ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME FOR AN EXPLORATION RIGHT APPLICATION FOR PETROLEUM PRODUCTS ON VARIOUS FARMS IN THE MAGISTERIAL DISTRICT OF PIETERMARITZBURG, KWAZULU-NATAL (12/3/291 ER)

EXECUTIVE SUMMARY

1. Introduction and Background

This Environmental Impact Report (“EIR”) and Environmental Management Programme (“EMPr”) have been compiled and distributed for review and comment as part of the Scoping and Environmental Impact Assessment (hereafter collectively referred to as “EIA”) process that is being undertaken for the application by Rhino Oil & Gas Exploration South Africa (Pty) Ltd (hereafter referred to as “Rhino Oil and Gas”) for an “Exploration Right (“ER’) for petroleum products on various farms in the magisterial district of Pietermaritzburg\(^1\), KwaZulu-Natal, South Africa (12/3/291 ER).

This EIR summarises the EIA process followed to date and provides an overview of the proposed project and the affected environment. It provides an assessment of the impacts of the proposed project and sets out the recommend management measures. Interested and Affected Parties (“I&APs”) are asked to comment on the EIA and EMPr before it is submitted to the Petroleum Agency of South Africa (“PASA”) for decision-making.

In early 2015 Rhino Oil and Gas lodged an application for an ER to explore for petroleum products (including oil, gas, condensate, coal bed methane, helium and biogenic gas) with PASA in terms of Section 79 of the Mineral and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA), as amended. PASA accepted the ER application on 22 May 2015 (Ref: 12/3/291 ER).

The purpose of exploration is to identify the existence of any commercially viable reserves of oil and/or gas. Exploration is a technically complex and iterative process consisting of a number of stages typically termed i) early-phase exploration, ii) appraisal and iii) well drilling. Data from each stage improves the knowledge and understanding of the resource, and informs the following stage, which is only undertaken if results are positive. Exploration can require a period of up to 10 years to inform a decision on a production right application. Rhino Oil and Gas is proposing to undertake ‘early-phase exploration’ activities.

The initial ER application area was approximately 1 500 000 ha in extent and covered approximately 10 000 properties (farms and portions) (see Figure below for the regional setting of the project). The scope of the application proposed ‘early-phase exploration’ activities namely:

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\(^1\) The PASA acceptance names the Magisterial District of Pietermaritzburg. However the application area (now revised) lies within the Nqutu, Glencoe, Dundee, Kliprivier, Babanango, Nkandla, Msinga, Estcourt, Weenen, Mvoti, Mooiriver, Lions River, Pietermaritzburg, Mpendle, New Hanover, Richmond and Ixopo Magisterial Districts.
various non-invasive and remote exploration techniques (including analysis of existing data and full tensor gradiometry gravity survey);
the drilling of up to 10 core boreholes; and
125 km of seismic survey acquisition.

Subsequent to the acceptance of the Scoping Report, Rhino Oil and Gas reduced the extent of the ER application area through the exclusion of all known protected areas with status defined under Section 48 of the National Environmental Management: Protected Areas Act (57 of 2003). Rhino Oil and Gas also acquired and reviewed further geological data and determined from this that certain areas along the eastern extent of the application area are unlikely to be prospective for oil or gas. The extent of the ER application area was reduced to an area of 850 000 ha covering approximately 6700 properties. (dotted black line shows initial ER, orange line shows revised ER).

In addition, Rhino Oil and Gas has excluded the ground-based core hole drilling and seismic surveys from proposed ‘early-phase exploration’ work for which they are seeking environmental authorisation. Thus the current focus of the application and the related environmental assessment work is now only related to the proposed remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey).
If the application is approved, Rhino Oil and Gas would be in a position to conduct the remote exploration and to develop a more detailed understanding of the potential oil and gas resources in the ER area. Thereafter, should Rhino Oil and Gas propose to conduct ground-based exploration activities this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process. A benefit of this revised approach is that any future application for ground-based exploration activities will be focussed on specified sites, thereby enabling I&APs to know where Rhino Oil and Gas proposes to access land and conduct ground-based exploration activities.

