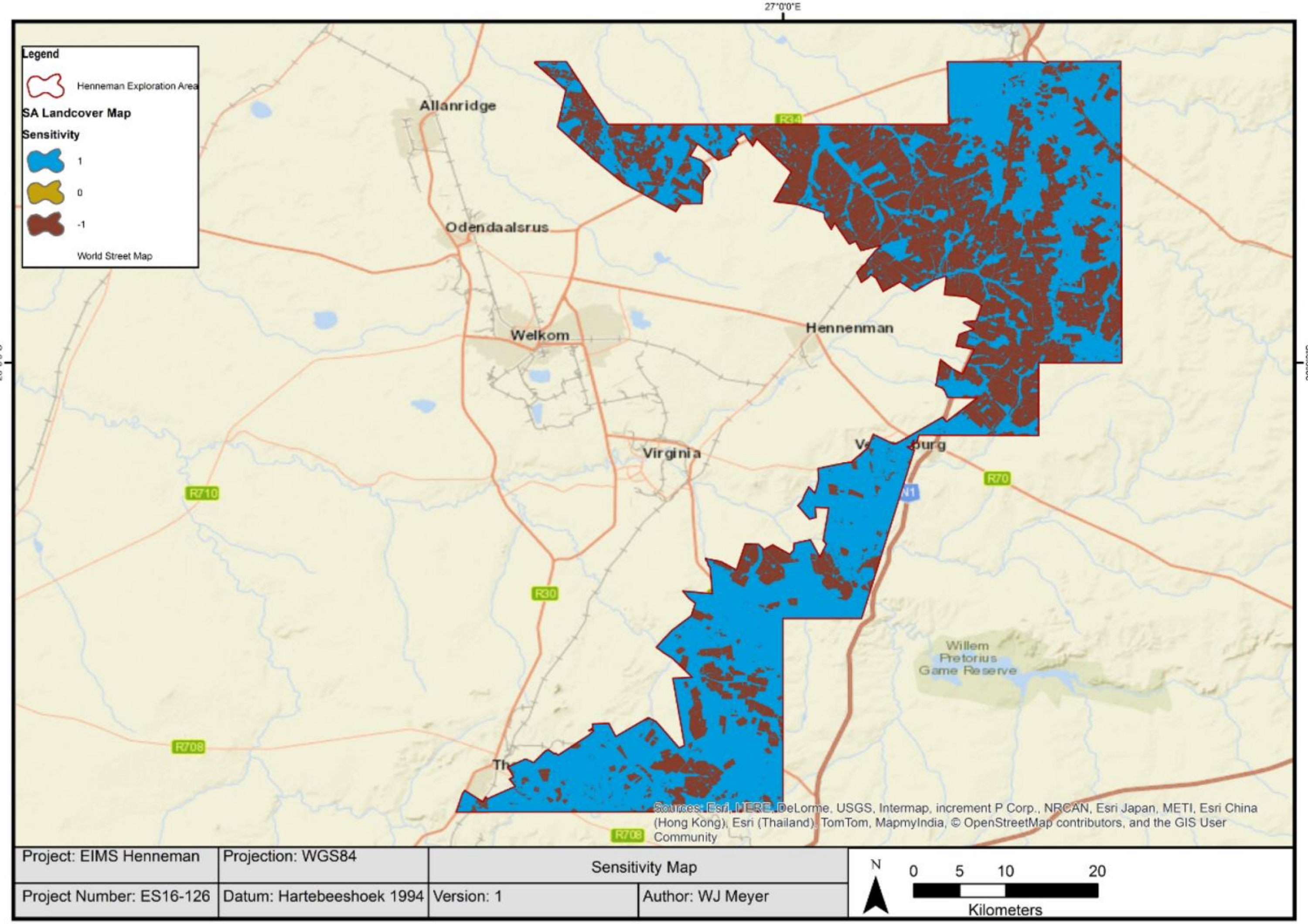


Figure 22: Geohydrology sensitivity map

### 8.2.2 DECOMMISSIONING PHASE IMPACTS

**Air quality / greenhouse gas emissions**

The concerns raised over the possibility of greenhouse gas releases during the decommissioning phase and thereafter has been raised by the public. The MPRDA regulations provide for stringent measures to be included during the drilling and decommissioning phases which measures have been stipulated in the EMPR. The potential short term releases of greenhouse gasses are not anticipated to significantly impact on the regional or global greenhouse gas emissions and as such this impact is rated to have a low negative significance

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Air quality / greenhouse gas emissions | -6 | -1.25 | -1.46 |

Mitigation Measures:

- Ensure that all mitigation measures as stipulated in the EMPR relating to the decommissioning of the wells (specifically technical specifications) as well as the MPRDA regulations are adhered to.

**Surface Water Contamination**

The decommissioning activities may have a similar impact in terms of surface water contamination should appropriate mitigation measures not be implemented. As such, suitable mitigation measures have been put forward and once implemented, this impact would have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Surface Water Contamination | -4.5 | -1.75 | -2.92 |

***Proposed Mitigation***

- Proper stormwater management should be implemented in line with the EMPR;
- The ECO must monitor the decommissioning activities on a day to day basis to ensure that should spills occur, these are immediately cleaned up.

**Ground Water Contamination**

The decommissioning activities may have a similar impact in terms of ground water contamination should appropriate mitigation measures not be implemented. This impact has been raised as a significant concern by the public and as such the prioritization factor has raised the final significance. As such, suitable mitigation measures have been put forward and once implemented, this impact would have a medium negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Ground Water Contamination | -9.75 | -6 | -10 |

***Proposed Mitigation***

- The decommissioning of the wells must be undertaken in line with the MPRDA requirements.
- The ECO must monitor the decommissioning activities on a day to day basis to ensure that the decommissioning is undertaken in line with the legislated requirements.

**Soil compaction**

The work required to decommission the wells may further impact on soil compaction. As such, mitigation measures are put forward to ensure that following decommissioning, the compacted areas are suitably loosened to permit vegetation growth and prevent erosion. This impact is anticipated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Soil compaction | -6 | -4.5 | -4.5 |

Mitigation Measures:

- All areas that are compacted as a result of exploration activities must be assessed by the ECO and where necessary, scarifying must take place to loosen the soil.

**Soil pollution**

The risk of soil pollution and contamination as a result of the decommissioning activities must be managed on a day to day basis to ensure that following rehabilitation, the disturbed areas are not adversely affected. Through the implementation of the mitigation measures put forward, this impact is considered to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Soil pollution | -7.5 | -2.5 | -2.92 |

Mitigation Measures:

- Drip trays must be placed under vehicles as directed by the ECO;
- All grouting or cement should be “ready-mixed” if possible. Alternatively, any mixing must be completed on a temporary impermeable layer or in a container;

- All pouring of cement or grouting should be completed over a temporary impermeable layer to avoid spillage;
- Cleaning of the chute of the cement truck, if applicable, should be done over a temporary impermeable layer; and
- Any spills or leaks must immediately be cleaned up and the contaminated soil suitably disposed of.

**Safety and security**

The potential safety and security issues that could be perceived during the decommissioning phase must be adequately managed as detailed in the EMPR. The risk of tampering with the decommissioned well will be removed through the full plugging of the well with cement and capping of the well below ground. As such, through these measures, this impact is rated as a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Safety and security** | -6.75 | -2 | -2.33 |

Mitigation Measures:

- The decommissioned well must be fully sealed to prevent tampering. This will include plugging the well to it's full depth with cement and capping the well below ground where necessary.
- The contractors are to ensure that they maintain an open and transparent communication with affected landowners to ensure that their presence does not adversely affect safety and security concerns.

**Pollution of the environment through waste**

Upon completion of the exploration activities, all foreign materials including general and hazardous waste must be removed from site and disposed of at a suitably licenced landfill site. Under no circumstances is any form of waste to be disposed of on site. These requirements are detailed in the EMPR and will be legally binding on the contractors. As such, through these measures, this impact is rated as a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Pollution of the environment through waste** | -4 | -1.25 | -1.25 |

Mitigation Measures:

- Upon completion of the exploration activities, all foreign materials including general and hazardous waste must be removed from site and disposed of at a suitably licenced landfill site;

- No empty containers, drums, liner, concrete, foreign sand and stone, scrap materials or any such will remain on site;
- No foreign matter such as rubble or waste material shall be introduced into the hole; and
- Under no circumstances is any form of waste to be disposed of on site.

**Dust generation**

The decommissioning phase is anticipated to have short duration and some wells may be decommissioned immediately following drilling and data acquisition. Due to the short duration of this activity, the low number of vehicles and small scale of this operation, this impact is anticipated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Dust generation** | -6.75 | -3.5 | -3.5 |

Mitigation Measures:

- All vehicles utilising public gravel roads must adhere to the speed limits;

**Increased traffic**

The decommissioning phase is anticipated to have short duration and some wells may be decommissioned immediately following drilling and data acquisition. As such, this phase is not anticipated to significantly contribute to increased traffic in the area. Therefore this impact is anticipated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Increased traffic** | -5.25 | -1.75 | -2.04 |

Mitigation Measures:

- The contractors are to adhere to all traffic rules and regulations.

**Damage to road infrastructure**

The decommissioning phase is not anticipated to result in significant damage to road infrastructure. There will be very few vehicles throughout the exploration and decommissioning phase and as such this impact is anticipated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Damage to road infrastructure** | -5.5 | -1.75 | -1.75 |

Mitigation Measures:

- The contractors are to adhere to all traffic rules and regulations; and
- The ECO should monitor the existing roads conditions prior to exploration and throughout the decommissioning of the wells.

**Noise**

The decommissioning activities may pose the potential for noisy conditions due to machinery and vehicles. The small number of vehicles and temporary decommissioning works are anticipated to result in a noise impact with a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Noise** | -6 | -1.5 | -1.5 |

Mitigation Measures:

- All construction vehicles and machinery must be maintained in good working order; and
- When working or traveling past noise sensitive receptors, no unnecessary hooting or noise should occur.

### 8.2.3 CLOSURE AND REHABILITATION PHASE IMPACTS

**Introduction/ invasion by alien (non-native) species**

During the rehabilitation phase, all disturbed areas must be adequately rehabilitated to the state that they were in prior to exploration. The disturbance will provide a suitable environment for alien and invasive species to flourish and as such, control of these species must be undertaken. This impact is considered to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Introduction/ invasion by alien (non-native) species | -2.5 | -2 | -2.33 |

***Proposed Mitigation***

- The stockpiled topsoil will be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank.
- The ECO must monitor rehabilitation activities to ensure that natural vegetation is returned to all disturbed areas (where natural vegetation occurred prior to exploration); and

- Any alien and invasive species that establish in previously disturbed areas must be controlled to ensure that they are effectively eradicated.

**Altered hydrological regime**

The exploration activities (in particular the core wells and associated surface disturbances) could have the potential to alter the hydrological regime if not adequately rehabilitated. Mitigation measures are presented which when implemented will result in a low negative significance of this impact.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Altered hydrological regime | -1.5 | -1.25 | -1.46 |

***Proposed Mitigation***

- The ECO must monitor rehabilitation activities to ensure that natural vegetation is returned to all disturbed areas (where natural vegetation occurred prior to exploration); and
- Adequate ground cover must be achieved in all disturbed areas to prevent erosion and siltation risks.

**Surface water contamination**

The disturbance of the environment as a result of exploration activities has the potential to cause surface water contamination if not adequately rehabilitated through siltation of watercourses, etc. Mitigation measures are presented which when implemented will result in a low negative significance of this impact.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Surface water contamination | -2.25 | -1.5 | -2.75 |

***Proposed Mitigation***

- The ECO must monitor rehabilitation activities to ensure that natural vegetation is returned to all disturbed areas (where natural vegetation occurred prior to exploration);
- During and after rehabilitation ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment; and
- Adequate ground cover must be achieved in all disturbed areas to prevent erosion and siltation risks.

**Groundwater contamination**

The core wells have the potential to result in groundwater contamination if not adequately decommissioned and closed. Mitigation measures are presented which when implemented will result in a low negative significance of this impact.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| Groundwater contamination | -5 | -1.5 | -2.75 |

***Proposed Mitigation***

- All wells must be closed in compliance with the requirements of the MPRDA technical specifications;
- A suitably qualified expert must oversee the decommissioning and closure of the wells to confirm compliance with the MPRDA technical specifications;
- Ongoing monitoring of the local groundwater quality following closure of the wells must be undertaken until such time as a qualified Geohydrologist confirms that no negative impacts on groundwater quality have been perceived and that the monitoring programme can be suspended.

**Soil stability and pollution**

The exploration activities may have an impact on soil compaction and any spills may impact by polluting the soils. Various mitigation measures have been put forward in the EMPR to prevent pollution of the soils. As such, through these measures, this impact is rated as a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Soil stability and pollution** | -4 | -1.25 | -1.46 |

***Proposed Mitigation***

- All areas that are compacted as a result of exploration activities must be assessed by the ECO and where necessary, scarifying must take place to loosen the soil;
- Drip trays must be placed under vehicles as directed by the ECO;
- Any spills or leaks must immediately be cleaned up and the contaminated soil suitably disposed of;
- Drilling fluids (mud) must be contained in the steel sumps and any spills or leaks must be cleaned up; and

- No domestic and/or hazardous waste, redundant equipment, building or construction waste or any other foreign matter may be introduced or be filled into voids.

**Loss of biodiversity**

Depending on the final location of the exploration activities, there may be an impact on the natural vegetation within the exploration area. Detailed rehabilitation requirements are presented in the EMPR which would ensure that all impacts caused by the exploration activities are adequately rectified. Post exploration monitoring requirements are additionally included in the EMPR to ensure that upon completion of rehabilitation, the affected areas are returned to the pre-exploration conditions. As such, through these measures, this impact is rated as a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Loss of biodiversity** | -6 | -1.5 | -2 |

Mitigation Measures:

- Adequate rehabilitation of all disturbed areas must be undertaken to the conditions (vegetation composition) as before exploration took place;
- Ongoing monitoring of the biodiversity in the rehabilitated areas must be undertaken until such time as the rehabilitation reflects the surrounding environment.

**Erosion**

One of the purpose of rehabilitation is to ensure that the erosion potential of the disturbed areas is minimised. This will be achieved by reinstating the topography to match the surroundings as well as reinstating vegetation cover to match the surroundings. As such, this impacts is anticipated to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Erosion** | -6.75 | -1.5 | -1.5 |

Mitigation Measures:

- Reinstate the topography to match the surroundings;
- Reinstate vegetation cover to match the surroundings;
- Drill sites located on steep topography, ensure that these areas are backfilled and compacted with material removed from such exploration areas;
- All equipment, fencing and other infrastructure will be removed from site; and
- Monitor the reinstated areas to ensure that erosion does not occur.

**Disturbance to wildlife**

During the course of the closure and rehabilitation phase, the contractors must be cognisant of their potential impacts on wildlife (including livestock). This impact is considered to have a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Disturbance to wildlife** | -3 | -1.25 | -1.25 |

Mitigation Measures:

- No unnecessary disturbance of wildlife may be undertaken by the contractors;

**Safety and security**

The potential safety and security issues that could be perceived during the closure and rehabilitation phase must be adequately managed as detailed in the EMPR. As such, through these measures, this impact is rated as a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Safety and security** | -5 | -1.25 | -1.46 |

Mitigation Measures:

- The contractors are to ensure that they maintain an open and transparent communication with affected landowners to ensure that their presence does not adversely affect safety and security concerns.

**Disturbance to communities in vicinity**

The closure and rehabilitation activities may result in minor disturbance to communities in the vicinity of the works. The contractors must be aware of this and ensure that they completed this phase in as short a time as possible. This impact is rated as a low negative significance.

| Impact | Pre-Mitigation Score | Post-Mitigation Score | Final Significance |
|---|---|---|---|
| **Disturbance to communities in vicinity** | -3.5 | -1.5 | -1.5 |

Mitigation Measures:

- All work must be completed in the shortest time possible.

# 9 COMBINED SENSITIVITY MAP

The environmental sensitivity maps created by each of the specialists above have been combined into a consolidated sensitivity map below (Figure 23, Figure 24 and Figure 25). This map will aid in determining the avoidance of sensitive features and the placement of invasive exploration activities to minimise the impact of the proposed project on the environment. The exact placement of these exploration wells will be refined based on the sensitivity of the surrounding sensitivity, the results of further public consultation and additional specialist input during the exploration phase of the project (prior to onsite work).

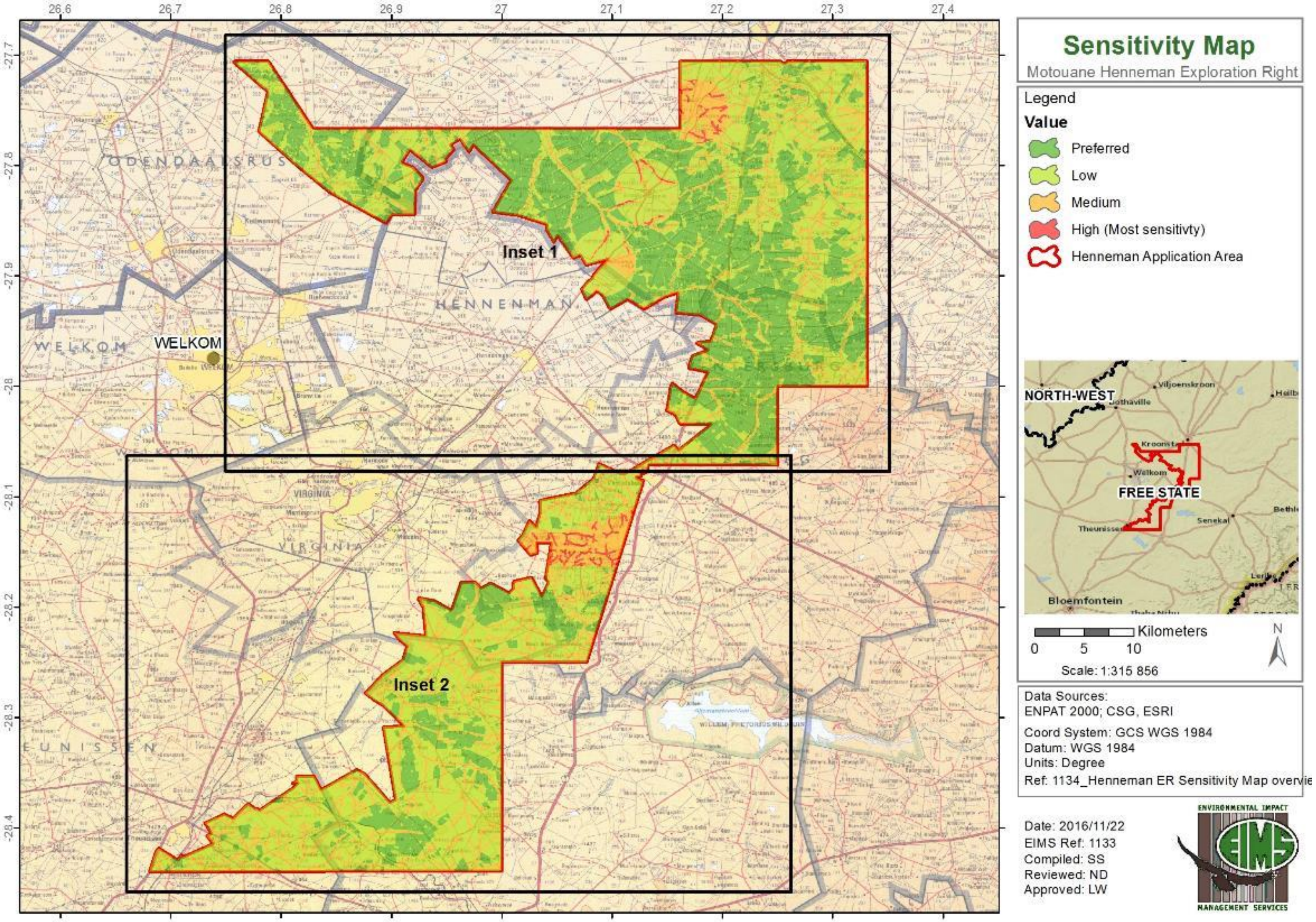


**Figure 23: Overall Sensitivity Map**

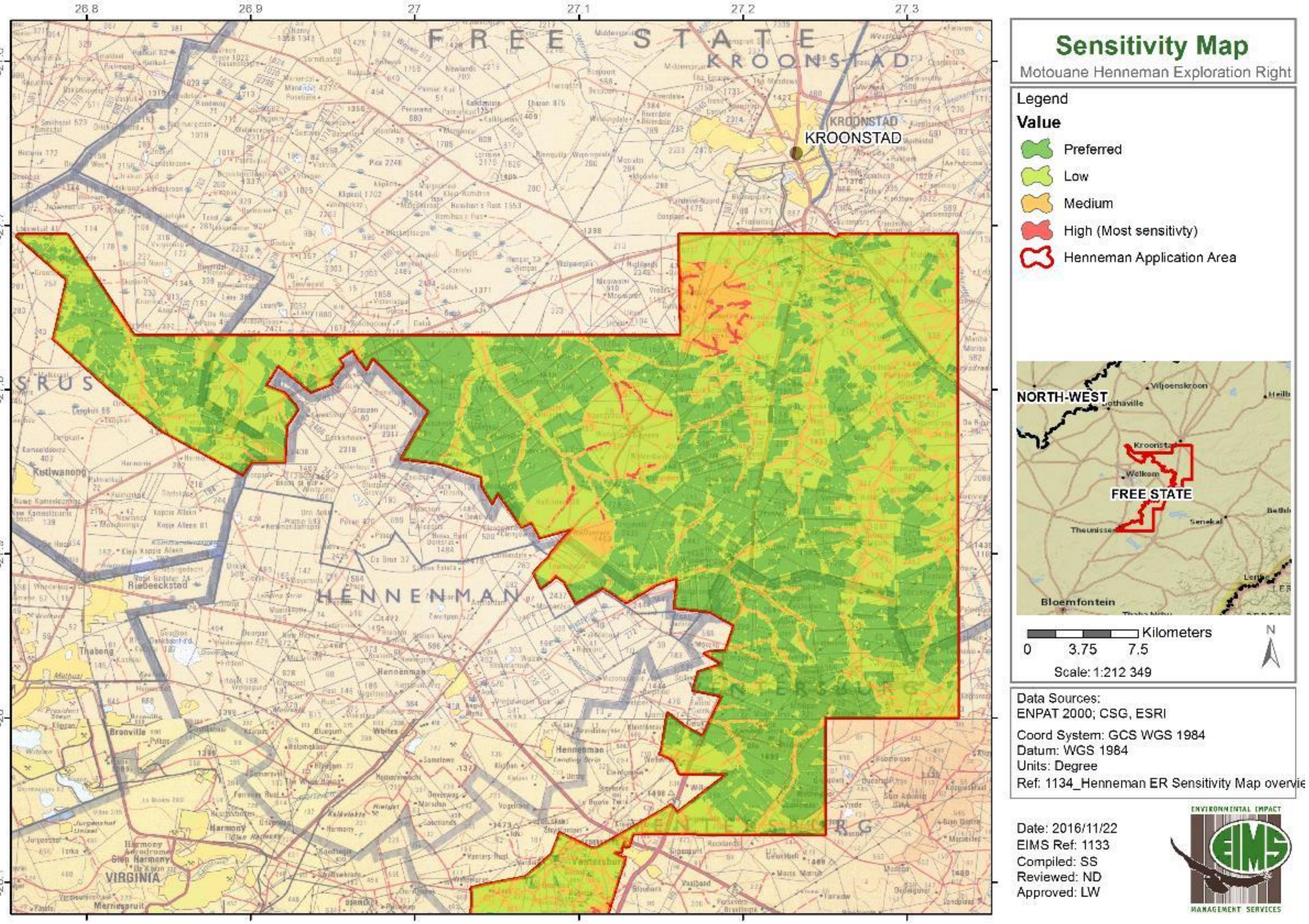


**Figure 24: Sensitivity Map (Northern Section)**

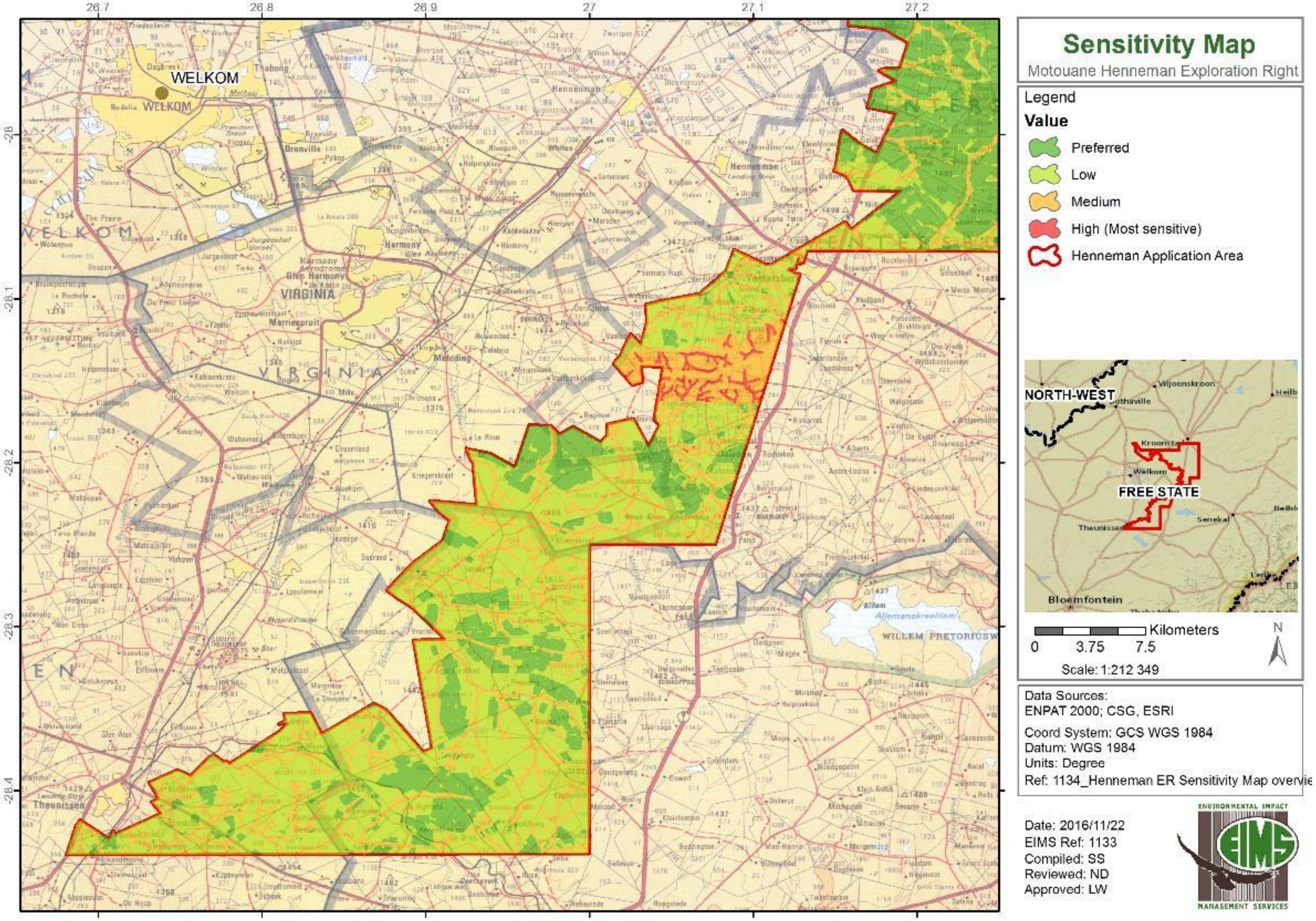


**Figure 25: Sensitivity Map (Southern Section)**

# 10 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

The Applicant has applied for an exploration right over the site assessed in this report and as such, no alternative sites have been assessed.

# 11 STATEMENT MOTIVATING THE ALTERNATIVE DEVELOPMENT LOCATION

The preferred site layout was determined based on the sensitivity maps created by each of the specialists. These were combined to create a consolidated sensitivity map over which the initial site layout was overlayed. Areas of low environmental sensitivity have been highlighted and the applicant is required to restrict all invasive exploration activities to these identified areas.

# 12 SUMMARY OF SPECIALIST REPORTS

A summary of the recommendations from the specialist studies undertaken is provided in Table 28 below.

**Table 28: Summary of specialist recommendations**

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| Ecology and Wetlands | **Key Findings**<br>• The natural habitat on site varies from having low biodiversity value to having relatively high biodiversity value in different parts of the study area.<br>• Mapping from aerial imagery indicates that various parts of the study area have been transformed by cultivation and mining activities and there are significant areas that have been altered by previous cultivation. There are patches of natural habitat still remaining, but most remaining natural areas are associated with the drainages. Remaining patches of Endangered grassland have been classified as having VERY HIGH sensitivity, other natural habitats as having HIGH sensitivity and transformed areas as having LOW sensitivity. | X | Section 7<br>Section 8.2.1<br>Section 16 |

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| | • Up to eight plant species of concern were identified that could potentially occur on site.<br>• There are various vertebrate fauna species of concern that could potentially occur on site.<br>• 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, namely the Giant Bullfrog, listed as protected.<br>• A total of 48 reptile species have a geographical distribution that includes the general study area in which the site is found, but the only species of conservation concern that could potentially occur in the study area are the Giant Dragon Lizard, listed as Vulnerable, and the Striped Harlequin Snake, listed as Near Threatened.<br>• A total of 27 of the bird species with a geographical distribution that includes the site are listed in a conservation category.<br>• There are significant wetland systems on site in which a variety of wetland habitats are contained, including | | |

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| | open water, streams, riparian habitat, reedbeds, marsh wetlands, floodplains, hillslope seeps and pan depressions. These wetland habitats are important in a biodiversity sense in that they provide habitat for a wide variety of plant and animal species of concern.<br>• A preliminary impact assessment indicates that the following impacts are potentially of medium significance for the proposed project:<br>• Loss/destruction of natural habitat,<br>• Flora direct or indirect mortality.<br>**Recommendations**<br>• A more detailed investigation should take place at each proposed drilling site and immediately surrounding areas prior to the activity taking place in order to ensure that no features of ecological concern occur there.<br>• Control measures for some potential impacts are relatively well-known and easy to implement and it is recommended that these be applied as mitigation measures for some potential impacts. | | |

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| Heritage | **Key Findings**<br>The desktop study findings, identified a number of heritage sensitivities. These include the following:<br>• Disturbance / destruction of components of the battlefield on which the Battle of Zand River (7-10 May 1900) took place during the South African War<br>• Disturbance / destruction of possible tangible remains which may be associated with the Boer position at<br>• Boschrand<br>• Disturbance / destruction of black concentration camps at Holfontein, Geneva and Boschrand<br>• Destruction / damage of archaeological sites<br>• Disturbance / destruction of historic buildings and structures<br>• Disturbance / destruction of cemeteries and graves<br>• Disturbance / destruction of unmarked stillborn graves<br>• Disturbance / destruction of palaeontological resources<br>• Disturbance / destruction of Sacred Natural Sites | **X** | Section 7<br>Section 8.2.1<br>Section 16 |

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| | • Disturbance / destruction of Monuments and National Monuments<br>The archaeological and heritage field survey as well as the palaeontological field assessment undertaken around the existing "blower" in the north western section of the exploration footprint area, revealed the following site specific heritage sensitivities:<br>• Disturbance / destruction of the cemetery at HEN 1<br>• Disturbance / destruction of the historic farmstead at HEN 2<br>• Disturbance / destruction of the cemetery at HEN 3<br>• Disturbance / destruction of palaeontological resources<br>**Recommendations**<br>• Drilling near dolerite contact zones should be avoided in order to prevent possible impact on intact groundwater aquifers.<br>• The applicant should appoint a suitably qualified groundwater specialist to establish beforehand that groundwater aquifers will not be negatively affected | | |

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| | before the construction phase of the project commences.<br>• It is necessary to provide a clear explanation of the drilling procedures on the methods that will be followed to prevent hydrocarbons and associated gas from the Ecca and Beaufort Groups from entering groundwater aquifers and polluting them or to avoid the creation of conduits through which deep-seated groundwater could migrate to shallow aquifers. The information must be disseminated to the South African heritage community as well as to all affected communities going forward in reviewing the EIA process.<br>• SAHRA must provide written instruction to the heritage industry as to whether groundwater aspects need to be included in Heritage Impact Assessments.<br>• SAHRA must recommend in writing whether the three recommendations made by Dr. Rossouw must be viewed as mitigation measures of this Heritage Impact Assessment and as a result must be implemented. | | |

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| Geohydrology | **Key Findings**<br>• There are both sensitive and non-sensitive geohydrological zones in the study area. These zones should be differentiated when considering the area and the exploration areas have been established.<br>• Data from the National Groundwater Archive (NGA) indicate that there are at least 56 existing water boreholes drilled in the exploration area. No water quality data is was available for any of the recorded geosites within the NGA.<br>• A baseline hydrocensus was performed in a 3 km radius around the "Hennenman blower" as well as a regional spot hydroncensus to obtain a regional picture of the groundwater quality.<br>• The main activity associated with exploration is diamond drilling, which has a small footprint (less than 0.2 $m^2$ once rehabilitated) and has an insignificant impact on the surface and groundwater quantity and quality. | **X** | Section 7<br>Section 8.2.1<br>Section 16 |

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| | • No fatal flaws or latent groundwater impacts were identified for the exploration core drilling activity, should quality casing be used and a professional grouting job be done when sealing and closing the borehole after sampling. The borehole should be fully grout-sealed all along the casings and open hole (if applicable) from the bottom to the surface.<br>• Potential minor and localized impacts on local aquifers could be from drilling fluids or the linking of layered aquifer systems. The potential of these impacts arising is considered to be low, but the possibility of this occurring should be managed and mitigated. This must be included in the drilling company's standard operational procedures.<br>**Recommendations**<br>• All land use activities in the regional catchment should be done in an environmentally responsible way and within the principle of sustainability. Environmental processes should be followed and a catchment wide | | |

| List of Studies Undertaken | Recommendations of Specialist Reports | Specialist recommendations have been included in the EIA Report | Reference to applicable section of report where Specialist Recommendations have been included |
|---|---|---|---|
| | monitoring programme implemented for all land use activities and by all significant land users.<br>• The precautionary measures as listed in the geohydrology report should continue to be followed.<br>• Any potential wetlands and green riparian zones should be delineated and no drilling should take place in these areas without more detailed specialist ecological and water studies.<br>• The EMP should be followed, especially for the handling of drilling fluids.<br>• Water gains or losses should be recorded on all boreholes drilled.<br>• A water quality monitoring programme should be developed to verify any pre and post drilling impacts.<br>• Regular audits should be done to ensure that the EMP is complied with.<br>• A water user's association (WUA) could be established that can be used as a management authority to consider all users within the regional catchment. | | |

# 13 ENVIRONMENTAL IMPACT STATEMENT

## 13.1 SUMMARY OF KEY FINDINGS

Three specialist studies were undertaken for the proposed Hennenman exploration project. Based on the specialist assessments, it was determined that a number of sensitive features exist within the application area. Below is a brief summary of key findings:

- The site is primarily within two regional vegetation types called Central Free State Grassland and Vaal-Vet Sandy Grassland, with other parts of the study area falling within Winburg Grassy Shrubland, Bloemfontein Karroid Shrubland, Highveld Alluvial Vegetation or Highveld Salt Pans. Vaal-Vet Sandy Grassland is considered in the scientific literature to be Endangered, and 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). Central Free State Grassland is considered in the scientific literature to be Vulnerable, but is not listed as Endangered in the National List of Ecosystems that are Threatened and need of protection (GN1002 of 2011).
- There is no Systematic Conservation Plan for Free State. The SANBI BGIS website provides municipal biodiversity summaries that are based on landcover data, which shows areas transformed versus natural, in combination with existing vegetation and wetland datasets.
- A broad habitat map of the study area was produced by mapping from aerial imagery for this project. This showed that significant parts of the study area have been transformed by cultivation. Remaining natural areas include Grassland, Wetlands and Pans.
- There are seven Red or Orange List plant species that have been recorded from the quarter degree grid in which the study site is situated. All of these were considered to have a medium to high chance of occurring in the type of habitats available on site, one of which is listed as Vulnerable, two as Near Threatened and four as Declining.
- There are two plant species protected according to the National Environmental Management: Biodiversity Act that have a geographical distribution that includes the site. These are *Merwilla plumbea* and *Crinum bulbispermum*, both of which could potentially occur on site.
- There is one protected tree species that could occur in the types of habitats that occur in the study area (*Acacia erioloba*). It is considered to be unlikely to occur on site.
- A total of 66 mammal species have a geographical distribution that includes the general study area in which the site is found. Of the species currently listed as threatened or protected (see Appendix 5 for list of protected species), the following are considered to have a medium to high probability of occurring on site, based on habitat suitability: Brown Hyaena, Spotted-necked Otter, Natal long-fingered Bat, Welwitsch's Hairy Bat, Geoffroy's Horseshoe Bat and the White-tailed Rat. Given the nature of the proposed project and the fact that many of the species of concern are relatively mobile, few threatened, near threatened or protected mammal species are likely to be significantly negatively impacted by activities on the site. The species that could

potentially be affected by habitat disturbance or degradation are the Spotted-necked Otter and the African White-tailed Rat.

- The site contains habitat that is suitable for various frog species, although only one protected species could potentially be affected by activities on site, the Giant Bullfrog.
- A total of 48 reptile species have a geographical distribution that includes the general study area in which the site is found. Two reptile species of conservation concern could potentially occur in the study area, as follows: Giant Dragon Lizard (Vulnerable) and Striped Harlequin Snake (Near Threatened).
- A total of 320 bird species have a geographical distribution that includes the general study area in which the site is found. The site contains habitat that is suitable for various bird species of conservation concern. Those that are potentially 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) and Black-winged Pratincole (NT).
- The site is not adjacent to or within any Important Bird Area for the country.
- A number of heritage sensitive features were identified within the study area and include the Battle of Zand River, Boer Position at Boschrand, Black Concentration Camps, a number of archaeological sites, historic buildings and structures, graves and cemeteries, the possibility of unmarked stillborn graves, and potential palaeontological resources. Furthermore, Monuments and National Monuments occur within close proximity to the exploration area although none were identified within the exploration area.
- The entire site is made up fully or partially of 13 quaternary catchments and located in the Middle Vaal Water Management Area (WMA).
- No major surface water features are located within the proposed exploration area. The Allemanskraal dam is located 21 km south of Ventersburg, however, 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 Affairs and Sanitation (DWS) GIS data.
- The area on which the study area is located is characterised by fractured or secondary porosity hard rock aquifers. Although it is not verified, it is anticipated that locally developed alluvial and weathered aquifers would occur close to the drainages 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).
- Successful boreholes within these fractured-rock aquifers will typically have a safe yield of 0.5 – 2 L/s, but exceptions may occur where safe yields are > 5 L/s. The former mentioned yields are considered as low to 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 baseflow component to streams and rivers.

- Data from the National Groundwater Archive (NGA) indicate that numerous water boreholes have been drilled in the area. 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 measurements. The average water level depth is 17 mbgl, with a maximum and minimum water level measurements of 60 mbgl and 2.44 mbgl respectively. There are no springs on record.
- Groundwater quality (based on the hydrocensus undertaken) is relatively good with few parameters above the standard limits.

Based on Environmental Impact Assessments (EIA) conducted by the various specialists as well as the EAP, the environmental impacts associated with exploration activities are expected to be localised and of low significance, if mitigation measures are implemented. Specialists have recommended several mitigation measures, and proposed suitable monitoring programmes to eliminate and/or reduces environmental impacts. These mitigation measures and monitoring programmes have been included as commitment in the EMPR. The EMPR aims to present management measures that will eliminate, offset or reduce adverse environmental impacts, as well as to provide the framework from environmental monitoring. The primary purpose of the EMPR is to ensure that negative environmental impacts of the proposed project are effectively managed within acceptable limits and that the positive impacts are enhanced.

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.

## 13.2 SUMMARY OF POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS

The exploration for additional domestic hydrocarbon reserves is considered important and any discoveries may 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. An increase in domestic natural gas reserves would also contribute to security of supply in the gas to liquids industry, which currently relies on feedstock from coal, oil and gas reserves. The Governments Integrated Energy Plan 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).

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 terms of negative impacts, a number of potential environmental risks on surface water, groundwater, heritage features, ecology and wetlands were identified by the respective specialists, and include the following:

- Air quality / greenhouse gas emissions
- Altered hydrological regime
- Blockage of seasonal and dispersal movements
- Contamination of groundwater
- Damage/disruption of services
- Displacement of faunal species
- Disturbance of local hydraulic head (water level)
- Disturbance / Destruction of HEN 1
- Disturbance / Destruction of Possible Stillborn Graves at HEN 2
- Disturbance / Destruction of HEN 3
- Disturbance/ destruction of sections of the Battle of Zand River
- Disturbance/ destruction of sections of the Boer position at Boschrand
- Disturbance/ destruction of black concentration camps
- Disturbance/ destruction of archaeological sites
- Disturbance/ destruction of historical buildings and structures
- Disturbance/ destruction of graves and cemeteries
- Disturbance/ destruction of unmarked stillborn graves
- Disturbance / Destruction of National Monuments and Monuments
- Disturbance / Destruction of Palaeontology
- Employment opportunities
- Fauna direct and indirect mortality
- Flora direct and indirect mortality
- Groundwater contamination
- Habitat fragmentation and edge effects
- Hydraulic head decline due to drilling water supply

- Impact on existing infrastructure
- Impact on wetland/ drainage lines
- Interference with existing land uses
- Introduction/ invasion by alien (non-native) species
- Linking aquifers in drilling process
- Loss/ destruction of natural habitat
- Nuisance and impact on sense of place
- Perceptions and expectations
- Pollution of habitats
- Pollution of surface water resources
- Safety and security
- Soil compaction
- Soil pollution
- Soil stability and pollution
- Surface water contamination

However, if the management mitigation measures and proposed monitoring programmes presented in the EMPR are adequately implemented, these management measures would to a great extent eliminate, offset or reduce adverse environmental impacts.

# 14 PROPOSED IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES

The following potential mitigation measures and residual risks have been provided for each environmental aspect assessed. It should be noted that this report will be made available to I&AP's for review and comment, and their comments and concerns will be addressed in the final report submitted to the PASA for adjudication. Furthermore, it should be noted that the results of the public consultation will be used to update the proposed mitigation measures prior to the submission of the finalised EIR and EMPR to the PASA for adjudication.

## 14.1 SOCIO-ECONOMIC

The following preliminary list of potential socio-economic mitigation measures has been identified:

- Ensure all communities that were identified during the EIA, will be consulted with;
- Adhere to an open and transparent communication procedure with stakeholders at all times;
- Ensure that accurate and regular information is communicated to I&APs;
- Ensure that information is communicated in a manner which is understandable and accessible to I&APs;
- Enhance project benefits and minimise negative impacts through intensive consultation with stakeholders; and

- Assemble adequate, accurate, appropriate, and relevant socio-economic information relating to the context of the operation.

## 14.2 HISTORICAL AND CULTURAL ASPECTS

The following objectives have been identified and should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- Ensure that no adverse impacts due to exploration activities are perceived on heritage sensitive sites or features;
- Ensure that all heritage sites or features near to proposed exploration areas are identified prior to commencement with site activities and suitably demarcate these sites or features and educate exploration personnel on the location and limitations associated with these sites or features; and
- Implement and maintain suitable buffer zones around heritage sites or features to prevent adverse impacts on these sites or features.

## 14.3 TOPOGRAPHY

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To maintain the integrity of the landscape as far as possible;
- To ensure drainage lines are not disturbed as far as possible; and
- To create pollution control structures to ensure pollution on site is minimized

## 14.4 SOILS

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To prevent losing soil quality through mixing of usable soil with subsoil horizons;
- To prevent soil loss through erosion;
- To prevent loss of soil quality through contamination with other substances such as hydrocarbons;
- To prevent loss of soil structure through compacting of soil;
- To prevent loss of soil fertility; and
- To prevent water logging of any soils in the area.

## 14.5 LANDUSE

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To limit interference with existing land uses as far as possible during exploration; and

- To maximise potential land use options for post exploration.

## 14.6 LAND CAPABILITY

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To preserve soil so that land capability class can be re-established post exploration.

## 14.7 SURFACE WATER

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- Progressive rehabilitation of disturbed land should be carried out to minimize the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff;
- Traffic and movement over stabilised areas should be controlled (minimised and kept to certain paths), and damage to stabilised areas should be repaired timeously and maintained;
- The total footprint area to be cleared for drilling should be kept to a minimum by demarcating the drilling areas and restricting removal of vegetation to these areas only.
- The placement of drip trays under the drilling rigs should be implemented and recorded to minimize the contamination of waste oil from the drilling rig;
- Oil recovered from the drilling rigs should be collected, stored and disposed of by accredited vendors for recycling; and
- Drilling fluids should be biodegradable and should be kept in a lined mud pit or surface container. Proper rehabilitation and off site removal of excess fluids should take place.

## 14.8 GROUNDWATER

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- Any formation water encountered during the drilling operations must be collected along with drilling fluids and suitably disposed of in line with relevant policies, norms and standards and legislation;
- Construction/drilling should preferably take place during the dry season;
- Excavations should be open for as short period as practically possible and drilling circulation fluid sumps be cleaned out and rehabilitated;
- 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 drilling rig and vehicles are done on site.
- Chemical sanitary facilities should be provided for drilling crew. 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;

- 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 drilling pad or site shall be permitted;
- Chemical storage areas should be sufficiently contained, and the use of chemicals should be controlled;
- The correct type of fluids should be used during the construction phase and the boreholes should be correctly constructed so that no gas leakage occur during the construction or operational phases. Biodegradable drilling fluids should be used wherever possible; and
- The correct drilling process should be used and a qualified experienced contractor should be appointed.

## 14.9 ECOLOGY AND WETLANDS

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- All wetland areas should be avoided by exploration activities, including a suitable buffer zone to minimize or avoid impacts on these areas. According to Regulation 122(3) of the Mineral and Petroleum Resources Development Act – “A well may not be drilled within 1 km of a wetland”;
- In order to comply with the National Water Act (Act 36 of 1998), a formal wetland delineation should be undertaken in order to properly determine the boundaries of wetlands, channels and riparian areas on site;
- A more detailed investigation should take place at each proposed drilling site and immediately surrounding areas prior to the activity taking place in order to ensure that no features of ecological concern occur there;
- Control measures for some potential impacts are relatively well-known and easy to implement and it is recommended that these be applied as mitigation measures for some potential impacts.

## 14.10 FLORA

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To eliminate alien invasive and exotic plants;

- To minimise and limit the destruction or disturbance of vegetation of the proposed exploration areas, and infrastructures such as buildings, offices, roads, haul roads, stockpile areas, and power lines;
- To prevent the destruction of natural and/or pasture vegetation of the surrounding areas that will not be mined or used as roads or for other infrastructures;
- To prevent heavy machinery and light vehicles driving through natural vegetation that will not be disturbed by the proposed activities;
- To prevent the destruction of vegetation in areas prone to soil erosion;
- To remove and relocate any rare and endangered species within the areas where the natural vegetation will be destroyed;
- To prevent the destruction of the vegetation of sensitive areas of the wetlands such as pans and streams and to commit to the conservation of any wetlands adjacent to the exploration area that will not be mined or used during the proposed exploration activity; and
- To prevent any pollution of natural vegetation, wetlands and red data species.

## 14.11 FAUNA

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- Not to alienate, other than in the disturbed exploration areas, the wildlife in the area or to harm any animal life found on the property;
- To prevent the unnecessary destruction of natural habitat and animal life within the boundaries of the exploration area and adjacent areas;
- To prevent animals being killed by speeding trucks, hunting of any kind by any worker, contractor or visitors to the exploration sites;
- To relocate any red data animals that can be removed to a safe place outside the proposed exploration area, and as far as possible record all rare and endangered animals observed; and
- Not to disturb the movement of any mammals, birds, amphibians, insects or reptiles, which tend to move out of the undisturbed and disturbed areas.

## 14.12 AIR QUALITY

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To limit air emissions as far as practically possible;
- To reduce dust emissions from exploration activities to acceptable levels; and
- To reduce to nuisance factor of dust to neighbouring residents.

## 14.13 NOISE

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To reduce noise levels from the exploration activities as far as possible; and
- To reduce noise annoyance to the surrounding community as far as possible.

## 14.14 VISUAL

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To limit the visual impact of exploration and related infrastructure as far as possible during exploration; and
- To enhance the visual aspect and maintain the aesthetics of the region post exploration.

## 14.15 TRAFFIC

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To create safe entry roads into the construction and exploration areas;
- To avoid damage to road infrastructure; and
- To maintain safety to pedestrians and motorists.

## 14.16 HEALTH AND SAFETY

The following objectives should be attained during the exploration, decommissioning, closure and rehabilitation phases of the exploration activities:

- To undertake exploration and ancillary activities in safe and responsible manner so as to protect the safety of people and the environment;
- To management hazardous materials in a safe and responsible manner so as to protect the safety of people and the environment;
- To understand the nature of the activities undertaken and the associated safety risks and to effectively mitigate the risks; and
- To understand the nature of risks to the health and safety of the surrounding community and landowners and to develop effective management measures to avoid and limit these risks and impacts.

# 15 FINAL PROPOSED ALTERNATIVES

The most appropriate development alternative going forward is considered to be Alternative 3: Sensitivity Planning Approach, which utilises the Consolidated Sensitivity Map generated (see Figure 23) with I&AP, specialist, and EIMS input as a planning tool.

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

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

This alternative will allow for the proposed Motuoane Hennenman 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.

# 16 ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION

- The Applicant is to appoint a suitably qualified Environmental Control Officer (ECO) who must oversee the invasive exploration activities and monitor compliance with the EMPR and relevant legislation;
- The specialist reports undertaken as part of the EIA must form an extension of the authorisation/right. All mitigation measures, monitoring protocols, etc. contained in these specialist reports must be complied with;
- Where necessary, relevant specialists must be appointed by the applicant prior to finalisation of the invasive exploration activity locations to undertake more detailed assessments (through ground truthing etc.) and the results of these assessments must be used to update the EMPR, maps, etc.;
- All wetland areas should be avoided by exploration activities, including a suitable buffer zone (minimum 1km or in line with relevant legislation at the time) to minimize or avoid impacts on these areas;
- In order to comply with the National Water Act (Act 36 of 1998), formal wetland delineation should be undertaken around proposed invasive exploration activities in order to properly determine the boundaries of wetlands, channels and riparian areas on site;
- Various servitudes exist within the application area and these must be identified prior to finalising the invasive exploration works in order to ensure that relevant bufferzones around these servitudes are excluded from exploration works. IN line with Regulation 17 (6)(a) of the Mine Health and Safety Act, 1996, no mining operations may be carried out under or within a horizontal distance of 100 metres from buildings, roads, railways, reserves, etc.;
- A more detailed investigation should take place at each proposed drilling site and immediately surrounding areas prior to the activity taking place in order to ensure that no features of ecological concern occur there. If any features of concern are located at any

proposed site or within 100 m, the proposed infrastructure should be re-located or else all possible measures taken to avoid, minimise or offset likely impacts;

- A Rehabilitation Programme should be established before commencing exploration. 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;
- The EMPR must be updated to include the name of the municipality and name of the facilities where solid waste and effluent from the project will be disposed and written agreements from the Municipalities who will receive such waste, indicating adequate capacities, must also be included in the EMPR;
- The water quality monitoring results to verify any pre and post drilling impacts should be submitted to the DWS;
- The applicant must identify the licensed water users who will be consulted for the drilling water and indicate the volumes that will be required before the Authorisation is issued by the DWS;
- The DWS should be appropriately consulted for appropriate authorisation if water will be obtained from a water resource for the exploration works;
- All permanent facilities must be removed upon closure. This will include the associated equipment, material and waste on site;
- Any formation water encountered during exploration drilling must be collected along with the drilling muds and must be disposed of at a suitably licensed waste disposal site;
- Progressive rehabilitation of disturbed land should be carried out to minimize the amount of time that bare soils are exposed to the erosive effects of rain and subsequent runoff;
- Traffic and movement over stabilised areas should be controlled (minimised and kept to certain paths), and damage to stabilised areas should be repaired timeously and maintained;
- The total footprint area to be cleared for drilling should be kept to a minimum by demarcating the drilling areas and restricting removal of vegetation to these areas only;
- The placement of drip trays under the drilling rigs should be implemented and recorded to minimize the contamination of waste oil from the drilling rig;
- Oil recovered from the drilling rigs should be collected, stored and disposed of by accredited vendors for recycling;
- Drilling fluids should be biodegradable and should be kept in a lined mud pit or surface container. Proper rehabilitation and off site removal of excess fluids should take place;
- The proposed monitoring protocols presented in this EIA report as well as in the various specialist reports must be utilised to develop a detailed monitoring protocol prior to site exploration activities commencing;
- Drilling near dolerite contact zones should be avoided in order to prevent possible impact on intact groundwater aquifers;

- The applicant should appoint a suitably qualified groundwater specialist to establish beforehand that groundwater aquifers will not be negatively affected before the construction phase of the project commences;
- It is necessary to provide a clear explanation of the drilling procedures on the methods that will be followed to prevent hydrocarbons and associated gas from the Ecca and Beaufort Groups from entering groundwater aquifers and polluting them or to avoid the creation of conduits through which deep-seated groundwater could migrate to shallow aquifers. The information must be disseminated to the South African heritage community as well as to all affected communities going forward in reviewing the EIA process;
- SAHRA must provide written instruction to the heritage industry as to whether groundwater aspects need to be included in Heritage Impact Assessments;
- SAHRA must recommend in writing whether the three recommendations made by Dr. Rossouw must be viewed as mitigation measures of this Heritage Impact Assessment and as a result must be implemented;
- The planning of additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional exploration footprints;
- As soon as the additional exploration footprints are confirmed, a suitably qualified heritage specialist, with expertise in archaeology, must be appointed. Such additional exploration footprints include drilling positions, and localities where geochemical and soil samples are to be taken;
- The applicant must ensure that a risk assessment is conducted prior to the aerial activities and that provision is made for liability cover where relevant;
- The appointed heritage specialist will be responsible for undertaking heritage walkthroughs of the additional exploration footprint areas to identify any heritage sites located there;
- The appointed heritage specialist must be notified in writing of the commencement of the Construction and/or Operation Phases of the Exploration; and
- The conditions contained in all specialist reports as well as the EIR and EMPR must be binding on the Applicant throughout the exploration phase.

# 17 REHABILITATION REQUIREMENTS

The following commitments are considered to be extremely important to ensure negative impacts are effectively mitigated and should be specifically included as conditions in the Authorisation.

- A Rehabilitation Plan that complies with the framework, guidelines and principles presented in this EMPR must be developed and implemented prior to any onsite invasive exploration works being undertaken. This Rehabilitation Plan must be submitted to the competent authority for approval prior to implementation.

# 18 ENVIRONMENTAL IMPACT ASSESSMENT ASSUMPTIONS AND LIMITATIONS

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

## 18.1 HERITAGE AND CULTURAL RESOURCES

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

- At the time of the fieldwork, the only confirmed exploration footprint was a circular area some 314 hectares in extent within which an exploration drilling site (and possible associated impacts such as access roads) will be established. Any exploration footprints additional to this circular area were not assessed. Once such additional exploration footprints are proposed, additional heritage fieldwork and reporting will have to be undertaken.
- It is important to note that the heritage resources and sites identified during the desktop study component of the study do not necessarily represent the entire heritage site database of the study area. As such, a more detailed footprint-specific heritage inventory would be required of exploration footprints additional to the one assessed as part of this report.
- PGS Heritage is aware that the opinion has been raised that groundwater aquifers could be recognised within the auspices of the National Heritage Resources Act and National Water Act as geological formations of National and Cultural Heritage Importance. No written guidelines or instructions regarding the inclusion of aspects relating to groundwater in heritage impact assessment reports had yet been received from national and provincial heritage authorities. PGS Heritage requests these heritage authorities, and especially the South African Heritage Resources Authority, to provide the heritage industry with a clear indication of its views on this matter and provide its recommendation as to whether these groundwater aspects need to be included in heritage impact assessments or not. It is the opinion of PGS Heritage that we as archaeologists and heritage specialists do not have the necessary education nor experience to identify groundwater sensitivities, calculate impact risks or outline suitable groundwater mitigation measures. With this as background, any aspects relating to groundwater were excluded from the present report. Please note that the matter of Sacred Natural Sites (and especially Sacred Water Sites) was included in this report as such sites are not only groundwater-related, but has specific and direct cultural association and significance. This said, the discussion on Sacred Natural Sites included in this report was primarily obtained through discussions with the project Geohydrologist Reuben Grobler. A combined set of mitigation measures regarding the identification and avoidance of such sites during exploration work were agreed upon by both the heritage and groundwater specialists. These mitigation measures are

included in this report. However, please note that the matter of the possible impact on Sacred Natural Sites was not taken through the impact risk calculations of this report as such impacts on sites such as springs and fountains are expected to be addressed in the geohydrological report.

- Fieldwork undertaken of the proposed exploration footprint area excluded that section of the farm Harmonia 282 that is located within the footprint area. This was due to access limitations at the time of the fieldwork.
- It is understood that no well stimulation (e.g. fracking) is to take place during this exploration activity. It must be clearly understood that the author of this report, and PGS Heritage, does not stand by this report or its recommendations should such well stimulation (e.g. fracking) be proposed or undertaken during the exploration work.
- 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.
- Due to the massive extent of the study area assessed during the desktop study component of this work (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 and HIA reporting focussed on any exploration footprints additional to the one assessed as part of this report, would be required.
- Although the terms National Monuments are used in the HIA report, it is understood by the author that most, if not all, of the National Monuments declared before the promulgation of the National Heritage Resources Act, are now proclaimed Provincial Heritage Sites.
- For the purposes of this report, and especially in terms of the proposed mitigation measures and action plan, a 'heritage specialist' is viewed as someone with experience in archaeology. Similarly, when the term 'archaeologist' is used in these sections, the understanding is that such a person has experience in heritage impact assessments as well.

## 18.2 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.
- The fact that the study area was so large has made it difficult to assess potential sensitivity at a local scale. The sensitivity assessment is therefore considered to be very course and needs to be done in more detail in the areas surrounding the locations of proposed activities, once these are known.
- The location of drilling sites was unknown at the time that this impact assessment was undertaken.

## 18.3 GROUND WATER

The findings of the geohydrological EIA study indicated the following assumptions and limitations:

- The entire area was assessed at desktop study level with regards to geology and geohydrology. Once exploration borehole locations are known, geological and geohydrological sites assessments should be performed to check for no major faults or geological structures or sensitive geohydrology.
- Locations of exploration boreholes where not available during the time of the baseline and scoping and EIA 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. Groundwater quality samples were however taken during the hydrocensus and selected samples analysed.
- Sensitive areas such as wetlands and drainages should be viewed as off limits when exploration targets are finalised.

# 19 REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

Exploration success could 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. An increase in domestic natural gas reserves would also contribute to security of supply in the gas to liquids industry, which currently relies on feedstock from coal, oil and gas reserves. The Government's Integrated Energy Plan 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 reserves is considered an important step 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.

Due to the nature of the activity, potential impacts are expected to be localised. Based on specialist EIA results, the potential impacts that have been identified, will have a low significance if exploration impacts are mitigated correctly. The EMP/EMPR aims to present management measures that will eliminate, offset or reduce adverse environmental impacts, as well as to provide the framework for environmental monitoring. Furthermore, the requirements put forward for the relevant specialists to undertake further assessments once the preliminary exploration activities have identified actual exploration locations will assist in more detailed and specific mitigation measures to protect any sensitive receptors. Based on the various impact assessments as well as the mitigation measures put forward during the course of this EIA, it is the opinion of the EAP that this activity should be authorised with conditions attached.

# 20 PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

The Environmental Authorisation is required for five (5) years.

# 21 FINANCIAL PROVISION

For a detailed description of the financial provision and costings for the proposed Motuoane Hennenman Exploration Project, please refer to Appendix E for a stand-alone Final Rehabilitation, Decommissioning and Closure Plan.

# 22 DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY

In terms of the Approved Scoping Report and Plan of Study, no deviations were undertaken. However, based on public input to date, additional impacts have been assessed during the EIA phase.

# 23 DEVIATIONS FROM THE METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

No deviations in the impact assessment methodology were undertaken.

# 24 OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

The following information was requested from the competent authority:

- The various state departments must be consulted and their comments incorporated in the EIR befoe submission to the Agency. State Departments/ Agencies to be consulted include amongst other the Provincial Heritage Resources Authority/Agencies to be consulted include amongst others the Provincial Heritage Resources Authority/ South African Heritage Resources Agency, Provincial Environmental Department, Department of Agriculture, Forestry and Fisheries (DAFF), Department of Water and Sanitation (DWS), Department of Land Affairs (DLA), district and local municpalities. Should you be unable to obtain comments, proof of attempts made to obtain comments should be submitted to the Agency. **All relevant state departments have been consulted with and comments included in this report.**

- Objections raised by all Interested and Affected Parties (I&APs) must be addressed and taken into consideration during the development of the EIR. **The various objections received to date have been addressed and included in the EIR.**
- Where desktop studies are used during environmental assessment, they must be authenticated by physical assessment in order to provide definite characteristics of the proposed exploration area. In this regards, you and the specialist are required to undertake physical site assessment of the application are and present the results thereof in the EIR. **Site visits were undertaken in order to further inform this EIR.**
- The description of the proposed exploration activities in the FSR is inadequate as it does not include information relating to the duration of the proposed activities, size of the geochemical and soil sampling area; type of equipment to be used during exploration operations; use of drilling fluids during drilling operations and method to be used for the selection of borehole sites. **The description of the exploration activities has been expanded upon in line with the above requirements.**
- Section 24 P of the NEMA requires that an applicant for an environmental authorisation relating to prospecting, mining or production must, before the Minister responsible for mineral resources issues the environmental authorisation, comply with the prescribed financial provision for the rehabilitation, closure ad ongoing post decommissioning management of negative environmental impacts. Therefore, the potential environmental liabilities associated with the proposed activity must be quantified and indicate the method of financial provision in line with the National Environmental Management Act (1998): Regulations pertaining to the financial provision for prospecting exploration, mining and production, (2015). **The financial provision costs have been included in the Final Rehabilitation, Decommissioning and Closure Plan which is contained in Appendix E.**

# 25 COMPLIANCE WITH THE PROVISIONS OF SECTIONS 24(4)(A) AND (B) READ WITH SECTION 24(3)(A) AND (7) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998) THE EIA REPORT MUST INCLUDE THE:

## 25.1 IMPACT ON THE SOCIO-ECONOMIC CONDITIONS OF ANY DIRECTLY AFFECTED PERSON

The potential impacts on the socio-economic conditions have the potential to include:

- Perceptions and expectations of the proposed exploration activities;
- Interference with existing land uses;
- Impacts on services;
- Job creation;
- Damage to road infrastructure; and
- Nuisance and impact on sense of place.

The EIA/EMPR has further assess these impacts and has provided detailed mitigation and management measures to minimise (or enhance where possible) the positive and negative socio-economic impacts of the proposed exploration activities on any directly affected person.

Further to the above, it must be noted that I&AP's, including directly affected parties such as landowners, have the opportunity to review and comment on this EIR and EMPr report. The results of the public consultation shall be included in the final EIR and EMPR report to be submitted to the PASA for adjudication.

## 25.2 IMPACT ON ANY NATIONAL ESTATE REFERRED TO IN SECTION 3(2) OF THE NATIONAL HERITAGE RESOURCES ACT

The Heritage Impact Assessment has revealed that the study area and surrounding landscape has a long and diverse historical and archaeological history and that archaeological and historical sites and material occurs within the study area. The research has also identified specific possible heritage sensitive areas within and adjacent to the study area, namely:

- Components of the battlefield on which the Battle of Zand River (7-10 May 1900) took place during the South African War;
- Possible tangible remains which may be associated with the Boer position at Boschrand;
- Black concentration camps at Holfontein, Geneva and Boschrand;
- Archaeological sites;
- Historic buildings and structures;
- Cemeteries and graves;
- Potential for unmarked stillborn graves to occur around foundation structures of old buildings;
- Potential for palaeontological resources to occur within the subsurface geology;
- Potential for sacred natural sites to occur within the study area (although none have yet been confirmed;
- Monuments and National Monuments including:
    - Early Sotho Settlement, Waterval, Sandriviershoogte - 558 m outside the exploration right area;
    - Place where the Sand River Convention was signed - 530 m outside the exploration right area;
    - Stone Rampart and Voortrekker Graves, Ventersburg - 57 m outside the exploration right area; and
    - Matloang Archaeological Site - 1 650 m outside the exploration right area.

These heritage resources are presented in relevant sections of this report, have been included in the impact assessment and suitable mitigation measures put forward to prevent adverse impacts on these resources.

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

This Environmental Impact Report forms proof that an investigation as required by Section 24(4)(a) and (b) of the Act (NEMA) is being undertaken for the proposed Motuoane Hennenman Exploration Right Project. The EIA/EMPR further assesses the preferred alternative as identified in this report.

# 27 TECHNICAL SUPPORTING INFORMATION

The following Appendices form addendums to this report:

**Appendix A: Details of the EAP**

**Appendix B: Project Maps (A3 for higher resolution)**

**Appendix C: Public Participation**

**Appendix D: Specialist Reports**

**Appendix E: Final Rehabilitation, Decommission and Closure Plan**

**Appendix F: Impact Assessment Matrix**

# SECTION 2: ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

This section details the Environmental Management Programme (EMPR) for implementation during the exploration phase.

# 28 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 Hennenman. 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).

In accordance with Regulation 16 of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014, an application for Environmental Authorisation (EA) must be submitted to the PASA in support of the application for an exploration right. 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 Regulations 21 and 23 of the NEMA. Additionally, I&AP's must be notified and consulted as per Chapter 6 of the NEMA Regulations (GN R982).

# 29 PURPOSE OF THIS DOCUMENT

This document represents the Environmental Management Programme (EMPR) for the proposed Exploration Right Application for hydrocarbons in 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. The EMPR contains the following information:

- A description of the work programme and proposed activities;
- An assessment of the potential positive and negative impacts of the proposed activities; and
- An Environmental Management Plan to manage and/or mitigate potential negative impacts.

The EMPR aims to present management measures that will eliminate, offset or reduce adverse environmental impacts, as well as to provide the framework from environmental monitoring. The primary purpose of the EMPR is to ensure that negative environmental impacts of the proposed project are effectively managed within acceptable limits and that the positive impacts are enhanced.

# 30 REPORT STRUCTURE

This report has been compiled in accordance with the 2014 NEMA EIA Regulations. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 29 below.

**Table 29: Report Structure**

| Environmental Regulation | Description | Section in Report |
|---|---|---|
| **NEMA Regulation 982 (2014)** | | |
| **Appendix 4(1)(a):** | Details of – | |
| | i) The EAP who prepared the report; and | Section 31 |
| | ii) The expertise of the EAP, including a curriculum vitae; | Section 31.1 |
| **Appendix 4(1)(b):** | A detailed description of the aspects of the activity that are covered by the EMPR as identified in the project; | Section 32.1 |
| **Appendix 4(1)(c):** | A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers; | Section 32 |
| **Appendix 4(1)(d):** | A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including –<br>i) Planning and design;<br>ii) Pre-construction activities; | Section 34 |

| | | |
|---|---|---|
| | iii) Construction activities;<br>iv) Rehabilitation of the environment after construction and where applicable post closure; and<br>v) Where relevant, operation activities; | |
| **Appendix 4(1)(e):** | A description and identification of impact management outcomes required for the aspects contemplated in paragraph (d); | Section 34.3 |
| **Appendix 4(1)(f):** | A description of proposed impact management actions, identifying the matter in which the impact management objectives and outcomes contemplated in paragraph (d) and (e) will be achieved, and must, where applicable, include actions to –<br>i. Avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;<br>ii. Comply with any prescribed environmental management standards or practices;<br>iii. Comply with any applicable provisions for the Act regarding closure, where applicable; and<br>iv. Comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable; | Section 34 |
| **Appendix 4(1)(g):** | The method of monitoring the implementation of the impact management actions contemplated in paragraph (f); | Section 40 |
| **Appendix 4(1)(h):** | The frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f); | Section 40 |
| **Appendix 4(1)(j)** | An indication of the persons who will be responsible for the implementation of the impact management actions; | Section 40.4 |

| | | |
|---|---|---|
| **Appendix 4(1)(j):** | The time periods within which the impact management actions contemplated in paragraph (f) must be implemented; | Section 40.5 |
| **Appendix 4(1)(k):** | The mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f); | Section 40 |
| **Appendix 4(1)(l):** | A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations; | Section 40.12 |
| **Appendix 4(1)(m)** | An environmental awareness plan describing the manner in which – <br> i. The Applicant intends to inform his or her employees of nay environmental risk which may result from their work; and <br> ii. Risk must be dealt with in order to avoid pollution or the degradation of the environment; | Section 40.15 |
| **Appendix 4(1)(n)** | Any specific information that may be required by the competent authority. | Section 41 |

# 31 DETAILS OF THE EAP

Environmental Impact Management Services (Pty) Ltd (EIMS) has been appointed by Motuoane Energy (Pty) Ltd. to act as the Independent Environmental Assessment Practitioner (EAP) and to assist in preparing and submitting the EA application, Scoping and Environmental Impact Report (and EMPR), and undertaking a Public Participation Process (PPP) in support of the Motuoane Hennenman Exploration Right application. The contact details of the EIMS consultant who compiled the report are as follows:

Name of the Practitioner: Bongani Khupe

Tel No.: 011 789 7170

Fax No.: 011 787 3059

E-mail address: FSMotuoane@eims.co.za

## 31.1 EXPERTISE OF THE EAP

### 31.1.1 QUALIFICATIONS OF THE EAP

In terms of Regulation 13 of the 2014 EIA Regulations (Government Notice R. 982), an independent Environmental Assessment Practitioner (EAP), must be appointed by the applicant to manage the application. EIMS has been appointed by the Applicant as the EAP and is compliant with the definition of an EAP as defined in Regulation 13 of the EIA Regulations (GN R982). This includes, inter alia, the requirement that EIMS is:

1. Objective and independent;
2. Has expertise in conducting EIA's;
3. Comply with the NEMA, the Regulations and all other applicable legislation;
4. Takes into account all relevant factors relating to the application; and
5. Provides full disclosure to the applicant and the relevant environmental authority.

**Mr. 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

**Mrs Sonja van de Giessen** is a Senior Environmental Scientist and holds a Bachelor of Science Honours degree and is currently working towards her Master Degree in Environmental Management.

The declaration of independence of the EAP and the Curriculum Vitae (indicating the experience with environmental impact assessment and relevant application processes) of the consultants that were involved in the Scoping and EIA process and the compilation of this report are attached as Appendix A

### 31.1.2 SUMMARY OF THE EAP'S PAST EXPERIENCE

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.

Mr. Khupe's 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 energy 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).

Mrs van de Giessen has more than three years of experience in environmental impact assessments and environmental management. Her core experience and expertise is in the mining industry sector, focusing on Environmental Impact Assessments, Environmental Management Programmes, Water Use

Licence Applications and Integrated Water and Waste Management Plans, and Environmental Auditing. Her involvement in such projects varies from project management, to the compilation of technical and environmental documentations and reports. Sonja is registered as a trainee certified natural scientist in the field of environmental science with SACNASP.

## 31.2 SPECIALIST CONSULTANTS

Three specialist studies were undertaken to address the key issues that required further investigation, namely the impact on ecology and wetlands, 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 8.1). Specialists also recommended appropriate mitigation / control or optimisation measures to minimise potential negative impacts or enhance potential benefits, respectively. The specialists appointed for the proposed Motuoane Hennenman Exploration Project are indicated in Table 30 below.

**Table 30: 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 |

# 32 EXPLORATION AREA

The proposed Motuoane Hennenman Exploration Project is located over an area of approximately 149 377 hectares (ha), covering various farms within the Free State Province. The project site extends north from approximately Theunissen, north east towards Kroonstad, and east of Virginia and Hennenman. 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 locality of the proposed Motuoane Hennenman Exploration Project is indicated in Figure 26 below.

The exploration activities will not take place across the entire region. 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 X (30mx30m) drill sites which cover a totally area approximately 0.27 ha excluding associated access roads. It is necessary in such early phase exploration 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. Details of the properties which make up the exploration right application area is attached as Appendix B.

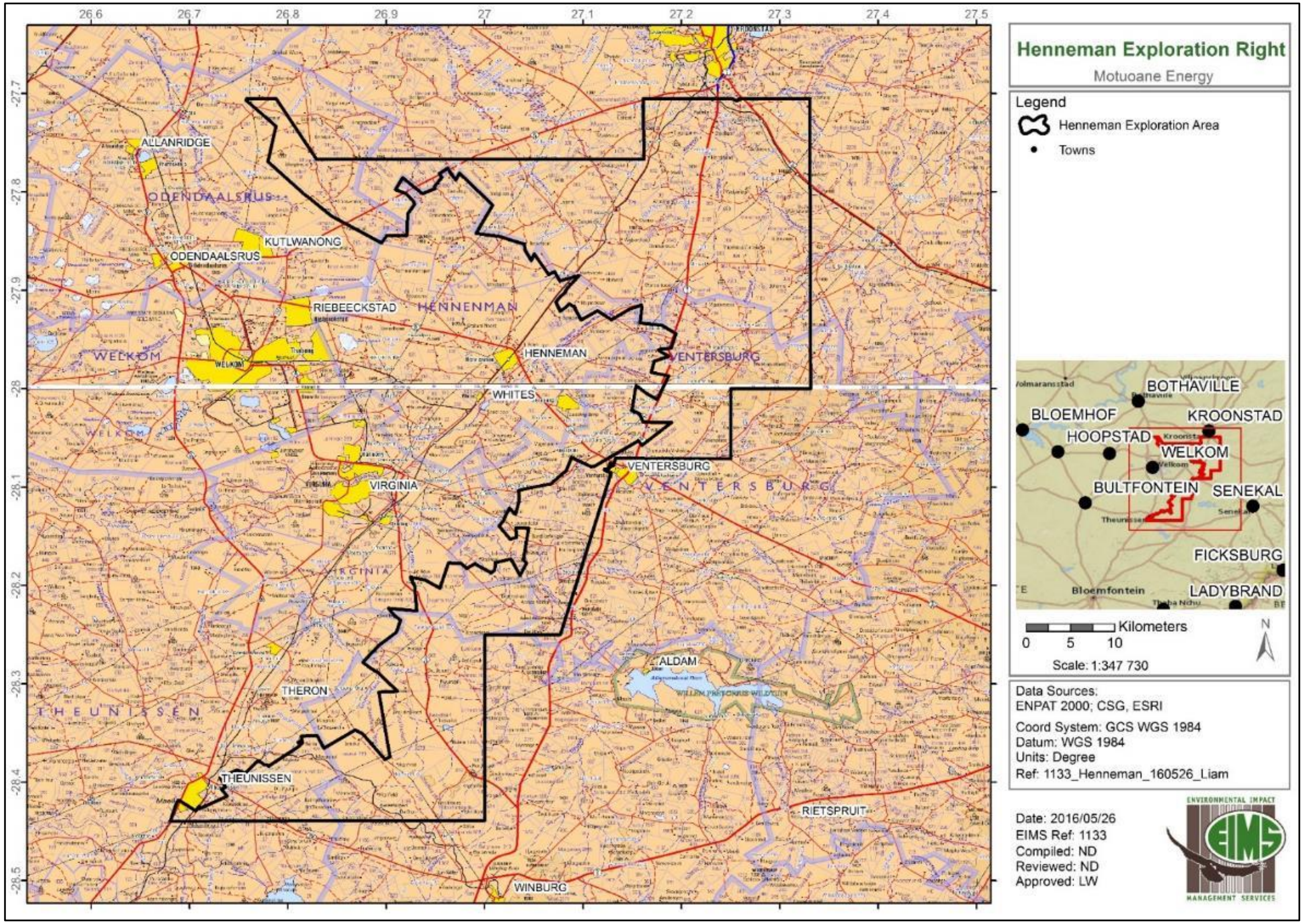


**Figure 26: Locality map of the proposed project**

## 32.1 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

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

- Background data collection and data management
- Geological mapping
- Geochemical soil sampling Diamond core drilling

The proposed, if approved, will allow Motuoane Energy to determine if there is an economically viable resource available in the area. Objectives of the Exploration Work Programme

- The Exploration Work Programme serves as a guideline for the development of a good understanding of the baseline environment and geological formations within the application area, in order to develop a geological model of the area;
- Delineate the extent of potential gas reserves by utilising all the available information gathered during the primary data capture phase;
- Determine and establish the geographic extent of existing boreholes within and surrounding the application area, in order to elaborate on the groundwater baseline and determine where gas may be present in water;
- Utilise all the information gathered during the data capture phase through a combination of literature research, desktop studies, geological mapping and specialist input, in order to identify area with hydrocarbon potential; and
- Should the initial phases indicate prospective areas, a detailed planning (including specialist input) of the execution of the exploration work programme can be conducted.

### 32.1.1 LISTED AND SPECIFIED ACTIVITIES

The following table presents a summary of the listed activities associated with the proposed project.

**Table 31: Summary of the listed activities**

| Name of Activity | Aerial Extent of Activity (Ha or $m^2$) | Listed Activity | Applicable Listing Notice |
|---|---|---|---|
| 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 – | Minimum of 0.27 ha (excluding access roads) | X | GNR 983 of 4 December 2014 |

| | | | |
|---|---|---|---|
| ○ The undertaking of a linear activity; or<br>○ Maintenance purposes undertaken in accordance with a maintenance management plan. | | | |
| 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. | 149 377 ha | X | GNR 984 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.<br>(a) In Eastern Cape, Free State, Gauteng, Limpopo, North West and Western Cape Provinces;<br>i. Trans-frontier protected areas managed under international conventions;<br>ii. Community Conservation Areas; | Minimum of 0.27 ha (excluding access roads) | X | GNR 985 of 4 December 2014 |

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;<br><br>x. Sites or areas identified in terms of an International Convention;<br><br>xi. Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose;<br><br>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<br><br>xiii. In an estuarine functional zone. | |

## 32.2 DESCRIPTION OF ACTIVITIES TO BE UNDERTAKEN

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

**Table 32: Exploration Activities**

| Main Activity/Action/Process | Ancillary Activity |
|---|---|
| **Non-invasive exploration** | Background data collection and data management |
| | Geological and geophysical logging |
| **Invasive exploration** | Geotechnical and soil sampling |
| | Diamond core drilling |

Each of the above mentioned activities presented in Table 32 are described in more detail in the subsequent subsections.

## 32.3 NON-INVASIVE EXPLORATION ACTIVITIES

### 32.3.1 PROJECT DATABASE ESTABLISHMENT AND MANAGEMENT

During the first year of the exploration right period it is envisaged that potentially affected landowners will be identified and contacted in preparation for the ground exploration activities. Gas emitting boreholes will be sought if they exist, photographed, measured and analysed. Meetings will be set up with mining companies in the vicinity to see if they have had any experience with gas and gas emitting boreholes. Any gas emitting boreholes found will then be mapped.

In order to acquire information from the existing gas wells, wellhead control and measurement equipment will be designed and installed to measure pressure, flow rate and collect gas samples for analysis. In addition, gravity/magnetic data will be obtained and analysed and new lines might be flown if required using a light aircraft or drone (this will comply with the necessary CAA restrictions and requirements). Any available cores and cuttings from previous mining/exploration activities will also be analysed.

During the second year of exploration geophysical data will be acquired and reprocessed where practical so as to analyse and interpret the data. Surface mapping (surface geological features and outcrops) of the various parts of the Exploration area will also commence during the second year. Data from surface mapping along with year one data gathered will be analysed and geological maps prepared.

Reservoir studies using magnetic, geological and geophysical data will be conducted. In addition, analyses (including Isotope work to determine type of gas) on gas samples taken will also be undertaken.

### 32.3.2 GEOLOGICAL AND GEOPHYSICAL LOGGING

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 (surface geological features and outcrops) will be integrated into maps. These activities will be undertaken within the second and third year of exploration.

## 32.4 INVASIVE EXPLORATION ACTIVITIES

### 32.4.1 GEOTECHNICAL AND SOIL SAMPLING

Once the magnetic geological and geophysical data has been analysed this information will delineate the areas susceptible for geotechnical and soil sampling. This process involves the removal of small sections of the soil profile using a soil auger drilling to a depth between 15 and 30 centimetres. 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 analysis to determine the presence of hydrocarbon tracing and microbes.

### 32.4.2 DIAMOND CORE DRILLING

During the third year using the data gathered during the preceding two years the first core drill hole will be sited. A further two holes will be drilled, each hole position being guided by the results of the previous hole. The core from these holes will be logged and geophysical logging carried out on the open holes.

The project will involve the drilling of three (3) wells in locations still to be identified as described above, to a depth of approximately 700 m, commencing with a 203mm hole cased with 152mm casing for the loose top material (conductor casing), followed by 122.6mm hole cased with 114mm casing to isolate ground water (surface/intermediate casing) and finally 96mm cased with 89mm casing for the target formation (production casing). Each borehole will be steel cased and cement grouted to prevent groundwater seepage. Drilling activities are estimated to be one week per hole during which time there will be a drill rig, a service truck and an LDV on site. Intermittent use of a TLB will be used during site establishment and demobilisation. In order to establish the gas contents a mobile desorption laboratory will be established.

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 consisting of drilling foams and Bentonite. 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 plugged entirely or left as is for future analysis. Regardless of which 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.

## 33 POLICY AND LEGISLATIVE CONTEXT

A summary of the specific applicable legislation is provided in Table 33 below. More detail on the legislative framework is presented in Section 33.1 below.

**Table 33: Applicable Legislation**

| Applicable Legislation and Guidelines | Reference Where Applied | How does this Development Comply with and Respond to the Legislation and Policy Context |
|---|---|---|
| **National Environmental** | This report is prepared as part | In terms of the National Environmental Management |

| | | | |
|---|---|---|---|
| | **Management Act (NEMA):**<br><br>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. | of the Application for Environmental Authorisation under the NEMA. | Act an Application for Environmental Authorisation subject to a Scoping and EIA Process has been applied for. |
| | **Minerals and Petroleum Resources Development Act (MPRDA):**<br><br>In support of the exploration Right Application submitted by Motuoane the applicant is required to conduct a NEMA Scoping and EIA process in terms of Section 5A and Chapter 79 of the MPRDA. | This report is prepared as part of the Exploration Right Application under the MPRDA. | In terms of the Mineral and Petroleum Resources Development Act an Exploration Right Application has been applied for. |

## 33.1 APPLICABLE NATIONAL LEGISLATION

The legal framework within which the proposed Motuoane Hennenman Exploration right 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:

### 33.1.1 THE MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT

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.

### 33.1.2 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA Environmental Impact Assessment (EIA) regulations, the proponent is required to appoint an environmental assessment practitioner (EAP) to undertake the EIA as well as the public participation process. In South Africa, EIA became a legal requirement in 1997 with the promulgation of regulations under the Environmental Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant environmental authorisation. On 21 April

2006, the Minister of Environmental Affairs and Tourism promulgated regulations in terms of Chapter 5 of the NEMA.

The objective of the Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the activities that have been identified. The purpose of these procedures is to provide the competent authority with adequate information to make decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorized, and that activities which are authorized are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

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.

### 33.1.3 THE 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.

#### 33.1.3.1 CATCHMENT MANAGEMENT STRATEGIES

Catchment Management Agencies (CMAs) are tasked with coordinating the water demands, interests and responsibilities of all relevant government departments, institutions and water users within a specific CMA (DWA, 2012). This is to ensure that on a regional scale, water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons. The main instrument that guides and governs the activities of a CMA is the Catchment Management Strategy (CMS) which, while conforming to relevant legislation and national strategies, provides detailed arrangements for the protection, use, development, conservation, management and control of the region's water resources.

### 33.1.4 THE NATIONAL ENVIRONMENTAL 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 holder's 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 in the EMPR to be implemented for this project.

Schedule 3: Defined Wastes have been broken down into two categories: Category A being hazardous wastes and category B being general wastes. Under Category A (hazardous wastes) the act makes allowance for "wastes resulting from exploration, mining, quarrying, and physical and chemical treatment of minerals".

In order to attempt to understand the implications of this it is important to ensure that the definitions of all the relevant terminologies are defined:

- Hazardous waste: means *"any waste that contains organic or inorganic elements or compounds that may, owning to the inherent physical, chemical or toxicological characteristic of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles."*
- Residue deposits: means *"any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right."*
- Residue stockpile: means *"any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act."*
- Various regulations have been drafted in support of the NEMWA, as discussed below:
- Proposed Regulations regarding the planning and management of waste from a prospecting, mining, exploration or production operations (2014)
  - Chapter 2, Section 3 states the identification and assessment of any environmental impacts, including those on groundwater, arising from waste must be done as part of the Environmental Impact Assessment (EIA) conducted in terms of the National Environmental Management Act, 1998 (Act No.107 of 1998) (hereafter referred to as the NEMA). The pollution control barrier system shall be defined by the (a) Waste Classification and Management Regulations (2013); (b) National Norms and Standards for the Assessment of Wastes for Landfill Disposal (2013); and (c) National Norms and Standards for Disposal of Waste to Landfill (2013).

  - Waste Characterisation must be done in terms of physical and chemical composition, as well as content. The classification must be done in terms of the health and safety classification and the environmental classification.
- Proposed Regulations to exclude a waste stream or a portion of a waste stream from the definition of a waste (2014)
  - This regulation will give the holder of the right the opportunity to exclude a waste stream, or a portion of a waste stream from the definition of a waste. Chapter 2, Section 4 of this Regulation, Sub-section (1) states that any portion of a waste generated from a source listed in Category A of Schedule 2 of the NEM:WA, may be excluded from being defined as hazardous on demonstration that such portion of waste in non-hazardous in accordance with the Waste Management and Classification Regulations of 2013.
  - The application process will be in the form of a prescribed process and application must be made to the Minister.
  - This Regulation is however not yet in force.
- National Norms and Standards for the assessment of waste for landfill disposal (23 August 2013)
  - These norms and standards prescribe the requirements for the assessment of waste prior to disposal to landfill.
  - The aim of the waste classification tests is to characterise the material to be deposited or stored in terms of the above-mentioned waste classification guidelines set by the Department of Environmental Affairs (DEA).
  - The outcomes of the tests provide the necessary information in terms of:
- Identification of chemical substances present in the waste; and
- Determination of the total concentrations (TC) and leachable concentrations (LC) of the elements and chemical substances that have been identified in the waste and that are specified in Section 6 of the above-mentioned Regulations. The obtained TC and LC values of the waste material will be compared to the threshold limits for total concentrations (TCT limits) and leachable concentrations (LCT limits) specified in Section 6 of the above-mentioned Regulations. Based on the TC and LC values of the elements and chemical substances in the waste exceeding the corresponding TCT and LCT limits respectively, the specific type of waste for disposal to landfill will be determined in terms of Section 7 of the above-mentioned Regulations.
- As part of the tests:
  a) The TC of all the elements and chemical substances specified in Section 6 of the above-mentioned Regulations that are known to occur, likely to occur, or can reasonably expected to occur in the waste will be determined;
  b) The LC of elements and chemical substances will be determined using the Australian Standard Leaching Procedure (AS 4439.1, 34439.2 and 4439.3). The type of leaching fluid used in the leaching procedure will be selected based on:

c) Waste that will be disposed with, or contains, putrescible wastes;

d) Waste that will be disposed of other, non-putrescible, waste;

e) Non-putrescible waste that will be disposed of without any other wastes.

- As mentioned above, the TC and LC values of the elements and chemical substances as obtained from the TC and LC tests will be compared to the TCT and LCT guidelines and the waste classified. These tests will define the type of waste one deals with, i.e. Type 0 – 4.
- Waste Classification and Management Regulations (23 August 2013)
    - Chapter 9 of the above-mentioned Regulations stipulates the requirements for a motivation for and consideration of listed Waste Management Activities that do not require a Waste Management License. The motivation must:
- Demonstrate that the waste management activity can be implemented without unacceptable impacts on, or risk to, the environment or health;
- Must provide a description of the waste;
- Description of waste minimisation or waste management plans;
- Description of potential impacts, etc.
    - The transitional provisions under Chapter 6 of this regulations prescribes timeframes in which all wastes must be classified within 18 months from the date of commencement of these regulations (23 August 2013).
    - National Norms and Standards for disposal of waste to landfill (23 August 2013)
    - Once the waste has been assessed and classification is done (waste type identified) the guidelines in Regulation 636 (above-mentioned regulations) can be used to determine the minimum requirements for the landfill and containment barrier design. This will distinguish between Class A, Class B, Class C, or Class D landfills and the associated requirements.

### 33.1.5 THE NATIONAL HERITAGE RESOURCES 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.

## 33.2 ENVIRONMENTAL MANAGEMENT PRINCIPLES

It is extremely important for effective environmental management that the exploration activity management be made aware of the general principles upon which sound environmental management is based and that these principles are considered in all aspects of the exploration phase. NEMA establishes a general framework for environmental law, in part by prescribing national environmental management principles that must be applied when making decisions that may have a significant impact on the environment. These principles are briefly summarised in the sections that follow.

### 33.2.1 HOLISTIC PRINCIPLE

The Holistic principle, as defined by NEMA (Section 2(4)(b) requires that environmental management must be integrated, acknowledging that all elements of the environment are linked and inter-related and it must take into account the effect of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option (defined below). Holistic evaluation does not mean that a project must be looked at as a whole. It rather means that it must be accepted that there is a whole into which a project introduced. If the indications are that the project could have major adverse effects, the project must be reconsidered and where appropriate re-planned or relocated to avoid an adverse impact or to ensure a beneficial impact.

### 33.2.2 BEST PRACTICABLE ENVIRONMENTAL OPTION

When it is necessary to undertake any action with environmental impacts, the different options that could be considered for the purpose must be identified and defined. The Best Practicable Environmental Option (BPEO) is defined in NEMA as "the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term." Other guidelines typically used for environmental management in terms of other legislation include: BPM which is the Best Practicable Means and BAT which is the Best Available Technology.

### 33.2.3 SUSTAINABLE DEVELOPMENT

The concept of sustainable development was introduced in the 1980's with the aim to ensure that the use of natural resources is such that our present needs are provided without compromising the ability of future generations to meet their own needs. The constitution of South Africa is built around the fact that everyone has the right to have the environment protected through reasonable legislative and other measures that secure ecologically sustainable development. The National Environmental Principles included in the NEMA require development to be socially, environmentally and economically sustainable.

### 33.2.4 PREVENTATIVE PRINCIPLES

The preventative principle is fundamental to sustainable development and requires that the disturbance to ecosystems and the pollution and/or degradation of the environment and negative impacts on the environment be avoided, or, where they cannot be altogether avoided, are minimised and remedied.

### 33.2.5 THE PRECAUTIONARY PRINCIPLES

The precautionary principle requires that where there is uncertainty, based on available information and as a matter of precaution, that said impact will be harmful to the environment until such time that it can be proven otherwise. The precautionary principle requires that decisions by the private sector, governments, institutions and individuals need to allow for and recognise conditions of uncertainty, particularly with respect to the possible environmental consequences of those decisions. In South Africa, the DWA adopted a BPEO guideline in 1991 for water quality management and in 1994 in the Minimum Requirements document for waste management.

In terms of DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, the precautionary principle is defined as, “Where a risk is unknown; the assumption of the worst case situation and the making of provision for such a situation.” Here the precautionary principle assumes that a waste or an identified contaminant of a waste is “both highly hazardous and toxic until proven otherwise.”

In the context of the EIA process in South Africa, the precautionary principle also translates to a requirement to provide sound, scientifically based, information that is sufficient to provide the decision making authority with reasonable grounds to understand the potential impacts on the environment, the extent thereof and how impacts could be mitigated. If such information is not adequate for this purpose, the relevant authority cannot be satisfied as is required and then the authority should require that further information be collected and provided.

### 33.2.6 DUTY OF CARE AND CRADLE TO GRAVE PRINCIPLE

In terms of the NEMA Section 28, “Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.”

By way of example, the principle of “duty of care” in terms of waste management emphasises the responsibility to make sure that waste is correctly stored and correctly transported, as it passes through the chain of custody to final point of disposal. This means that waste must always be stored safely and securely. The company removing and disposing of waste also holds the responsibility to hold the relevant licenses, and that waste is transported alongside the necessary paperwork.

“Cradle to Grave” refers to the responsibility a company takes for the entire life cycle of a product, service or program, from design to disposal or termination. In terms of the DWAF Minimum Requirements for the Handling and Disposal of Hazardous Waste, 1994, “any person who generates, transports, treats or disposes of waste must ensure that there is no unauthorised transfer or escape of waste from his control. Such a person must retain documentation describing both the waste and any related transactions. In this way, he retains responsibility for the waste generated or handled.” This places responsibility for a waste on the Generator, and is supported by the "Cradle to Grave" principle, according to which a "manifest" accompanies each load of Hazardous Waste until it is responsibly and legally disposed. This manifest is transferred from one transporter to the next along with the load, should more than one transporter be involved. Once the waste is properly disposed of at a suitable, permitted facility, a copy of the manifest must be returned to the point of origin." Duty of Care offers one strategy to implement sustainable development.

### 33.2.7 POLLUTER PAYS PRINCIPLE

The "polluter pays principle" holds that the person or organisation causing pollution is liable for any costs involved in cleaning it up or rehabilitating its effects. It is noted that the polluter will not always necessarily be the generator, as it is possible for responsibility for the safe handling, treatment or disposal of waste to pass from one competent contracting party to another. The polluter may therefore not be the generator, but could be a disposal site operator or a transporter. Through the 'duty of care' principle, however, the generator will always be one of the parties held accountable for the pollution caused by the waste. Accordingly, the generator must be able to prove that the transferral of management of the waste was a responsible action. The polluter pays principle acceding to NEMA dictates that "the cost of remedying pollution, environmental degradation and consequent adverse effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment."

### 33.2.8 DUTY OF CARE RESPONSIBILITIES

The principle of duty of care is especially important to understand when it comes to pollution that arises as a result of an activity. Notwithstanding any licences or permits that may exist, the exploration works would still have a responsibility to take suitable measures should pollution arise as a result of the activities.

Training and awareness should be fostered in all staff working to ensure that they can perform their duties. Failure to comply with the provisions in the EMPR and NEMA would be a contravention of the Act. The relevant sections of NEMA are provided below, to outline the duty of care and responsibility that the applicant and all employees have towards the environment. The National Environmental Management Act (Act 107 of 1998) (NEMA) Section 28 makes provision for duty of care and remediation of environmental damage. The binding principals are described below:

1. Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

2. Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-

a) any activity or process is or was performed or undertaken; or

b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

3. The measures required in terms of subsection (1) may include measures to-

a) investigate, assess and evaluate the impact on the environment;

b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;

c) cease, modify or control any act, activity or process causing the pollution or degradation;

d) contain or prevent the movement of pollutants or the cause of degradation;

e) eliminate any source of the pollution or degradation; or

f) remedy the effects of the pollution or degradation.

Any person convicted of an offence in terms of the NEMA may incur a fine not exceeding R1 to R10 million or to imprisonment for a period not exceeding 1 to 10 years or to both such a fine and such imprisonment.

## 33.3 FAILURE TO COMPLY WITH ENVIRONMENTAL CONSIDERATIONS

Within the provisions of the relevant environmental legislation, there are a number of penalties for non-compliance or offences. It is recommended that a procedure for non-compliances (i.e. incentives or disincentives for conformance and non-conformance with the EMP requirements) must be employed to ensure that the EMP is adequately implemented. The system to be used must be determined before on site exploration activities commence and must be included in the tender documents and contracts, and made clear to all project workers. The system may include that the independent ECO can be authorized to impose spot fines on the Contractor and/or his subcontractors for any of the transgressions detailed below:

- Littering on site;
- Lighting of illegal fires on site;
- Persistent or un-repaired oil leaks;
- Persistent/repeated transgressions;
- Any persons, vehicles or equipment related to the Contractor’s operations found within any designated “no – go” areas;
- Any vehicles being driven in excess of designated speed limits;
- Removal and/or damage to fauna, flora or heritage objects on site; and

- Legal contraventions.

Such fines should be issued in addition to any remedial costs incurred as a result of non-compliance with the Environmental Specifications and/or legal obligations.

# 34 IMPACTS, MANAGEMENT, OBJECTIVES, ACTIONS AND OUTCOMES

This section presents specific environmental management requirements for the proposed activities to be undertaken during the exploration process.

Impact and risk management actions that are considered as part of the management system, should be complementary to achieve the most cost-effective and environmentally sound approach, and should be based on the following principles:

- Integrate environmental issues and concerns into business decisions through formal management systems;
- Integrate health and safety of local communities and the environment into a single programme;
- Consider all environmental components and aspects (air, soil, water, ecology and biodiversity) in decision making;
- Prevent and reduce pollution at its source through implementation of pollution control measures;
- Aim at minimising resource inputs;
- Evaluate alternatives that included environmental values based on benefits/risks; and
- Strive for continual improvement of management system.

Based on guidelines by the Oil Industry International Exploration and Production Forum (EPF) (1994), the following components form a crucial part of a management systems:

a) Leadership and commitment: Commitment and company culture is essential to the success of the system;
b) Policy and strategic objectives: Principles of exploration actions and aspiration with respect to the health and safety of local communities and the receiving environment;
c) Organization, resource planning and documentation: Organisation of human management structure, adequate resource planning and possession of all required documentation/authorisation;
d) Evaluation and risk management: Identification and evaluation of financial, social, economic and environmental risks, and development of management measures to reduce/eliminate risks;
e) Planning: Planning and conducting exploration/work activities, and prepare emergency responses;
f) Implementation and monitoring: Performance and monitoring of activities, and implementation of corrective measures when necessary;

g) Auditing and reviewing: Periodic assessments of system performance, suitability and effectiveness of management measures; and
h) Review: review of audits by senior management.

Figure 27 presents the proposed exploration activities to be undertaken in each phase of the project, and the potential ground requirements associated with each activity.

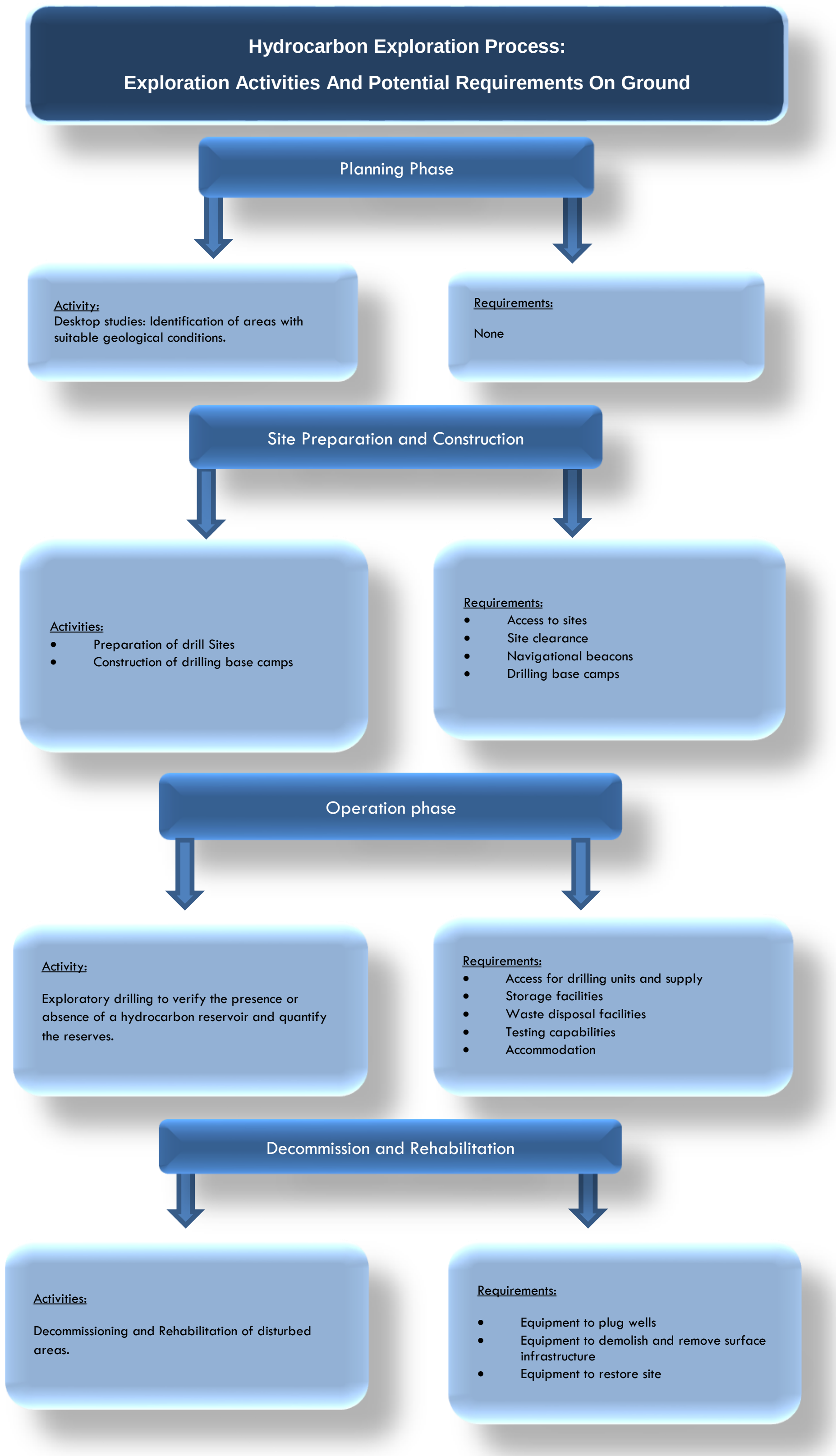


**Figure 27: Proposed activities to be undertaken and the potential requirements associated with each phase**

## 34.1 DETERMINATION OF CLOSURE OBJECTIVES

The EMP includes a rehabilitation plan. The plan outlines the closure objectives which are aimed at re-instating the landform, land use and vegetation units to the same as before exploration activities 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.

1. **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 exploration wells, ongoing monitoring, etc.
2. **Re-vegetation.** This involves either reseeding or allowing natural succession depending on the area, climate, etc.
3. **Storm water management and erosion control.** Management of storm water and prevention of erosion during rehabilitation. E.g. cut off drains, berms, etc. and erosion control where required.
4. **Verification of rehabilitation success.** Entails monitoring of rehabilitation.
5. **Successful closure.** Obtain closure certificate.

## 34.2 POTENTIAL IMPACTS IN THEIR RESPECTIVE PHASES

The EMPR includes preventative measures to firstly avoid potential risks and impacts. Where avoidance is not possible, thee EMPR provides mitigation measures to control, remedy or modify risks and impacts such as pollution. The potential risks and impacts identified for each phase, is summarised in Table 34 below.

**Table 34: Potential impacts and risks in their respective phases**

| Activities | Phase | Size and Scale of Disturbance | Mitigation Measures | Compliance with Standards | Time Period for Implementation |
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| Site clearance | Construction | <0.27ha. Short term and localized | • Demarcation of sensitive areas in consultation with relevant specialists and ECO;<br>• Utilise local labour if possible;<br>• Minimise removal of vegetation as far as possible;<br>• Relocation of protected species;<br>• Minimize dust generation;<br>• Limit vehicle access;<br>• Implement alien vegetation management<br>• Ongoing identification of risks and impacts;<br>• Emergency preparedness; and<br>• Monitoring and review. | NEMA<br>MPRDA<br>NEMBA<br>NEMAQA<br>Dust regulations<br>NWA<br>DWAF Best Practice Guidelines | Throughout construction phase |
| Establishment of site infrastructure | Construction | <0.27ha. Short term and localized | • Minimise physical footprint of construction;<br>• Ensure construction is consistent with occupational health and safety requirements;<br>• Minimise vegetation clearance;<br>• Ensure proper and adequate drainage;<br>• Minimise waste and control waste disposal;<br>• Fencing of all drill sites with security access control and warning signs; | NEMA<br>MPRDA<br>NEMBA<br>NEMAQA<br>Dust regulations<br>NWA<br>DWAF Best Practice Guidelines | Throughout construction phase |

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| | | | • Establish waste storage areas for recycling;<br>• Ensure adequate containment of waste to prevent pollution;<br>• Minimise dust generation;<br>• Limit vehicle access to approved access roads;<br>• Prepare contingency plans for spillage and fire risks | | |
| Storage of construction vehicles | Construction and Operation | Short term and localized | • Any equipment that may leak, and does not have to be transported regularly, must be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays must be of a size that the equipment can be placed inside it;<br>• Drip trays must be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility; and<br>• Compacting of soil must be avoided as far as possible, and the use of heavy machinery must be restricted in areas outside of the proposed exploration sites to reduce the compaction of soils. | NWA<br>DWAF BPG | Throughout construction and operation |
| Transportation/ access to and from drill sites | Construction and Operation | Short term and localized | • Where possible, drill sites should be located along existing access roads to reduce the requirement for additional access roads;<br>• Any new temporary access routes to the drill site should result in minimal disturbance to existing vegetation;<br>• Prior to accessing any portion of land, the Applicant must enter into formal written agreements with the affected landowner. This formal agreement should additionally stipulate | NEMA<br>NEMBA<br>CARA<br>NEMAQA<br>Dust Regulations<br>Road Traffic Act | Throughout Construction and Operation |

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| | | | landowners special conditions which would form a legally binding agreement;<br>• All farm gates must be closed immediately upon entry/exit;<br>• Under no circumstances may the contractor damage any farm gates, fences, etc.;<br>• On-site vehicles must be limited to approved access routes and areas on the site so as to minimize excessive environmental disturbance to the soil and vegetation on site, and to minimize disruption of traffic (where relevant);<br>• All construction and vehicles using public roads must be in a roadworthy condition and their loads secured. They must adhere to the speed limits and all local, provincial and national regulations with regards to road safety and transport;<br>• Damage caused to public roads as a result of the construction activities must be repaired in consultation with the relevant municipal authorities; and<br>• All measures should be implemented to minimize the potential of dust generation. | | |
| Storage of hazardous substances | Construction and Operation | Localized and short-term | • All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage and appropriate steps must be taken to prevent pollution in the event of a spill; and | NWA<br>NEMWA<br>DWAF BPG | Throughout Construction and Operation |

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| | | | • Hazardous substances must be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. | | |
| Waste Management | Construction and Operation | Localized and short-term | • Waste generated on site must be recycled as far as possible. Recyclable waste must not be stored on site for excessive periods to reduce risk of environmental contamination;<br>• Drill muds, formation water (if encountered), etc. would constitute waste and must be classified and ranked in terms of relevant legislation for correct disposal; and<br>• A Waste Management System must be implemented, and provide for adequate waste storage (in the form of enclosed containers) waste separation for recycling, and frequent removal of non-recyclable waste for permanent disposal at an appropriately licensed waste disposal facility. No waste material is to be disposed of on site. | DWAF Minimum requirements for waste disposal | Throughout Constriction and Operation |
| Aerial Surveys | Operation | Localized and Short Term | • Aerial flying for gravity/magnetic data must be undertaken in accordance with the CAA regulations as well as any reasonable specific requirements of the affected landowners;<br>• Minimum flight height restrictions include 2500ft above nature reserves and 500ft in open areas unless otherwise agreed to with the CAA and the affected landowners;<br>• A risk assessment associated with the aerial surveys must be prepared prior to conducting this activity and must include a flight plan with due | CAA Regulations | Throughout operation |

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| | | | cognisance of the noise receptors and risks along the flight paths; | | |
| Diamond Core Drilling | Operation | Localized and Short term | • Depending on the final location of the drill sites with respect to the locations sensitivity as defined by the sensitivity maps and in consultation with the ECO and relevant specialists, the following must be undertaken prior to drilling:<br>○ In low sensitive areas, the conditions of the EMPR must be complied with;<br>○ In medium sensitive areas, the respective specialists must be brought to site to assess the drill sites and surroundings (1km radius around drill sites) and develop site specific mitigation measures. Furthermore, the conditions of the EMPR must be complied with; and<br>○ In high sensitive areas, the respective specialists must be brought to site to assess the drill sites and surroundings (with relevant buffer zones, e.g. 1km radius for wetlands, etc.) and develop site specific mitigation measures. These measures (site specific EMPR conditions) must be submitted to the PASA for approval prior to commencement with the drilling operations;<br>• Once exploration drilling footprints are proposed, a public participation process must be implemented during which the Interested & Affected Parties are invited to come forward and state whether they are aware of any sacred water sites (secret or not) located within a 500m radius area from each | MPRDA Regulations GN R527<br>SANS 10103<br>ECA Noise Regulations<br>NEMAQA<br>Dust Regulations<br>NWA<br>DWAF BPG<br>NHRA | Throughout operation |

proposed drilling positions. It is important to note that at this stage the Interested & Affected Parties will not be requested to provide information on the exact location of such sacred sites, only whether such sites are located within a 500 m radius area from the proposed drilling position(s) or not. Care must be taken during the public participation to ensure that the cartographic and location information presented to the Interested & Affected Parties contain clear enough information for them to confidently recognize the positions of such proposed drilling site(s) should these be located anywhere in proximity to the properties and landscapes they have knowledge of. The presentation of such cartographic information in English, Afrikaans and Sesotho would be paramount;

- The water quality monitoring results to verify pre and post drilling impacts must be submitted to the DWS;
- Should an Interested & Affected Party state that such a sacred site is indeed located within 500 m of a proposed drilling position, an experienced team comprising a heritage specialist and Geohydrologist must accompany the Interested & Affected Party to the sacred site for confirmation purposes;
- The heritage specialist and Geohydrologist must compile a letter to indicate the findings of their fieldwork i.e. whether such a sacred site was indeed identified within 500 m from the proposed drilling position;

- All aspects relating to the location of the sacred site must be kept strictly confidential. At no stage will any information regarding the position of the sacred site (GPS coordinates, property description etc.) be contained in the letter, or in any other report, document or verbal communication;
- The confidential manner in which this mitigation will be approached and undertaken with regards to the locations of Sacred Natural Sites, must be clearly communicated to the Interested & Affected Parties from the outset;
- No exploration drilling may be allowed within 500 m of a confirmed Sacred Natural Site;
- A buffer area of 200 m wide surrounding the cemetery at HEN 1 and HEN 3 must be kept clear of any exploration footprints, whether it be drilling positions, access roads etc.;
- A buffer area of 100 m wide surrounding the farmstead at HEN 2 must be kept clear of any exploration footprints, whether it be drilling positions, access roads etc.;
- The planning of all additional exploration footprints must take cognizance of the heritage sensitivities depicted on the heritage sensitivity maps. To the extent possible, identified heritage sensitivities must be avoided in the establishment of additional exploration footprints;
- As soon as any additional exploration footprints are confirmed, a suitably

qualified heritage specialist, with expertise in archaeology, must be appointed. Such additional exploration footprints would include all aspects relating to the exploration work;

- The appointed heritage specialist will be responsible for undertaking heritage walkthroughs of the additional exploration footprint areas to identify any heritage sites located there;
- The appointed heritage specialist will be responsible for compiling a report containing the findings of the heritage walkthroughs, assessing the heritage significance of such identified heritage sites, assessing the impact of the proposed exploration activity(ies) on the identified heritage sites and outlining mitigation measures which may be required;
- The report would be a subsequent heritage impact assessment aimed specifically at the additional exploration footprints, and must be submitted to SAHRA as well;
- No exploration footprints are allowed within a distance of 500 m from the boundaries of the Stone Rampart and Voortrekker Graves at Ventersburg;
- Once the drilling sites are known, the applicant should invite a professional palaeontologist to monitor drilling cores for subsurface fossil remains that may be intersected by the drilling process;
- The palaeontologist must apply for a valid permit from SAHRA for the collection / removal of fossils if necessary;

- Local residents (landowners and directly adjacent landowners) should be notified of any potentially noisy activities or work and these activities should be undertaken at reasonable times of the day. This work should not take place at night or on weekends;
- The contractor must attempt to restrict noisy activities as far as is possible to times and locations whereby the potential for noise nuisance is reduced;
- Dust suppression methods must be applied when necessary to restrict the visual impact of dust emissions;
- Any spills of hydrocarbons or fluids used during operation, must be cleaned up immediately;
- Construction/drilling should preferably take place during the dry season;
- Excavations should be open for as short period as practically possible and drilling circulation fluid sumps be cleaned out and rehabilitated. Drilling sumps should preferably not be dug in the ground, but steel or plastic tank sumps be used to eliminate possible soil and shallow aquifer contamination;
- 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 drilling rig and vehicles are done on site;
- Biodegradable or environmentally friendly drilling fluids (polymers) should be used wherever possible. It is essential that the exploration borehole be flushed once the target depth has

been reached. This is preferably done by pumping the drilling fluid out once the drilling fluid breaks down to form thin watery fluid. If the borehole cannot be developed by abstraction of the drilling fluid, e.g. due to full casing to the bottom, then the borehole should be circulated with clean water to enhance break-down of the polymer. Drilling specialists and specialist methodologies should be followed to allow drilling fluids/polymers to be removed from the borehole as far as possible and to prohibit possible bacterial contamination of the borehole and aquifer. The boreholes should be correctly constructed so that no gas leakage occurs;

- As part of mitigation of contamination of groundwater, Chapter 8 and Chapter 9 of the MPRDA R. 527 Regulations for petroleum exploration and production should be adhered to wherever these regulations apply to exploration diamond core drilling;
- After exploration coring has been completed, core samples removed and borehole cleaning has been completed, the boreholes should be fully grouted/cemented with the casing left in correct stratigraphic and aquifer zones as described by the MPRDA Petroleum exploration and production R. 527 Regulations, Chapter 8 and Chapter 9;
- A Groundwater Monitoring Program must be implemented in nearby private boreholes to establish impacts of groundwater extraction. Baseline data

must be obtained on groundwater and surface water quality prior to any drilling commencing;

- No exploration boreholes should be drilled in the immediate vicinity of existing private boreholes;
- Soils in drilling areas where disturbances will be encountered must be stripped and stockpiled outside affected areas for use after completion of the drilling program. Topsoil must be adequately stripped to the correct depth and stored separately from subsoils;
- Cut of trench and berm must be constructed around the drill pad to prevent contaminated surface runoff from entering shallow aquifers and surrounding water resources;
- A liner should be placed over the drill pad and drip trays must be used in all areas where hydrocarbons are handled;
- On-site vehicles must be limited to approved access routes and areas on the site so as to minimize excessive environmental disturbance to the soil and vegetation on site, and to minimize disruption of traffic;
- Workforce should be kept within defined boundaries ad to agreed access routes

Well Construction Standards

- All wells must be cased according to current industry standards published by the API “5CT Specification for Casing and Tubing” and the casing thread compound and its use must confirm to the current API RP 5A3;

- A casing installed must have a minimum yield pressure designed to withstand at least 1.2 times the maximum pressure to which the casing may be subjected during drilling operations;
- Installation of casings and cement seals in exploration wells are important to manage impacts on groundwater quality. Surface casing must be set to a depth of 60m below the base of the deepest fresh water or at least 100m above the top of expected petroleum bearing zones, whichever comes first, and cemented to the surface;
- The minimum yield pressure must be based upon engineering calculations as listed in the API "TR 5C-3 Technical Report on Equations and Calculations for Casings, Tubing and Line Pipe used as Casing and Tubing, and Performance Properties Tables for Casing and Tubing";
- Casing may not be pitted, patched, bent, corroded or crimped;
- Casing may not have threads which are worn or damaged;
- Casing that has been reconditioned and that has not passed the approved hydrostatic pressure and drift test pursuant to API "5CT Specification for Testing and Tubing" may not be used;
- The Applicant/ drill contractor must contact the designated agency (PASA) at least 2 days prior to setting a casing

to enable an authorized person to be present when the test is done;

Conductor Casing

- Conductor casing must be set and cemented to a surface in order to stabilize unconsolidated sediments, isolate shallow aquifers that provide or are capable of providing fresh groundwater for water wells and springs in the vicinity of the well, and provide a base for equipment to divert shallow natural gas;

Surface Casing

- Surface casing for exploration or production wells must be set to a depth of 60m below the base of the deepest fresh water or at least 100 metres above the top of expected petroleum bearing zones, whichever comes first, and cemented to a surface;

Intermediate Casing

- Intermediate casing must be set to protect unexpected fresh water found below the surface casing shoe;
- Intermediate casing used to isolate fresh water must not be used as the production string in the well in which it is installed;
- When intermediate casing is installed to protect fresh water, it must be set at least 30 meters below the base of the unexpected deepest fresh water and must be cemented to the surface;
- In instances where intermediate casing is set solely to protect fresh water

encountered below the surface casing shoe and cementing to the surface is technically infeasible and may result in lost circulation or both, cement must be brought to a minimum of 180 meters above the shallowest fresh water zone encountered below the surface casing shoe;

- The location and depths of petroleum-bearing zones or fresh water zones that are open to the wellbore above the casing shoe, must be confirmed by coring, electric logs, testing or such data from an offset well on the same well pad and must be reported to the designated agency (PASA);

Centralisers

- Casing must be centralised in each segment of the wellbore to provide sufficient casing standoff and foster effective circulation of cement to isolate critical zones including aquifers, flow-zones, voids, lost circulation zones and hydrocarbon production zones;
- Surface casing must be centralised at the shoe, above and below a stage collar or diverting tool, and through fresh water zones;
- In non-deviated holes, a pipe centraliser must be placed every fourth joint from the cellar cement shoe to the ground surface or to the bottom of the cellar;
- Centralisers must be in accordance with the standards of API “10 D, Specification for Bow-Spring Casing Centralizers and all rigid centralizers”,

API "10 TR 4 Considerations Regarding Selection of Centralizers for Primary Cementing Operations", and API RP "10D-2, Recommended Practice for Centralizer Placement and Stop Collar Testing";

Cement requirements and compressive tests

- The Applicant/ drilling contractor must notify the designated agency (PASA) at least 2 days before commencing with cementing of casing operations to enable an authorised person to be present;
- Cementation of casing must be done by the pump and plug method with a minimum of 25% excess cement and appropriate loss circulation material, unless another amount of excess cement is approved by the designated agency (PASA);
- Cement placed into the well bore must be cement that is manufactured to meet the standards of API "10 A Specification for cements and material for well cementing" or ASTM "C150/C150M Standard Specification for Portland Cement" and foamed cement slurry must be prepared to minimise its free water content in accordance with API "RP 10B-4 Recommended Practice On Preparation and Testing of Foamed Cement Slurries at Atmospheric Pressure";
- The Applicant must conduct tests for cement mixtures for which published performance data is not available on

representative samples of the basic mixture of cement and additives used, by using distilled water or potable tap water for preparing the slurry;

- Cement mixture tests must be conducted using the equipment and procedures established in the current API “RP 10 B-2 Recommended Practice for Testing Well Cements” and API “RP 10B-4 Recommended Practice on Preparation and Testing of Foamed Cement Slurries at Atmospheric Pressure”;
- Test data showing competency of a proposed cement mixture to meet the requirements of the current API “API RP 10 B-2 Recommended Practice for Testing Well cements” must be submitted to the designated agency (PASA) for approval prior to the cementing operation;
- The Applicant/ drilling contractor must perform cement compressive strength tests on casing strings and if it does not conform to standards it must be redone;
- After the cement is placed behind the casing, the Applicant/ drilling contractor must wait for the cement to set until the cement achieves a calculated compressive strength of at least 500psi (3447.38 kPa) before the casing is disturbed in any way, including installation of a blow-out preventer;
- The cement must have a compressive strength of at least 1,200 psi (8273.71 kPa), and the free water separation must be no more than 6 millilitres per

250 millilitres of cement, tested in accordance with the current API TR 10TR3;

- The Applicant/ drilling contractor must, in co-operation with specialist contractors, prepare suitable programmes for cement placement operations, including monitoring of the effectiveness of placement as part of the operations planning, contingency plans and procedures to cover the possibility of a failure to meet the cementation design objectives;
- A holder must run a radial cement bond evaluation log and monitor the annular pressure to verify the cement bond on all casing strings and must carry out remedial cementing if the cement bond is not adequate for drilling ahead;
- A copy of the cement job log for a cemented casing string in the well must be maintained in the well file and be submitted to the designated agency (PASA);

Casing string tests

- After the setting and cementing of a casing string, except the conductor casing, and prior to further drilling, the casing string must be tested with fresh water, mud, or brine to at least the maximum anticipated treatment pressure but no less than 0.22 psi per foot (1.512 kPa per 0.3048 meter) of casing string length or 1,500 psi (10 342.12 kPa), whichever is greater, for at least 30 minutes with less than a 5% pressure loss;

- The pressure test must not exceed 70% of the minimum internal yield and if the pressure declines more than 5%, or if there are other indications of a leak, corrective action must be taken before conducting further drilling operations;
- The Applicant/ drilling contractor must notify the designated agency at least 2 days prior to conducting a pressure test to enable an authorised person to be present when the test is done;

Formation Pressure Test Integrity

- After a successful casing string test, the drilling contractor must conduct a formation pressure integrity test below the surface casing and below all intermediate casing;
- The Applicant/ drilling contractor must notify the designated agency (PASA), at least 2 days prior to conducting a formation pressure integrity test, to enable an authorised person to be present when the test is done;

Blowout Prevention

- Blowout prevention equipment must be installed that meets the current API Std 53 for blowout equipment after setting the casing to shut- off a wellhead which must be supported and secured to prevent stresses on all connections;
- The Applicant/ drilling contractor may be exempted from installing blowout prevention equipment only if written approval from the designated agency (PASA) is obtained. Furthermore, it

would need to be shown that the conditions under which the drilling operations are being conducted do not require the installation of blowout preventer equipment. The Applicant would need to provide reliably operating well control equipment it intends to install in order to control kicks, prevent blowouts and to safely carry out all well operations;

- Lines, valves and fittings between the blowout preventer and the remote actuator must be flame resistant and must have a working pressure rating higher than the maximum anticipated well heads surface pressure;
- Blowout prevention equipment must be in good working condition at all times;
- When blowout prevention equipment is installed, tested, or in use, a competent person must be present at the well site and that person must have a current well control certification from an accredited training programme that is acceptable to the designated agency (PASA);

Pressure testing of blowout prevention equipment

- The blowout prevention equipment must be tested to 100% of rated working pressure and the annular-type blowout preventer must be tested to 1,000 psi (6894.76 kPa) at the time of installation in accordance with current API Std 53 for blowout equipment;
- Testing of blowout prevention equipment for a drilling or completion

operation must take place prior to drilling below the last cemented casing seat;

- The Applicant/ drilling contractor must maintain a record of the pressure tests and submit the record to the designated agency (PASA);
- The Applicant/ drilling contractor must notify the designated agency (PASA) at least 2 days prior to conducting a blowout preventer test to enable an authorised person to be present when the test is done;
- Blowout prevention equipment that has failed any pressure test must not be used until it is repaired and passes the pressure test;

Well Examination

- The Applicant must submit a well examination plan to the designated agency (PASA) before commencing with drilling, which plan must include aspects not limited to the following:
    - groundwater and aquifer isolation;
    - fracture containment;
    - fracturing and flow-back or testing programmes and operations; and
    - independent well examination.
- The designated agency (PASA) may, at the cost of the Applicant, appoint an independent and competent person to undertake well examination.
- Well examination must at all times demonstrate that the pressure

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| | | | boundary of the well is controlled throughout the life cycle of the well.<br>• Regular monitoring of fugitive emissions must be undertaken throughout the drilling activity up to the decommissioning of the wells. | | |
| Refueling | Construction and Operation | Short term and localized | • Refueling may only take place within demarcated areas that is subject to appropriate spill prevention and containment measures refueling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimize the potential for leakage and to prevent spillage onto the soil;<br>• Drip trays should be utilized in relevant locations (inlets, outlets, points of leakage, etc.) during transfer so as to prevent such spillage or leakage. Any accidental spillages must be contained and cleaned up promptly. | NWA<br>DWAF BPG | Throughout construction and operation |
| Maintenance and Repair | Construction and Operation | Short term and Localized | • Trucks, machinery and equipment must be regularly serviced to ensure they are in proper working condition and to reduce risk of leaks. All leaks must be cleaned up immediately using spill kits or as per the emergency response plan. For large spills a hazardous materials specialist shall be utilized;<br>• Accidental hydrocarbon spillages must be reported immediately, and the affected soil should be removed, and rehabilitated or if this is not possible, disposed of at a suitably licenced waste disposal facility. | | Throughout Constriction and Operation |
| Well Plugging | Decommissionin g | Short term and localized | • All exploration wells which will not be required for later monitoring or other useful purposes should be sealed with | NWA<br>DWAF BPG | Throughout Decommissioning |

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| | cement to prevent possible cross flow and contamination between aquifers;<br>• All grouting or cement should be "ready-mixed" if possible. Alternatively, any mixing must be completed on a temporary impermeable layer or in a container;<br>• All pouring of cement or grouting should be completed over a temporary impermeable layer to avoid spillage;<br>• Cleaning of the chute of the cement truck, if applicable, should be done over a temporary impermeable layer; and<br>• Prior to well suspension and decommissioning, the required approvals from the designated agency must be obtained;<br>• A decommissioning plan must be prepared and approved by the designated agency;<br>• Cement and liquid concrete are hazardous to the natural environment on account of the very high pH of the material, and the chemicals contained therein. As a result, the contractor shall ensure that:<br>• Concrete shall not be mixed directly on the ground;<br>• The visible remains of concrete, either solid, or from washings, shall be physically removed immediately and disposed of as waste, (Washing of visible signs into the ground is not acceptable); and<br>• All excess aggregate shall also be removed. | |

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| Removal of surface infrastructure | Decommissioning | Small scale and localized | • All infrastructure, equipment, and other items used during exploration will be removed from the site.<br>• Compaction of soil must be avoided as far as possible. The use of heavy machinery must be restricted in areas outside of the proposed exploration sites to reduce the compaction of soils | MPRDA<br>In accordance with Rehabilitation Plan | Decommissioning |
| Removal of waste | Decommissioning | Small scale and localized | • Any excess or waste material or chemicals, including drilling muds etc. must be removed from the site and must preferably be recycled (e.g. oil and other hydrocarbon waste products). Any waste materials or chemicals that cannot be recycled must be disposed of at a suitably licensed waste facility;<br>• No empty containers, drums, liner, concrete, foreign sand and stone, scrap materials or any such will remain on site; and<br>• No foreign matter such as rubble or waste material shall be introduced into the hole. | NWA<br>DWAF BPG | Decommissioning |
| Rehabilitation | Rehabilitation | All disturbed areas | • Restoration and rehabilitation of disturbed areas must be implemented as soon as exploration activities are completed;<br>• Sites must be restored to the original condition with vegetation cover (where applicable) equaling the surrounding vegetation cover;<br>• All debris and contaminated soils must be removed and suitably disposed of;<br>• Contours and natural surrounding must be reformed.<br>• All equipment, fencing and other infrastructure will be removed from site; | MPRDA<br>In accordance with the Rehabilitation Plan | Rehabilitation |

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| | | | • Natural drainage patterns must be restored;<br>• The stockpiled topsoil will be returned to the surface of the reinstated areas. For topsoil's with highly enriched seedbanks, additional seeding may not be required, but this would need to be monitored over time. If necessary, seed from the surrounding areas should be used to augment the topsoil seedbank;<br>• During and after rehabilitation ensure that all water ways or areas where storm water naturally flowed are open and free of any impediment;<br>• All surface infrastructure on site must be removed;<br>• Temporary access routes/roads must be suitably rehabilitated; and<br>• Sites must be monitored by the ECO (including relevant specialist's inputs if necessary) for adequate rehabilitation until the desired rehabilitation objectives have been achieved. | | |
| Monitoring | Post-operational | All rehabilitated areas | • The post-operational monitoring and management period following decommissioning of exploration activities must be implemented by a suitable qualified independent party for a minimum of one (1) year unless otherwise specified by the competent authority. The monitoring activities during this period will include but not be limited to:<br>• Biodiversity monitoring;<br>• Ground and surface water (including water sample analysis);<br>• Re-vegetation of disturbed areas where required; and | MPRDA Regulations<br>In accordance with Rehabilitation plan | Post-operation |

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| | • Wetlands.<br>• Provision must be made to monitor any unforeseen impact that may arise as a result of the proposed exploration activities and incorporated into post closure monitoring and management. | |

## 34.3 IMPACT MANAGEMENT ACTIONS AND OUTCOMES

The following table present management actions and outcomes in order to reduce the potential impacts in the respective phases of the project.

**Table 35: Summary of the impact management outcomes**

| Activity | Potential Impact | Aspects Affected | Phase | Mitigation Type | Standard to be Achieved |
|---|---|---|---|---|---|
| Site Clearance | • Loss or destruction of natural habitats;<br>• Pollution of habitats;<br>• Affect drainage;<br>• Loss of fauna/flora species; | Topography;<br>Soil;<br>Air Quality;<br>Surface Water;<br>Groundwater;<br>Transportation | Construction<br>Operation | Control through implementation of EMP mitigation measures | NEMA<br>NEMBA<br>CARA<br>Threatened or Protected Species (TOPS) regulations<br>NEMAQA<br>Dust regulations<br>NWA<br>DWAF best Practice Guidelines |
| Establishment of base camps and access | • Loss or destruction of natural habitats;<br>• Pollution of habitats;<br>• Increased surface water runoff;<br>• Affect drainage;<br>• Loss of fauna/flora species;<br>• Sedimentation;<br>• Dust generation;<br>• Influx of people; and<br>• New access roads. | Topography;<br>Landform;<br>Soil disturbance;<br>Fauna and Flora;<br>Air Quality;<br>Surface Water;<br>Groundwater;<br>Socio-economics | Construction<br>Operation | Control through implementation of EMP mitigation measures | NEMA<br>MPRDA<br>NEMBA<br>CARA<br>Threatened or Protected Species (TOPS) regulations<br>NEMAQA<br>Dust regulations<br>NWA<br>DWAF best Practice Guidelines |
| Storage of construction vehicles | • Pollution of surface and groundwater resources from potential hydrocarbon spills; and<br>• Compaction of soils | Surface water;<br>Groundwater;<br>Soils. | Construction<br>Operation | Control through implementation of EMP mitigation measures | NWA<br>DWAF best Practice Guidelines |
| Transportation to and from drill sites | • Soil compaction;<br>• Disturbance and Loss of fauna and flora;<br>• Wearing and tearing of existing roads; and<br>• Dust generation from increased traffic. | Soil disturbance;<br>Fauna and Flora;<br>Air quality. | Construction<br>Operation | Control through implementation of EMP mitigation measures | NEMA<br>NEMBA<br>CARA<br>Threatened or Protected Species (TOPS) regulations<br>NEMAQA<br>Dust regulations<br>Road Traffic Act |

| Activity | Potential Impact | Aspects Affected | Phase | Mitigation Type | Standard to be Achieved |
|---|---|---|---|---|---|
| Storage of hazardous substances | Potential hydrocarbon spills that could pollute surface and groundwater resources. | Surface water;<br>Groundwater. | Construction<br>Operation | Control through implementation of EMP mitigation measures | NWA<br>DWAF best Practice Guidelines |
| Waste Management | Pollution of habitats and surrounding areas. | Pollution | Construction<br>Operation | Control through implementation of EMP mitigation measures | DWAF minimum requirement for waste disposal |
| Diamond Core Drilling | • Vegetation clearance<br>• Removal of topsoil;<br>• Changes in drainage and surface hydrology;<br>• Drainage and soil contamination;<br>• Land use conflict;<br>• Dust generation;<br>• Disturbance of wildlife and communities in close vicinity;<br>• New access roads;<br>• Increased transportation;<br>• Damage to local infrastructure;<br>• Damage to heritage resources;<br>• Influx of people;<br>• Waste water discharge;<br>• Spillage and leaks of hydrocarbons;<br>• Pollution or interplay between groundwater aquifers;<br>• Waste disposal; and<br>• Discharge from well test operations. | Air Quality;<br>Noise;<br>Heritage;<br>Ecology;<br>Social;<br>Surface water;<br>Groundwater. | Operation | Control through implementation of EMP mitigation measures | SANS10103<br>ECA Noise Regulations<br>NEMA<br>MPRDA<br>NEMBA<br>NEMWA<br>NEMAQA<br>Dust regulations<br>NWA<br>NHRA<br>DWAF best Practice Guidelines |
| Refueling | • Potential hydrocarbon spills that could pollute soil or surface and/or groundwater resources. | Pollution;<br>Surface water;<br>Groundwater | Construction<br>Operation | Control through implementation of EMP mitigation measures | NWA<br>DWAF best Practice Guidelines |
| Maintenance and Repair | • Potential hydrocarbon spills that could pollute surface and groundwater resources. | Pollution;<br>Surface water;<br>Groundwater. | Construction and Repair | Control through implementation of EMP mitigation measures | NWA |

| Activity | Potential Impact | Aspects Affected | Phase | Mitigation Type | Standard to be Achieved |
|---|---|---|---|---|---|
| Well plugging | • Pollution of groundwater resources;<br>Potential pollution of habitats with cement residue that may be exposed to runoff etc. | Pollution;<br>Groundwater. | Decommissionin g | Control through implementation of EMP mitigation measures | NWA<br>DWAF best Practice Guidelines |
| Removal of surface infrastructure | • Soil compaction;<br>• Pollution of habitats. | Landform;<br>Topography;<br>Soils. | Decommissionin g | Control through implementation of EMP mitigation measures | MPRDA<br>In accordance with Rehabilitation plan |
| Rehabilitation | • Soil compaction;<br>• Soil and Water contamination;<br>• Erosion;<br>• Change is drainage and surface hydrology;<br>• Loss of habitat; and<br>• Disturbance to wildlife and communities in close vicinity. | Topography<br>Land use<br>Soil disturbance<br>Ecology<br>Surface water<br>Groundwater | Rehabilitation | Control through implementation of rehabilitation actions | MPRDA<br>In accordance with Rehabilitation plan |
| Monitoring of rehabilitated sites | • Soil compaction;<br>• Soil and Water contamination;<br>• Erosion;<br>• Change is drainage and surface hydrology;<br>• Loss of habitat; and<br>• Disturbance to wildlife; and communities in close vicinity. | Topography<br>Land use<br>Soil disturbance<br>Ecology<br>Surface water<br>Groundwater | Post-Operation | Control through adhering to monitoring requirements | MPRDA and regulations |

# 35 FINANCIAL PROVISION

For a detailed description of the financial provision, refer to Appendix E for the Final Rehabilitation, Decommissioning and Closure Plan.

# 36 CLOSURE GOALS AND OBJECTIVES

The closure goals and objectives for the proposed Motuoane Hennenman Exploration Project are the following:

- 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 exploration wells etc.
- Reshape disturbed land to stable and suitable conditions similar to surrounding landscape. Return disturbed land to a capability similar to which existed prior to exploration.
- 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.
- Storm water management and erosion control. Management of storm water and prevention of erosion during rehabilitation. E.g. cut off drains, berms, etc. and erosion control where required.
- Removal of surface infrastructure. All surface infrastructures within disturbed areas will be removed before rehabilitation commences.
- Verification of rehabilitation success. Entails monitoring of rehabilitation. Each area will be maintained and monitored for a period of three to five years following re- vegetation and, if this monitoring shows that the objectives have been met, an application for closure will be made;
- To demolish and remove salvageable infrastructure, dump unsalvageable material and rubble in the adit, seal the access ways and rehabilitate the adit or box cut;
- To ensure that the areas mined by underground methods do not subside and that it will be safe to conduct normal farming operations above these workings by using appropriate safety factors and designs.
- To close off all entries to the underground workings so that the water table will be restored thereby preventing the ingress of air and preventing spontaneous combustion of the pillars. Any access to the working will also be restricted in accordance with the MPRDA.

# 37 CONSULTATION WITH LANDOWNERS AND I&APS

The Public Participation Process (PPP) is a requirement of several pieces of South African Legislation and aims to ensure that all relevant Interested and Affected Parties (I&AP's) are consulted, involved and their opinions are taken into account and a record included in the reports submitted to Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed Motuoane Hennenman Exploration right needs to be managed sensitively and according to best practises in order to ensure and promote:

- 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 Motuoane Hennenman Exploration right;
- Explain the environmental authorisations required;
- Explain the environmental studies already completed and yet 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.

# 38 REHABILITATION PLAN

## 38.1 INTEGRATED REHABILITATION AND CLOSURE PLAN

The main aim in developing this rehabilitation plan is to mitigate the impacts caused by the exploration well activities and to restore land back to a satisfactory standard. It is best practice to develop the rehabilitation plan as early as possible so as to ensure the optimal management of rehabilitation issues that may arise. It is important that the project's closure plan is defined and understood from before starting the process and is complementary to the rehabilitation goals. Rehabilitation and closure objectives need to be tailored to the project at hand and be aligned with the Environmental Management Plan (EMP). The overall rehabilitation objectives for this project are as follows:

- Maintain and minimise impacts to the ecosystem within the study area;
- Re-establishment of the pre-developed land capability to allow for a suitable post mining land use;
- Prevent soil, surface water and groundwater contamination;
- Comply with the relevant local and national regulatory requirements; and
- Maintain and monitor the rehabilitated areas.

Successful rehabilitation must be sustainable, and requires an understanding of the basic baseline environment, as well as project management to ensure that the rehabilitation program is a success.

It is noted that for decommissioning an application for environmental authorisation must be submitted in accordance with Activity 22 of GNR 983 of the NEMA (1998):

I. a closure certificate in terms of Section 43 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002); or

II. 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.

## 38.2 WELL CLOSURE PROCESS

According to Chapter 10 of GN. 446 of 2015 under the MPRDA (2002) a holder may only suspend an exploration well on obtaining the approval of the designated agency. The holder must submit a decommissioning plan, as per the requirements of Section 132 of GN. 446 of 2015 under MPRDA (2002) to the designated agency for approval.

### 38.2.1 PHASE 1: MAKING SAFE

Abandon wells in a safe and stable condition. The method of plugging and abandonment of each well shall be determined using an internationally recognised guideline such as the British Oil and Gas OP071 “Guidelines for Suspension and Abandonment of Wells, Issue 4, July 2012”, as updated, as well as the requirements of Section 132 (2) of GN.446 (2015).

The method shall be designed to ensure that aquifers are isolated and the long term risk of aquifer or surface pollution is minimised. Table 36 provides an indication of typical procedures that would be followed in abandoning a well.

**Table 36: Summary of typical International requirements for well abandonment**

| | |
|---|---|
| | Isolate all potential hydrocarbon / water bearing formations by utilizing placed cement plugs extending at least 30m above and below the reservoir. |
| | The cement plugs are stacked along the entire length of the wellbore (both in the open hole as well as the upper casing) to ensure efficient redundancy. |
| | All plugs are tagged with the drill string to ensure successful placement. |
| | Integrity of the plugs is confirmed by setting weight down on the upper most plug (using the drill string) as well as a differential pressure test of at least 500 PSI or more. |

| | |
|---|---|
| | A surface / shallow cement plug (+/-50m below ground Level) is set, and the well is cut and capped +/-1m below ground level to remove the wellhead and all casing above this point. |
| | The cellar is then collapsed and the surface reinstated and the site rehabilitated. |
| | For Perforated Intervals: |
| | Should the well tests indicate that a production well is not successful, the perforated zone is squeezed off with cement by setting a mechanical plug (cement retainer) just above the zone, stabbing into the retainer and pumping cement into the formation under pressure. |
| | The cement squeeze is then followed by another series of stacked cement plugs above the retainer at pre-determined intervals all the way to surface. |
| | Integrity of the plugs is confirmed by setting weight down on the upper most plug (utilizing the drill string) as well as a differential pressure test of at least 500 PSI or more. |
| | All plugs are tagged with the drill string to ensure successful placement. A surface / shallow cement plug (+/-50m below ground Level) is set, and the well is cut and capped +/-1m below ground level to remove the wellhead and all casing above this point. |
| | The cellar is then collapsed and the surface reinstated and the site rehabilitated. |

### 38.2.2 PHASE 2: LANDFORM DESIGN, EROSION CONTROL AND RE-VEGETATION

Landform, erosion control and re-vegetation is an important part of the rehabilitation process. Landform and land use are closely interrelated, and the landform should be returned as closely as possible to the original landform. Community expectations, compatibility with local land use practices and regional infrastructure, or the need to replace natural ecosystems and faunal habitats all support returning the land as closely as possible to its original appearance and productive capacity.

This requires the following:

- Shape, level and de-compact the final landscape after removing all of the project infrastructure, dress with topsoil and, where necessary, vegetate with indigenous species. Commission specialists to assist in planning re-vegetation and the management of environmental impact, as required.

- Remove access roads with no beneficial re-use potential by deep ripping, shaping and levelling after the removal and disposal of any culverts, drains, ditches and/or other infrastructure. Natural drainage patterns are to be reinstated as closely as possible.
- Shape all channels and drains to smooth slopes and integrate into the natural drainage pattern.
- Construct contour banks and energy dissipating structures as necessary to protect disturbed areas from erosion prior to stabilisation.
- Promote re-vegetation through the encouragement of the natural process of secondary succession.
- Natural re-vegetation is dependent on de-compaction of subsoils and adequate replacement of the accumulated reserves of topsoil (for example, over the well sites), so as to encourage the establishment of pioneer vegetation.
- Remove alien and/or exotic vegetation.
- Undertake a seeding programme only where necessary, and as agreed with the re-vegetation specialist.

### 38.2.3 PHASE 3: MONITORING, MAINTENANCE AND RELINQUISHMENTS

The purpose of monitoring is to ensure that the objectives of the rehabilitation programme are met and that the rehabilitation process is followed.

**Groundwater and Surface Water**

The post-closure monitoring should take place for five years or until a long term acceptable trend can be determined.

**Flora**

The following recommendations have been suggested for post rehabilitation and monitoring of the proposed development area. Biodiversity assessments mid wet season should be undertaken by a qualified ecologist / botanist to monitor the rehabilitation progress with regards to flora.

## 38.3 POST-CLOSURE MONITORING AND MAINTENANCE

Prior to decommissioning and rehabilitation activities, a monitoring programme shall be developed and submitted to the relevant Ministry for approval, as a part of the Final Rehabilitation Plan. The programme is to include proposed monitoring during and after the closure of the exploration wells and related activities.

It is recommended that the post-closure monitoring include the following:

- Confirmation that any waste, wastewater or other pollutants that is generated as a result of decommissioning will be managed appropriately, as per the detailed requirements set out in the Final Rehabilitation Plan,
- Confirmation that all de-contaminated sites are free of residual pollution after decommissioning.

- Confirmation that acceptable cover has been achieved in areas where natural vegetation is being re-established. 'Acceptable cover' means re-establishment of pioneer grass communities over the disturbed areas at a density similar to surrounding undisturbed areas, non-eroding and free of invasive alien plants.
- Confirmation that abandoned wells are safe and are not resulting in a pollution hazard.

Post-closure monitoring of abandoned well sites shall include continued inspection and testing of water quality from the boreholes situated adjacent to the wells at intervals to be determined in the monitoring programme and agreed with the Designated Authority.

Annual environmental reports will be submitted to the Designated Authority and other relevant Departments for at least three years post-decommissioning. In the case of well sites, the frequency of this reporting period may be extended to include longer term water quality monitoring, at intervals to be agreed with the Designated Authority.

The monitoring reports shall include a list of any remedial action necessary to ensure that infrastructure that has not been removed remains safe and pollution free and that rehabilitation of project sites are in a stable, weed and free condition.

# 39 FINANCIAL PROVISION QUANTUM CALCULATION

For a detailed description of the financial provision, please refer to Appendix E for the Final Rehabilitation, Decommissioning and Closure Plan.

# 40 COMPLIANCE MONITORING

## 40.1 MECHANISMS FOR MONITORING COMPLIANCE

The implementation of proper monitoring programmes shall allow early detection of possible impacts of the project on the environment, and enable the implementation of management measure to management the risk outcomes. The monitoring requirements necessary during the exploration project is defined in the table below.

**Table 37: Monitoring requirements during the exploration project**

| Source Activity | Impacts Requiring Monitoring Programmes | Functional Requirements for Monitoring | Roles and Responsibilities | Monitoring and Reporting Frequency and Time Periods for Implementation |
|---|---|---|---|---|
| Site preparation | • Possession of permits for protected species<br>• Relocation of protected species<br>• Alien vegetation management | Document control | Environmental Site Officer (same as ECO)<br>Environmental Specialist | Once-off control of documents, site visit and reporting |
| | | Site inspections and Reports | Environmental Site Officer<br>Environmental Specialist<br>Independent Environmental Auditor | Monthly Site Visits and Reports |
| | | Report review and development of actions plans | Senior Environmental Management | Monthly Reports<br>Annual Performance Assessment |

| | | | | |
|---|---|---|---|---|
| Diamond Core Drilling | • Groundwater<br>• Surface water<br>• Alien vegetation management<br>• Noise (if any complaints are registered by residents)<br>• Air quality (if complaints are registered) | Site inspections, checklists and reporting | Environmental Site Officer<br>Environmental Specialist<br>Independent Environmental Auditor | Monthly Site Visits and Reports |
| | | Report review and development of corrective action plans | Environmental representatives<br>Surface water specialist | Monthly Site Visits and Reports |
| | | Site inspections and audits | Environmental Site Officer<br>Environmental Specialist<br>Independent Environmental Auditor | Monthly Reports<br>Annual Performance Assessment |
| Decommission and Rehabilitation | • Groundwater<br>• Surface water<br>• Alien vegetation management<br>• Noise (if any complaints are registered by residents)<br>• Air quality (if complaints are registered) | Site inspections, checklists and reporting | Environmental Site Officer<br>Environmental Specialist<br>Independent Environmental Auditor | Monthly Site Visits and Reports |
| | | Report review and development of corrective action plans | Environmental representatives<br>Surface water specialist | Monthly Site Visits and Reports |

| | | | | |
|---|---|---|---|---|
| | | Site inspections and audits | Environmental Site Officer<br>Environmental Specialist<br>Independent Environmental Auditor | Monthly Reports<br>Annual Performance Assessment |

## 40.2 ENVIRONMENTAL ASPECTS THAT REQUIRE MONITORING

A monitoring strategy must be defined to ensure that the effectiveness of mitigation measures can be tracked and corrective actions identified if necessary. Monitoring is intended to evaluate the effectiveness of environmental management actions as specified in the EMP. Proper monitoring shall ensure early detection of any impacts of the proposed project on the environment, and allow for corrective measures to be implemented in order to reduce risk outcomes.

The monitoring of various environmental aspects and the impact on them as a result of the proposed project shall take place by means of both quantitative and qualitative techniques in order to determine whether or not the requirements of the Environmental Management Programme are being complied with. The importance and value of detailed environmental monitoring networks cannot be overstated.

Environmental monitoring serves as a tool to track compliance, assist with potential liability identification, and mitigation throughout the construction and exploration phases of the proposed project. Where monitoring is specified as a requirement as per Table 37, the responsible party shall develop a monitoring measurement and reporting procedure that shall outline the following:

- Monitoring objectives;
- A detailed description of monitoring measures including:
  - Responsibilities;
  - Parameters to be measured;
  - Monitoring methods to be used;
  - Sampling locations;
  - Frequency of measurements;
  - Detection limits and thresholds
  - Thresholds that need corrective actions.
- Reporting requirements with defined responsibility in order to ensure early detection of conditions that require corrective actions.

Environmental Aspects to be monitored include:

- Air quality;
- Surface water;
- Groundwater;
- Noise;
- Ecology;
- Wetlands and Aquatic Ecology;
- Waste Management.

Refer to Section 42.3 for the Monitoring Programmes of respective environmental aspects.

## 40.3 REHABILITATION MONITORING

The purpose of a Rehabilitation Monitoring Program is to ensure that the management measures, rehabilitation and decommissioning objectives for the management of various environmental aspects, are met and that the rehabilitation process is followed. The frequency of monitoring must be adequate to identify potential gaps in the effectiveness of the management plans. A rehabilitation programme must be implemented during the exploration and decommissioning phases of the exploration activities. The following identified aspects require monitoring during the exploration and decommissioning phase:

- Erosion and sedimentation status of disturbed areas;
- Surface drainage and surface water quality;
- Groundwater quality;
- Successful re-vegetation and basal cover proportions;
- Rehabilitation effectiveness;
- Fauna and flora re-colonization; and
- Control of invasive vegetation species.

To achieve the primary objective, management infrastructure must be designed and operated with the following objectives in mind (DWAF, 2008):

- Visual impacts of disturbed areas should be minimized by restoring the landform to a condition suited to the surrounding landscape;
- Management of invasive/alien vegetation;
- Restoration of native vegetation covers and ecology;
- Minimize the area of vegetation clearing for exploration activities;
- Ensure that water management measures take into account and fit into the broader regional water management context;
- Ensure that water of different quality (clean and dirty water) is kept separate and managed separately if possible. This implies minimizing the contact between water of different qualities to minimize potential deterioration of water quality;
- Address water pollution issued at sources; and
- The need for long-term monitoring must be reduced.

## 40.4 ROLES AND RESPONSIBILITIES

This section provides and overall organisational structure for the EMP on the project, and defines the responsibilities and authority of the various organisations and individuals involved in the project. The project structure and associated personnel shall be sufficient to ensure that the required standards of environmental performance are met. The roles and responsibilities of various organisations individuals are summarized in Table 38 below:

**Table 38: Summary of the Roles and Responsibilities**

| Role | Responsibility | Report to |
|---|---|---|
| **Independent Environmental Control Officer (ECO) (same as Environmental Site Officer)** | • Liaise with the Environmental Coordinator on specialist environmental issues and non-compliances;<br>• Liaise with specialist consultants when necessary;<br>• Liaise with Landowners when necessary;<br>• Liaise with Community/Tribal Authorities regarding environmental issues that could potentially affect the surrounding communities;<br>• Be thoroughly familiar with existing information on the immediate environment and sensitivities as described in the Scoping and EIA Reports;<br>• Be thoroughly familiar with the specifications and conditions set out in the EMP with which sub-contractors are obliged to comply to;<br>• Perform management actions required to monitor performance of sub-contractors according to specifications in the EMP; | • Applicant or Authority Representative<br>• Field Superintendent. |

| Role | Responsibility | Report to |
|---|---|---|
| | • Report non-compliances by contractors to the Applicant Representative in order to instruct necessary actions required to ensure that contractors rectify non-compliances as rapidly and effectively as possible;<br>• Record keeping of monitoring for the purpose of audits;<br>• Assist Environmental Coordinator in preparation of monthly reports that shall be presented at monthly meetings and distributed to the following individuals:<br>• Sub-contractors;<br>• Applicant Representative;<br>• Environmental Coordinator; and<br>• Drilling Manager.<br>• Prepare monthly compliance reports containing a brief descriptions of non-compliances with EMP specifications, responsible party, result/consequence and corrective actions taken;<br>• Prepare the Rehabilitation Plan in conjunction with the Environmental Coordinator and specialist Consultants | |

| Role | Responsibility | Report to |
| --- | --- | --- |
| | and ensure that the Rehabilitation Plan is implemented. | |
| **Environmental Coordinator (EC)** | • Provide support to the ECO by means of regular site visits (preferably on a monthly basis) during the duration of the project, and assist with the compilation of the most effective and structured monitoring reporting strategy according to the EMP conditions;<br>• Prepare monthly monitoring reports in conjunction with the ECO;<br>• Report and discuss non-compliances with the Applicant Representative and steps to be taken to rectify non-compliance issues;<br>• Prepare the Rehabilitation Plan in conjunction with the ECO;<br>• Participate in monthly site visits; | • Applicant Representative |

| Role | Responsibility | Report to |
| --- | --- | --- |
| | • Assist with internal and external audit reports;<br>• Prepare the project close-out report. | |
| **Specialist Consultants** | • Provide specialist input and advise with regard to impact management;<br>• Prepare integrated reports on environmental aspects of the project;<br>• Monitor the impacts of the proposed activities on the environment with particular emphasis on areas of environmental sensitivity;<br>• Audit compliance by contractors with the environmental standards as and when necessary, and prepare ad-hoc audit reports documenting the effectiveness of environmental management actions; | • ECO<br>• Environmental Coordinator |
| **Community Liaison Officer (CLO)** | • Act as guides and advisors to Contractors in respect of the EMP on communication and local community issues during the project duration;<br>• Support communication requirements of the EMP; | • Contractor<br>• ECO<br>• Environmental Coordinator<br>• Applicant |

| Role | Responsibility | Report to |
|---|---|---|
| | • Assist in consultation with village leaders for recruitment of temporary workers from the affected villages;<br>• Maintain open communication channels with affected landowners;<br>• Support the development of a transparent communication structures with communities;<br>• Inform communities about upcoming activities and progress on project;<br>• Arrange occasional site visits for District Government community leaders and senior community leaders when necessary. | |
| **Applicant Representative/ Field Superintendent** | • Instruct rectifications on non-compliances reported by the ECO and EC. | • Single communication channel for the ECO and EC. |

## 40.5 TIME PERIOD FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS

The time periods for implementation of the impact management actions are provided in Table 37 above.

## 40.6 THE EMPR PERFORMANCE ASSESSMENT

According to Regulation 55 of the MPDRA regulations compliance with the EMPR must be monitored on a continuous basis. This requirement shall be accomplished through the continuous monitoring of compliance undertaken by the EO and ECO. The performance assessment will focus on the following Key Aspects:

- Compliance with the Approved EMPR; and
- Appropriateness and validity (technical content) of the EMPR.

An EMPR performance assessment report shall be submitted to the Petroleum Agency of South Africa (PASA) on an annual basis (each year of exploration and before applying for closure). The holder of the exploration right may appoint an independent qualified person for the monitoring and to compile a report, but the responsibilities remain the holder's. The performance assessment will include:

- The period when the performance assessment was conducted;
- The scope of the assessment;
- The procedures used for conducting the assessment;
- Interpreted information gained from monitoring the EMPR (e.g. ECO reports);
- Evaluation criteria used during the assessment; and
- Results of the assessment are to be discussed and mention must be made of any gaps in the EMPR and how it can be rectified.

## 40.7 REVIEW AND REVISION OF THE EMPR

It is important to note that this EMPR is made legally binding on the applicant at such time as the EA is granted and the EMPR is approved by the decision making authority. Since this is an exploration project, the overarching legislation is the MPRDA, and it is important to note that in accordance with Section 102 of the MPRDA, no EMPR may be amended or varied without the written consent of the minister. It is however also important to consider that the EMPR is a dynamic document which may require such alteration and /or amendment as the project evolves.

The Applicant in consultation with the ECO should be responsible for ensuring that the registration and updating of all relevant EMPR documentation is carried out. It shall be the responsibility of the Applicant/ drilling contractor to ensure that all personnel are performing according to the requirements of this procedure and to initiate the revision of controlled documents, when required by changes in process or operations and shall notify the ECO of such changes.

It is recommended that a risk assessment protocol must be developed and implemented by the ECO which shall be utilised to evaluate the environmental risk associated with the potential proposed alterations and/or amendments. The results of the risk assessment must then be included in the submission to the competent authority for the amendment process. It is important to note that if alterations and/or amendments are required, these may only be effected with written approval from the competent authority and in accordance with the then-in-effect relevant legal processes.

## 40.8 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

Management of operational risk is a key consideration for exploration projects operating within the social and economic context of South Africa. Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. Operational risks and impacts are usually managed through the implementation of the Environmental and Social Management System (ESMS) and Safety, Health and Environmental (SHE) system. A formal, effective ESMS is an important requirement for establishing and maintaining effective environmental management and should be undertaken during the planning phase of the Project. As such the Applicant shall be required to appoint a suitably qualified specialist to develop the ESMS to be implemented on the exploration well sites and within the exploration area in general. Adequate resources (people, financial and technical) need to be made available to ensure effective establishment, implementation, maintenance and continual improvements of the ESMS. The roles and responsibilities for these key environmental personnel should be clearly defined and communicated throughout the organisation. The ESMS should include the requirement to constantly monitor environmental performance and assess the adequacy of environmental resources provided for the exploration project. If required, Motuoane would need to procure further environmental resources to ensure the successful implementation of the ESMS and EMPR. The development and implementation of an ESMS is a requirement in terms of compliance with international standards of best practise such as the IFC Performance Standards and Equator principles.

## 40.9 ESMS FRAMEWORK

The Motuoane Hennenman ESMS will be based on:

- Motuoane's corporate vision; and
- South African legal requirements;
- Mining/ exploration best practice.

The ESMS to be developed for the Motuoane Hennenman Exploration Project should incorporate and provide for:

- A project specific Environmental Policy;
- Organisational capacity and competency;
- The ESMS shall identify roles and responsibilities of key role players;
- The ESMS shall incorporate a mechanism for ongoing identification of risks and impacts;
- Integration of the ESMS with the SHE management system may be undertaken to form a holistic SHE risk management system;
- The ESMS shall comprise appropriate management plans and procedures to ensure effective operational control;

- The ESMS shall provide for emergency response and also make provision for emergency protocols;
- Effective communication (both internal and external) is a key requirement for successful implementation of the ESMS and an appropriate communication procedure to this effect shall be developed;
- The ESMS shall involve engagement between the client, its workers, landowners and local communities directly affected by the project (the affected communities) and where appropriate, other stakeholders. It is therefore imperative that there is integration between Stakeholder Engagement procedures and the ESMS;
- The ESMS shall make provision for ongoing compliance monitoring, performance assessment and external audits; and
- The ESMS shall make provision for internal auditing and continual improvement which should be incorporated into internal management review processes. The ESMS should provide for setting and reviewing objectives and targets to demonstrate continual SHE improvements associated with the project.

Ultimately an effective ESMS should provide for effective management of social and environmental risks and impacts whilst maintaining legal compliance and meeting international standards of best practise where these are feasible and appropriate.

## 40.10 DOCUMENT CONTROL

A formal document control system should be established during the development of the ESMS. The document control system must provide for the following requirements;

- Documents are approved for adequacy prior to use;
- Review and update documents as necessary and re-approve documents;
- Ensure that changes and the current version status of documents are identified;
- Ensure that relevant versions of applicable documents are available at points of use;
- Ensure that documents remain legible and readily identifiable;
- Ensure that documents of external origin necessary for the ESMS are identified and their distribution controlled; and
- Prevent unintended use of obsolete documents and apply suitable identification to them if they are retained for any purpose.

## 40.11 RECORD KEEPING

It is essential that an official procedure for control of records be developed to ensure records required to demonstrate conformity to environmental and social standards are maintained. Motuoane is, therefore, required to develop and maintain a procedure for the identification, storage, protection, retrieval, retention and disposal of records as part of the ESMS. Records must be legible, identifiable and traceable.

## 40.12 AUDITING AND REPORTING PROCEDURES

Motuoane shall develop an auditing and reporting procedure, for conveying information from the compliance monitoring activities and to ensure that management is able to take rapid corrective action should certain thresholds be exceeded. The sections below present a framework for the development of the necessary procedures.

Different reporting mechanisms may include:

- Inspections;
- Accidents and emergencies;
- Measuring performance indicators and interpreting and acting on the indicators;
- Records of monitoring activities to test the effectiveness of mitigation measures and impact controls, as well as for compliance auditing purposes; and
- Training programmes and evidence of appropriate levels/amount of skills/capacities created.

All monitoring and auditing must be accompanied by applicable records and evidence (e.g. delivery slips, photographic records, etc.). All reports must be retained and made available for inspection by the ECO, the Applicant and /or the Relevant Competent Authorities. All reports shall be signed by the relevant parties to ensure accountability. The applicant must use the audit report findings to continually ensure that environmental protection measures are working effectively on site through a system of self-checking. The EMP should be viewed as a dynamic document aimed at continual environmental performance improvement.

The following auditing and reporting shall be required throughout the operation phase;

- Daily Compliance Reports: These reports must be prepared by the designated Independent ECO and must aim to monitor and report on-site environmental performance;
- Monthly Compliance Audits: These audits must be undertaken by the ECO and must aim to monitor and report on compliance with the requirements of the relevant authorisations, licences and permits, the approved EMPR; and
- Quarterly Audit Reports: The ECO must compile quarterly compliance reports (audits) which are to be submitted to the applicant for his review and correction of non-compliance issues. It is the responsibility of the ECO to report any non-compliance, which is not correctly rectified.

## 40.13 RESPONDING TO NON-COMPLIANCES

Non-compliance will be identified and managed through the following four key activities including;

- **Inspections** of the site and activities across the site;
- **Monitoring** of selected environmental quality variables;
- **Audits** of the site and relevant documentation as well as specific activities;
- **Reporting** on a regular basis.

An environmental non-conformance and incident register must be prepared and maintained by the ECO throughout the lifespan of the exploration phase in order to monitor environmental concerns, incidents, and non-conformances. The register must include details of date, location, description of the NC or Incident, applicable environmental commitment/standard, corrective action taken, adequacy of corrective action, date rectified, etc.

Non-compliance with the EMPR or any other environmental legislation, specifications or standards shall be recorded by the ECO in the non-conformance register. This register shall be maintained by the ECO and will be sent to the Applicant and Contractor on a regular basis (at least monthly), and the Applicant shall ensure that the responsible party takes the necessary corrective actions. Non-conformances may only be closed out in the register by the ECO upon confirmation that adequate corrective action has been taken. The register should be utilised to measure overall environmental performance.

## 40.14 ENVIRONMENTAL INCIDENTS

For the purposes of this project, an environmental incident can be divided into three levels, i.e. major, medium and minor. All major and medium environmental incidents shall be recorded in the incident register. Minor incidents do not need to be reported, but require immediate rectification on site. Definitions and examples of environmental incidents are provided in Table 39 below.

**Table 39: Description of incidents and non-conformances for the purpose of the project**

| | |
|---|---|
| **Non-Conformance** | Any deviation from work standards, practices, procedures, regulations, management system performance etc. that could either directly or indirectly lead to injury or illness, property damage, damage to the workplace environment, or a combination of these. |
| **Major Environmental Incident** | An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread, long-term, irreversible significant negative impact on the environment and/or has a high risk of legal liability.<br><br>A major environmental incident usually results in a significant pollution and may entail risk of public danger. Major environmental incidents must be reported to the authorities. The ECO shall make the final decision as to whether a particular incident should be classified as a Major incident.<br><br>An example of a Major environmental incident would be a significant spillage (e.g. 500 litres) of fuel into a watercourse. |
| **Medium Environmental Incident** | An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in widespread or localised, short term, reversible significant negative impact on the environment and/or has a risk of legal liability. |

| | |
|---|---|
| | A medium environmental incident may be reported to the authorities, can result in significant pollution or may entail risk of public danger. The impact of medium environmental incidents should be reversible within a short to medium term with or without intervention. The ECO shall make the final decision as to whether a particular incident should be classified as a Medium incident.<br><br>An example of a Medium environmental incident would be a large spill of fuel (e.g. ~ 50 litres) onto land. |
| **Minor Environmental Incident** | An incident or sequel of incidents, whether immediate or delayed, where the environmental impact is negligible immediately after occurrence and/or once-off intervention on the day of occurrence.<br><br>An incident where there is unnecessary wastage of a natural resource is also classified as a minor environmental incident. An example would be leaking water pipes that result in the wastage of water.<br><br>A minor environmental incident is not reportable to authorities. An example of a minor incident is day to day spills of fuel or oil onto the ground. |

The following incident reporting procedures shall apply to this project:

- All environmental incidents shall be reported to drilling contractor who shall ensure that the appropriate rectification is undertaken;
- The ECO shall record all medium and major incidents in the incident register and advise on the appropriate measures and timeframes for corrective action;
- An incident report shall be completed by party responsible for the incident for all medium and major incidents and the report shall be submitted to the drill site manager and ECO within 5 calendar days of the incident;
- The ECO shall investigate all medium and minor incidents and identify any required actions to prevent a recurrence of such incidents;

In the event of an emergency incident (unexpected sudden occurrence), including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed, the Applicant shall notify the relevant authorities in accordance with legal requirements (e.g. Section 30 of NEMA and Section 20 of the NWA). In the event of a dispute in terms of the classification of a such an incident, the Applicant shall engage the ECO to advise on the potential reporting requirements in terms of the above.

## 40.15 ENVIRONMENTAL AWARENESS PLAN AND TRAINING

Training and environmental awareness is an integral part of a complete EMPR. The overall aim of the training will be to ensure that all site staff are informed of their relevant requirements and obligations pertaining to the relevant authorisations, licences, permits and the approved EMPR and protection of the environment.

The applicant and contractor must ensure that all relevant employees are trained and capable of carrying out their duties in an environmentally responsible and compliant manner, and are capable of complying with the relevant environmental requirements. To obtain buy-in from staff, individual employees need to be involved in:

- Identifying the relevant risks;
- Understanding the nature of risks;
- Devising risk controls; and
- Given incentive to implement the controls in terms of legal obligations.

The applicant shall ensure that adequate environmental training takes place. All employees shall have been given an induction presentation on environmental awareness. Where possible, the presentation needs to be conducted in the language of the employees. All training must be formally recorded and attendance registers retained. The environmental training should, as a minimum, include the following:

- General background and definition to the environment;
- The importance of compliance with all environmental policies;
- The environmental impacts, actual or potential, of their work activities;
- Compliance with mitigation measures proposed for sensitive areas;
- The environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving compliance with the environmental policy and procedures and with the requirement of the applicant's environmental management systems, including emergency preparedness and response requirements;
- The potential consequences (legal and/or other) of departure from specified operating procedures;
- The mitigation measures required to be implemented when carrying out their work activities; and
- All operational risks must be identified and processes established to mitigate such risk, proactively. Thus, the applicant needs to inform the employees of any environmental risks that may result from their work, and how these risks must be dealt with in order to avoid pollution and/or degradation of the environment.

In the case of new staff (including contract labour) the contractor / applicant shall keep a record of adequate environmental induction training.

## 40.16 MANNER IN WHICH EMPLOYEES WILL BE INFORMED OF ENVIRONMENTAL RISKS

The specific requirements for environmental training include:

- Site Environmental Induction Training: All site staff and employees will receive induction training. The induction training must include an environmental management component which will be will be prepared by the ECO and presented where possible by the ECO. The training material must include general environmental awareness and an overview of the EMPR and EA requirements. The Induction Training Material must be reviewed and approved by the ECO; and
- Informal training of all staff on site is also required on an on-going basis through informal discussions, on-site supervision and through facilitation of day to day activities. Such training must be given or otherwise facilitated by the ECO.

## 40.17 MANNER IN WHICH RISKS WILL BE DEALT WITH TO AVOID POLLUTION OR DEGRADATION

Motuoane will be required to develop an ESMS which provides a mechanism for ongoing assessment of operational risks and impacts associated with their activities and any new activities that may arise. The impacts and risks identified will be managed through the framework of internal procedures which specify the mechanisms and actions required to effectively manage the risks and impacts on the ground. Where any unexpected events occur that have the potential to result in environmental damage, these shall be manged through the emergency response procedure. The framework for the emergency response procedure is provided below.

## 40.18 EMERGENCY RESPONSE PLAN

Motuoane must identify potential emergencies and develop procedures for preventing and responding to them. There are several options for dealing with high priority impacts and risks, as the paradigm has two components, probability and consequence. The design of control measures rest on the understanding the cause and effect. Best practise is to intervene with the ultimate factors where feasible, rather than treat the outcomes. Emergency response therefore has the option of reducing probability, or reducing the consequence, reducing the probability is the preferred option. Below are some common emergency preparedness approaches:

- Threat consequence if and when the risk eventuates, when the risk becomes an issue;
- Combine reducing the probability and treating the consequence;
- Offset environmental losses by investing in other assets;
- Not manage some of the risks because there are too many; and
- Make provision to manage residual impacts or issues that arise because of shortcomings in risk identification and rating, avoidance and mitigation or because a rare event has occurred.

Residual impacts are those impacts that despite reducing the probability and consequence might still occur. In these cases, parties will have to be compensated, pollution cleaned up and damage to the environment remediated.

The Applicant shall be required to develop and implement an Emergency Preparedness and Response Plan prior to commencing work. The Emergency Preparedness and Response Plan should be based on a baseline Hazard and Risk Assessment and should provide for the following as a minimum:

- Risk assessment (identification of areas where accidents and emergency situations may occur, communities and individuals that may be impacted);
- Response procedures;
- Provision of equipment and resources;
- Designation of responsibilities;
- Communication and reporting (including that with potentially Affected Communities);
- Periodic training to ensure effective response; and
- Periodic review and revision, as necessary, to reflect changing conditions.

The Applicant must ensure that the Emergency Preparedness and Response Plan makes provision for environmental emergencies, including, but not limited to;

- Fire Prevention;
- Fire Emergency Response;
- Spill prevention;
- Spill Response;
- Contamination of a water resource;
- Accidents to employees; and
- Use of hazardous substances and materials, etc.

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

### 40.18.1 FIRE

Fires represent a significant risk to exploration activities, and require special attention in the Emergency Response Plan. The contractor/Applicant must take all reasonable measures to ensure that fires are not started as a result of activities on site. No smoking is allowed near containers with flammable contents or at areas that are highly flammable (directly near the drill rig in case of methane release). Smoking is only permitted at areas designated for smoking. No open fires are permitted on site and no burning of waste is to be allowed on site. The contractor/Applicant shall ensure that there is sufficient firefighting equipment available on site at all times. Such precautions include having an approved fire extinguisher immediately available at the site of any such activities. The contractor/Applicant is to ensure that he/she has the contact details of the nearest fire station in case of an emergency.

Appropriate and correctly serviced equipment must be available for all activities that are likely to generate fire.

It is further anticipated that firebreaks may be required around the exploration site perimeter. It is recommended that such fire prevention measures are implemented in consultation with landowners and where necessary that the Applicant coordinate fire prevention efforts with local Fire Protection Agency (FPA).

### 40.18.2 HEALTH AND SAFETY

The Applicant and Contractor shall make allowance for the supply, erection, maintenance and removal of the information boards. Information boards shall also provide the name of the drill site managers, relevant contact person and contact number. This will ensure that the public access to request information and/or to lodge any complaints. The boards will essentially be to advise the communities of the activities to be undertaken, or being undertaken and to advise of the prohibition of entering demarcated “no-go” areas.

The Applicant and Contractor must ensure that compliance with the Occupational Health and Safety Act (Act No. 85 of 1993) is strictly adhered to. All reasonable measures must be taken to ensure the safety of all site staff and the surrounding community is not compromised. No weapons may be brought onto the property by any person. Where fencing is temporarily affected, temporary security must be provided at all times until the fence is reinstated.

The Applicant and Contractor must ensure that all vehicles using public roads are in a roadworthy condition, that drivers adhere to the speed limits and that their loads are secured and that all local, provincial and national regulations are adhered to.

The Applicant and Contractor must ensure that all accidents and incidents are recorded and reported to the ECO. The Applicant/ contractor must have easy access to all relevant emergency numbers for example, spill response teams, fire authorities, fire protection associations, medical emergency, nearest emergency rooms (hospitals) to the site, of both private and public hospitals. The Applicant and Contractor must take all reasonable measures to ensure the health and safety of all employees, visitors and the public.

### 40.18.3 SPILL RESPONSE PROCEDURE

All employees, staff and labourers must be instructed regarding implementation of spill prevention measures and spill response procedures. In the event of a spill, the following general requirements shall apply and the detailed spill procedure to be developed prior to exploration commencing must cater for these requirements;

- Immediately reporting of spills by all employees and/or visitors to the relevant site supervisor and ECO (this requirement must be including in induction training);
- Take immediate action to contain or stop the spill where it is safe to do so;

- Contain the spill and prevent its further spread (e.g. earth berm or oil absorbent materials for spill to land or by deploying booms and/or absorbent material for a spill to water);
- Dispose of any contaminated soil or materials according to appropriate waste disposal procedure (waste from spills of hazardous materials shall be disposed of as hazardous waste at a suitably licensed waste disposal facility);
- The ECO shall record details of the spill in the incident register; and
- Photographic evidence shall be obtained of the spill clean-up.

In the case of large spills, the services of a specialist spill response agency shall be required, who shall advise on appropriate clean-up procedures and follow-up monitoring (if required).

In the event of any spills which are classified as medium or major incidents. The ECO shall record the incident non-conformance and incident register and advice on the appropriate measures and timeframes for corrective action. Environmental incident reports shall be completed and submitted to the drill site manager and Applicant within 5 working days for all medium and major incidents. If there is a requirement to report the incident to the authorities, this shall be done by the Applicant in consultation with the ECO.

The Applicant must also, (as per Section 30 of the NEMA) notify the Director-General (PASA, DWS, DEA and DMR), South African Police Services and Local Municipality and any persons whose health may be affected of the nature of an incident including:

- Any risks posed to public health, safety and property;
- Toxicity of the substance or by-products released by the incident; and
- Any step taken to avoid or minimise the effects of the incident on public health and the environment.

The Applicant and Contractor must ensure that lists of all emergency telephone numbers/contact persons (including fire control) are kept up to date and that all numbers and names are posted at relevant locations throughout the lifespan of the project.

#### 40.18.4 MEASURES TO CONTROL OR REMEDY ANY CAUSES OF POLLUTION OR DEGRADATION

The broad measures to control or remedy any causes of pollution or environmental degradation as a result of the proposed activities taking place are provided below:

- Limit the size of the area to be disturbed as far as is practically possible;
- Contain potential pollutants and contaminants (where possible) at source;
- Handling of potential pollutants and contaminants (where possible) must be conducted in bunded areas and on impermeable substrates;
- Ensure the timeous clean-up of any spills;

- Implement a waste management system for all waste stream present on site;
- Investigate any I&AP claims of pollution or contamination as a result of exploration activities;
- Rehabilitate the exploration sites in line with the requirements of the detailed rehabilitation and closure plan; and
- Implement the impact management objectives, outcomes and actions, as described in Section 34 above.

It is of critical importance that the broad measures to control or remedy any causes of pollution or environmental degradation are applied during all phases of the proposed exploration activities. This is essential and allows for the exploration to be conducted in a manner that will allow for the decommissioning and rehabilitation goals and objectives to be met.

# 41 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

In the approval of the scoping report, the PASA included the following information to be addressed in the EIR/EMPR:

- The various state departments must be consulted and their comments incorporated in the EIR befoe submission to the Agency. State Departments/ Agencies to be consulted include amongst other the Provincial Heritage Resorouces Authority/Agencies to be consulted include amongst others the Provincial Heritage Resources Authority/ South African Heritage Resources Agency, Provincial Environmental Department, Department of Agriculture, Forestry and Fisheries (DAFF), Department of Water and Sanitation (DWS), Department of Land Affairs (DLA), district and local municpalities. Should you be unable to obtain comments, proof of attempts made to obtain comments should be submitted to the Agency.
- Objections raised by all Interested and Affected Parties (I&APs) must be addressed and taken into consideration during the development of the EIR.
- Where desktop studies are used during environmental assessment, they must be authenticated by physical assessment in order to provide definite characteristics of the proposed exploration area. In this regards, you and the specialist are required to undertake physical site assessment of the application are and present the results thereof in the EIR.
- The description of the proposed exploration activities in the FSR is inadequate as it does not include information relating to the duration of the proposed activities, size of the geochemical and soil sampling area; type of equipment to be used during exploration operations; use of drilling fluids during drilling operations and method to be used for the selection of borehole sites.
- Section 24 P of the NEMA requires that an applicant for an environmental authorisation relating to prospecting, mining or production must, before the Minister responsible for mineral resources issues the environmental authorisation, comply with the prescribed financial provision for the rehabilitation, closure ad ongoing post decommissioning

management of negative environmental impacts. Therefore, the potential environmental liabilities associated with the proposed activity must be quantified and indicate the method of financial provision in line with the National Environmental Management Act (1998): Regulations pertaining to the financial provision for prospecting exploration, mining and production, (2015). The financial provision costs have been included in the Final Rehabilitation, Decommissioning and Closure Plan which is contained in Appendix E.

# 42 ENVIRONMENTAL MONITORING

## 42.1 FUNCTIONAL REQUIREMENTS OF MONITORING PROGRAMMES

The purpose of monitoring is not merely to collect data, but to provide information necessary to make informed decisions on managing and mitigating potential impacts. Monitoring therefore serves the following functions:

- Serve as early warning system to detect any potential negative impacts;
- To provide information to feedback into management controls to avoid, prevent or minimise potential negative impacts;
- Provide quantitative data that can serve as evidence for the presence of negative impacts or the lack thereof;
- Allows for trending, modelling and prediction of future conditions or potential impacts;
- Based on the above, the Applicant must ensure that monitoring programmes comprise of the following (at a minimum) in order to obtain valuable environmental data;
  - All equipment used in monitoring must be correctly calibrated and serviced regularly;
  - Samples required for analysis will be sent to an independent and accredited laboratory;
  - Monitoring data must be stored;
  - Data must be checked and interpreted and tending undertaken on a quarterly basis;
  - Both the date and reports on environmental monitoring must be kept on record and where relevant provided to I&AP's; and
  - The general and site specific parameters to be monitored must be identified by an independent specialist, the authorities and where relevant I&AP's.

## 42.2 LIST OF ASPECTS THAT REQUIRE MONITORING PLANS

The list of aspects that require on-going environmental monitoring includes the following:

- Air quality;
- Surface water (quality/ quantity);
- Groundwater (quality/ quantity);
- Waste Management; and
- Rehabilitation.

This list provided is by no means conclusive and must instead be used as a guideline for the impacts that require monitoring.

## 42.3 MONITORING PLANS FOR ENVIRONMENTAL ASPECTS

The monitoring of various environmental aspects and the impact on them as a result of the proposed project shall take place by means of both quantitative and qualitative techniques in order to determine whether or not the requirements of the EMPR are being complied with. The importance and value of detailed environmental monitoring networks cannot be overstated.

Environmental monitoring serves as a tool to track compliance, assist with potential liability identification, and mitigation throughout the life of the proposed project. This is achieved through the provision of actual evidence based monitoring and reporting thereof. In essence, monitoring is a continuous data-gathering, data interpreting, and control procedure that ranges from visual inspection to in-depth investigative monitoring and reporting. These monitoring plans need to be drawn into standalone plans that can be updated and amended as per authority requirements and additional data requirements identified during the exploration activities. These plans need to include the site specific roles and responsibilities for actions.

Where monitoring is specified as a requirement as per Table 37, the responsible party shall develop a monitoring measurement and reporting procedure that shall outline the following:

- Monitoring objectives;
- A detailed description of monitoring measures including:
  - Responsibilities;
  - Parameters to be measured;
  - Monitoring methods to be used;
  - Sampling locations;
  - Frequency of measurements;
  - Detection limits and thresholds
  - Thresholds that need corrective actions.
- Reporting requirements with defined responsibility in order to ensure early detection of conditions that require corrective actions.

### 42.3.1 AIR QUALITY

Due to the nature of the activity, air quality impacts are expected to be low, localised and short-term.

In terms of air quality, the main pollutant of concern during the exploration drilling phase is particulates (dust) and methane releases. As such, the design and implementation of the air quality monitoring program must incorporate the following considerations:

- Monitoring of dust fallout;
- Monitoring of methane during drilling operations; and
- Review and amendment of the monitoring program as required.

### 42.3.2 SURFACE WATER MONITORING

Motuoane Hennenman is required to develop a surface water monitoring program based on the Best Practice Guidelines G3: Water Monitoring Systems (DWAF, 2006). It is recommended that all water containment facilities on site be monitored for water quality and quantity on a monthly basis. The water quality results should meet applicable standards or ensure that water released and associated risks are well understood. Streams or natural drainage lines with flowing water within the catchment of the site (zone of impact) should be monitored on a monthly basis.

A biomonitoring programme is recommended for perennial streams. The programme should be on a bi-annual basis upstream and downstream of the site and include at least macro-invertebrate and habitat integrity assessments, but further assessments may be required, depending on the stream conditions. The main objective of the monitoring program is to effectively monitor the surface water quality in the vicinity of the exploration activities to ensure the protection of surrounding water users. This translated into the following composite objectives:

- To determine the current water quality in the vicinity of the drilling operations and if water quality changes over time. Baseline sampling will be important prior to commencing with exploration;
- Monitor pollution status and assess the impacts, which could possibly lead to pollution prevention; and
- Assess the performance of pollution prevention measures in order to determine if activities comply to license conditions.
- Ensure compliance with the requirements of the relevant legislation;
- Ensure the identification of suitable water quality parameters.

The Surface Water Quality Monitoring Program entails the following:

- Monthly water quality and quantity monitoring of water containment facilities on site, and quality and quantity monitoring of boreholes, streams and natural drainage lines with flowing water within the catchment of the site; and
- Bi-annual monitoring of perennial streams near to the exploration drill-sites.

Details of the proposed monitoring programme are presented in the table below. The monitoring programme should be amended according to on-site operations and future permit requirements.

**Table 40: Proposed monitoring programme**

| Water Type | Details | Monitoring Frequency |
|---|---|---|
| **Surface Water** | • Sample point in the wetland area upstream and downstream of the exploration drilling areas;<br>• Clean water discharge points (if any); | Monthly water samples |

| | | |
|---|---|---|
| **Drinking Water (pipe lines, boreholes)** | • Any supplied water used for domestic purposes should be monitored for parameters such as total faecal coliform; | Monthly water samples |

The following table presents the applicable parameters that should be monitored on a Monthly basis in the Surface Water Quality Monitoring Program:

**Table 41: Applicable parameters to be monitored on a monthly basis**

| Monthly analysis | |
|---|---|
| pH at 22◦ | Chloride (Cl) |
| Conductivity (mS/m) | Sulphate ($SO_4$) |
| Total Dissolved Solids | Nitrate ($NO_3$) |
| Calcium (Ca) | Fluoride (F) |
| Magnesium (Mg) (mg/ℓ) | Aluminum (Al) |
| Sodium (Na) | Manganese (Mn) |
| Potassium (K) | Iron (Fe) |
| Total Alkalinity as $CaCO_3$ | Zinc (Zn) |
| Bicarbonate ($HCO_3$) | Total Petroleum Hydrocarbons (TPH) |
| Diesel Range Organics (DRO) | |

The following table presents the applicable parameters that should be monitored on a bi-annual basis in the Surface Water Quality Monitoring Program:

**Table 42: Applicable parameters to be assessed on a bi-annual basis**

| Bi-annual analysis | |
|---|---|
| Antimony (Sb) | Nickel (Ni) |
| Arsenic (As) | Selenium (Se) |

| | |
|---|---|
| Barium (Ba) | Silicon (Si) |
| Beryllium (Be) | Silver (Ag) |
| Bismuth (Bi) | Strontium (Sr) |
| Cadmium (Cd) | Tin (Sn) |
| Cobalt (Co) | Titanium (Ti) |
| Lithium (Li) | Vanadium (V) |
| Mercury (Hg) | Zirconium (Zr) |
| Molybdenum (Mo) | |

#### 42.3.2.1 SURFACE WATER MONITORING LOCATIONS

Prior to exploration and once the target areas for exploration have been determined, a qualified hydrologist must assist in determining suitable surface water monitoring locations near to the exploration areas.

#### 42.3.2.2 SAMPLING PROCEDURE AND METHODOLOGY

The sampling procedure should be in accordance with the following publications:

- SABS ISO 5667 – 1:2008 Guidance on the design of sampling programmes
- SABS ISO 5667 – 2:1991 Guidance on sampling techniques
- SABS ISO 5667 – 3:2006 Guidance on the preservation and handling of samples
- SANB ISO 5667 - 6:2006 Water quality - Sampling Part 6: Guidance on sampling of rivers and streams
- SABS ISO 5667 – 11:2015 Guidance on sampling of groundwater

Samples must be submitted to a SANAS-accredited Laboratory Service.

Field observations such as the following must be recorded on field data sheets:

- Coordinates of each surface water sampling point;
- In-situ Electrical Conductivity (EC), pH, Temperature and redox potential (Eh) are measured and recorded for each sampling point; and
- Documenting general characteristics of the water samples such as colour, turbidity and smell.

- Any potential sources of contamination at the sampling points;
- Regular photographs of each sampling point;
- A chain of custody should be filled in at the time of sampling recording the following information:
  - Date and time of sampling.
  - Coordinates of each sample point (at first sampling event only).
  - *In-situ* measurements for each sampling point, namely pH, electrical conductivity, total dissolved solids and temperature.
  - General characteristics of the water samples such as colour, turbidity (murky/clear) and smell, as well as visual observations of the sample site.

The chain of custody form shall be completed when the samples are transported and transferred to the laboratory for analysis.

Care should be taken to ensure that the samples taken are sufficiently large enough (1ℓ) to allow the laboratory to run duplicate analysis if required. Samples should be kept cool when stored and transported. Samples for metal analysis should be filtered through a 0.45 μm pore size membrane in the field and preserved with nitric acid.

### 42.3.3 GROUND WATER MONITORING

The monitoring objectives are to detect and manage the possible impacts of the proposed petroleum exploration on the hydrological environment. The impacts are influenced by the management of the exploration, the physical and chemical composition of the possible contamination source, and the vulnerability of the receiving environment.

The main objective of the monitoring is to:

1. Obtain accurate information of the chemical, micro biological and physical characteristics of the receiving environment before any exploration commences.
2. The timely detection of any changes in the chemical, micro biological and physical characteristics of the receiving environment.
3. The timely detection of any changes in the chemical, micro biological and physical characteristics of the receiving environment due to pollutants released into the environment.
4. To detect any spills at or leakages.
5. To obtain information that can be used to update the environmental management plan.
6. To determine if applicable environmental laws and standards is adhered to.

This will ensure that any possible impacts on the receiving environment are detected and rectified in time. Once the exploration sites have been identified, the monitoring programme should be finalised for each site and implemented.

Once exploration borehole locations are known, a hydrocensus within a 3 km radius of each exploration borehole should be performed to identify existing boreholes that can be used for monitoring of each exploration borehole. The following monitoring is recommended:

**Groundwater level monitoring**

1. Pre-development (pre-drilling) hydraulic heads: Groundwater levels should be measured less than 1 month before the exploration borehole starts drilling, in at least 2 existing boreholes within a 3 km radius around the proposed exploration borehole. If active DWS groundwater monitoring boreholes are available within the 3 km radius of the exploration borehole, then hydraulic head data from these boreholes can be used as pre-development measurements.
2. During drilling groundwater levels: Groundwater levels should be measured in the close existing boreholes when drilling starts. The groundwater levels should also be measured 1 day after the exploration borehole drilling is completed, in 2 nearby existing boreholes (if available) and in the exploration borehole itself.
3. Post-drilling and grouting (cementing) groundwater levels: Groundwater levels should be measured in selected existing monitoring boreholes, 1 month after drilling has completed. A final groundwater level measurement run can be synchronised with the water quality sampling run, 6 months after drilling has completed.

**Groundwater- and surface water-quality monitoring**

1. Pre-development groundwater qualities: Once the exploration core borehole locations are known, groundwater quality should be sampled at the nearest existing borehole or spring, less than 1 month before drilling starts. This can be synchronised with the groundwater level measurement run. If more than one borehole is within a 1 km radius of the planned exploration borehole, then two boreholes should be sampled and water qualities analysed.
2. Pre-development surface water qualities: If nearby (< 1 km) flowing surface water drainages or springs exist, then the drainage should be sampled downstream of the exploration drilling site, within 1 km distance from proposed drilling pad. Similarly nearby downstream spring should be sampled. This sampling can be synchronised with the less than 1 month before drilling groundwater sampling run.
3. During drilling groundwater quality: Directly after cleaning and purging of the exploration borehole drilling fluid, the exploration borehole groundwater quality should be sampled and its water quality analysed. This is a very important water quality analysis.
4. Post-drilling surface water quality: If nearby (< 1 km) flowing surface water drainages or springs exist, then the drainage should be sampled downstream of the exploration drilling site, within 1 km distance of proposed drilling pad. Similarly nearby downstream spring should be sampled. This sampling run should be conducted directly after drilling and sealing of the borehole has been completed. Furthermore, if springs and nearby (< 1 km) mountain pools in the exploration borehole location exist, these should be sampled 1 month after the drilling and sealing activities were completed, should that be completed in the wet season. This surface water sampling (if applicable) can be synchronised with the groundwater sampling.

5. Post exploration drilling groundwater quality: Selected nearby existing boreholes or springs should be sampled 1 month after exploration drilling has completed. A final groundwater quality sampling run can be conducted at nearby (< 1 km) existing boreholes 6 months after exploration drilling has completed.
6. Groundwater quality deterioration complaints in nearby (< 1 km) existing water supply boreholes, after exploration borehole drilling, should be investigated by confirmative sampling and analysis.
7. Full spectrum initial groundwater constituents should be analysed in the initial sampling run and in the final sampling run. These constituents are listed in Table 8.2 of the attached geohydrological report.
8. Surface water qualities should be analysed for the surface water quality constituents as described in Table 8.2 of the attached geohydrological report.
9. Groundwater quality samples other than initial and final water quality sampling runs, should be analysed for the constituents as shown in Table 8.2 of the attached geohydrological report.

### 42.3.4 ECOLOGY AND WETLANDS MONITORING

David Hoare Consulting cc. conducted an ecological assessment of the application area, in order to identified potential impacts and recommend management and mitigation measures. Various mitigation measures were recommended to alleviate and/or reduce the potential ecological impacts. Based on findings and recommendations from ecology specialist, Motuoane is required to implement a monitoring program to evaluate the success of mitigation measures. The implementation of the Monitoring Program is based on the following objectives:

- Ensure that all required permits, according to National and Provincial legislation, for the removal and relocation of protected species are obtained (if and where necessary);
- To monitoring the relocation of protected species in order to establish if the intervention was successful or not;
- To monitor the impacts of exploration activities on sensitive habitats;
- To enforce continual eradication of alien and invasive species; and
- To ensure successful conservation of habitats and species.

Table 43 below presents the required monitoring activities to ensure that management actions are implemented:

**Table 43: Monitoring activities required for the ecology monitoring programme**

| **Obtain permits for protected species** | |
|---|---|
| Conceptual management strategy (Principles & Objectives) | Ensure that permits for the removal of any species protected according to National or Provincial legislation are obtained. |

| | |
|---|---|
| Baseline data | Identity, location and number of individuals of each affected species |
| Proposed monitoring locations | Environmental office |
| Recommended Data collection/sampling | Visual inspection of documentation |
| Recommended Methods and materials | Visual inspection of documentation |
| Applicable Parameters & Standards | Legal requirement for permits, as per applicable legislation |
| Recommended Timeframes & Responsibilities for Implementation where appropriate | Prior to construction / operation<br>Applicant is responsible |
| Recommended Targets and Key Performance Indicators | All permits in place. |
| Recommended Data Interpretation, Trending and Analysis | None |
| Recommended Reporting | Once-off confirmation |
| Recommendations for audit and review | External review |
| **Plant search & rescue** | |
| Conceptual management strategy (Principles & Objectives) | Monitoring of plants relocated during search and rescue to evaluate whether the intervention was successful or not. |
| Baseline data | Identity, location and number of individuals of each affected species |
| Proposed monitoring locations | At site where relocated plants relocated to. |
| Recommended Data collection/sampling | Count number of individual plants of each species |

| | |
|---|---|
| Recommended Methods and materials | Count number of individual plants of each species |
| Applicable Parameters & Standards | Conditions of authorisation |
| Recommended Timeframes & Responsibilities for Implementation where appropriate | Prior to construction / operation<br>Applicant is responsible |
| Recommended Targets and Key Performance Indicators | 100% survival of translocated plants |
| Recommended Data Interpretation, Trending and Analysis | Survival rate |
| Recommended Reporting | Annually |
| Recommendations for audit and review | External review |

### 42.3.5 WASTE MANAGEMENT PROGRAMME

If the elimination of waste is not achieved through pollution prevention measures, waste management must be accomplished through a waste management plan.

An area specific waste management programme relates directly to the type of waste handling and disposal options to the ecological sensitivities, regulatory requirements and availability of facilities within the area. The implementation of an areas specific waste management programme provides assurance in terms of protection of the environment and ingoing compliance with regulatory requirements, and minimisation of the volume and toxicity of waste. A waste management programme should be a living document which requires periodic review and revision in order to allow for changes and identification of new impacts during the course of the project duration.

The following steps form the structure of an area specific Waste Management Programme:

1. **Management approval**

Management approval and support for the Waste Management Programme should be obtained. Management should be aware of the timing and scope of the plan, and the goals of the management plant should be established with measurable objectives for each goal.

2. **Area definition**

The management plan should be site-or area specific and should include a description of the geographical area and operational activities addressed.

3. **Waste identification**

Operations personnel should identify all waste generated within the area defined for each exploration activity. A brief description of each waste type will assist in further management steps.

**4. Regulatory analysis**

Review national laws and regulations to determine the types of waste for which management practices should be highlighted. Waste types for which the regulations do not adequately defined, management requirements should also be addressed.

**5. Waste categorisation**

The physical, chemical and toxicological properties of each waste types should be identified, and waste should be grouped according to their health and environmental hazards.

6**. Evaluation of waste management and disposal options**

Waste management options for each waste type should be identified and compiled. Each option should be reviewed by appropriate operations personnel and management. Evaluation should include the following:

- Environmental considerations;
- Locations;
- Limitations;
- Regulatory restrictions;
- Operating feasibility;
- Potential long-term liability; and
- Waste minimisation

Waste, volume and toxicity reduction, recycling and reclaiming or treatment should be evaluated. Revision of the waste management programme should be made to reflect any minimisation practices implemented.

8. **Selection of preferred waste management practices**

Select the best practice for the specific operation and location. Life-cycle analysis including use, storage, treatment, transport and disposal should be considered.

9. **Implementation of area specific waste management programme**

Waste management and disposal options for each waste type should be compiled into one comprehensive waste management plan. Waste management practices should be summarised, including waste description, indicating the chosen waste management and disposal practice.

10. **Management plan review and update**

Effective waste management is an on-going process. The waste management programme should be reviewed by senior management whenever new management practices and options are identified. A procedure to review and update the waste management programme should be established, and practices modified to reflect changing technologies, needs and regulations.

### 42.3.6 REHABILITATION MONITORING

The purpose of a Rehabilitation Monitoring Program is to ensure that the management measures, rehabilitation and decommissioning objectives for the management of various environmental aspects, are met and that the rehabilitation process is followed. The frequency of monitoring must be adequate to identify potential gaps in the effectiveness of the management plans. A rehabilitation programme must be implemented during the exploration and decommissioning phases of the exploration activities. The following identified aspects require monitoring during the exploration and decommissioning phase:

- Erosion and sedimentation status of disturbed areas;
- Surface drainage and surface water quality;
- Groundwater quality;
- Successful re-vegetation and basal cover proportions;
- Rehabilitation effectiveness;
- Fauna and flora re-colonization; and
- Control of invasive vegetation species.

To achieve the primary objective, management infrastructure must be designed and operated with the following objectives in mind (DWAF, 2008):

- Visual impacts of disturbed areas should be minimized by restoring the landform to a condition suited to the surrounding landscape;
- Management of invasive/alien vegetation;
- Restoration of native vegetation covers and ecology;
- Minimize the area of vegetation clearing for exploration activities;
- Ensure that water management measures take into account and fit into the broader regional water management context;
- Ensure that water of different quality (clean and dirty water) is kept separate and managed separately if possible. This implies minimizing the contact between water of different qualities to minimize potential deterioration of water quality;
- Address water pollution issued at sources; and
- The need for long-term monitoring may be reduced when monitoring results indicate no adverse impacts.

# 43 UNDERTAKING

The EAP herewith confirms:

(a) The correctness of the information provided in the reports;
(b) The inclusion of comments and inputs from stakeholders and I&AP's;
(c) The inclusion of inputs and recommendations from the specialist reports where relevant; and

(d) That the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein.

# 44 TECHNICAL SUPPORTING INFORMATION

The following specialist reports have been included as Appendices to this report:

- **Ecology and Wetlands Specialist Report**
- **Geohydrology specialist Report**
- **Heritage specialist Report**

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