The approval being sought as part of this application does not include any activities relating to the appraisal or well drilling phases that comprise a commercial viability assessment of a possible resource, nor any aspect of production. Thus no wells, permeability testing, pressure testing or hydraulic fracturing (commonly referred to as “fracking”) is proposed as part of the initial three-year exploration programme.

1.1 Opportunity to Comment
This EIR has been distributed for a 30-day comment period from 13 September to 14 October 2016. Copies of the report have been made available for download from the SLR website (go to: http://www.ccaenvironmental.co.za/sub-oil-gas-minerals/) and are available in hard copy at the locations described below. An electronic copy of the EIR can be emailed or provided on CD on request. The reports’ Executive Summary has also been translated into isiZulu and is available for download from the SLR website or can be emailed on request.
Any comments on the EIR should be forwarded to SLR by no later than 14 October 2016.

2. Legislative requirements

An application for an exploration right requires statutory approval in terms of both the MPRDA and the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA), as amended.

The MPRDA provides that mineral and petroleum resources are the common heritage of all South Africans and that the State, as custodian thereof, is entitled to issue rights to ensure the sustainable development of South Africa’s mineral and petroleum resources within a framework of national environmental policy, while promoting economic and social development.

Any right granted under the MPRDA is a limited real right in respect of the mineral or petroleum and the land to which such right relates. The holder of a right is entitled to the rights referred to in Section 5 of the MPRDA and such other rights as may be granted to, acquired by or conferred upon such holder under the MPRDA or any other law. Mineral and petroleum rights are however also specific and have limitations in terms of the target resources, included land, the work programme and a timeframe. Any change to the scope of a right (i.e. further exploration or future production activities) would need to be subject to additional authorisation / approval in terms of the MPRDA and NEMA.
In terms of section 79 of the MPRDA an exploration right is required from the Minister of Mineral Resources (or delegated authority) prior to the commencement of any exploration activities. A requirement for obtaining an ER is that an applicant must comply with Chapter 5 of NEMA with regards to consultation and reporting (see below). The Minister (or delegated authority) may only grant the ER if an Environmental Authorisation is issued.

Section 2 of NEMA sets the environmental principles to be applied by all organs of State when taking decisions that significantly affect the environment. Included amongst the key principles is that all development must be socially, economically and environmentally sustainable and that environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably. NEMA also provides for the participation of I&APs and stipulates that decisions must take into account the interests, needs and values of all I&APs.

Chapter 5 of NEMA outlines the general objectives and implementation of Integrated Environmental Management (IEM), which provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and developments. Section 24 provides a framework for granting of Environmental Authorisations. In order to give effect to the general objectives of IEM, the potential impacts of listed activities must be considered, investigated, assessed and reported on to the competent authority. The proposed exploration right application triggers Activity 18 of Listing Notice 2 (GN R984) and a Scoping and EIA process must be undertaken to inform a decision from PASA on an environmental authorisation. Rhino Oil and Gas appointed SLR Consulting (South Africa) (Pty) Ltd (hereafter referred to as “SLR”) as the independent environmental assessment practitioner (“EAP”) responsible for undertaking the EIA process.

The scope of the current EIA process is aligned specifically to the early-phase exploration work programme (i.e. aerial full tensor gradiometry gravity survey). The environmental assessment of further ground based exploration including core hole drilling, seismic surveys, appraisal or well drilling activities for exploration or future production falls outside of the scope of this EIA process. If such work were to be proposed by Rhino Oil and Gas then it would be required to seek further approval from PASA in terms of the MPRDA and NEMA. Any further approval would be subject to an additional environmental assessment process with further public consultation as is required by NEMA.

In accordance with the EIA Regulations 2014, all other legislation and guidelines that were considered in the preparation of the EIR are documented. Review of the proposed exploration work programme in terms of the relevant legislation has not identified other requirements for authorisation.
3. Study Methodology

3.1 Scoping

A Scoping process was undertaken between October 2015 and April 2016 and concluded with a Scoping Report being submitted to PASA. The Scoping Report included copies of all supporting documents and inputs received during the public participation conducted during the Scoping phase. The Scoping Report was accepted by PASA on 10 June 2016, granting permission for the EIA to continue in terms of the Plan of Study described in the Scoping Report and the conditions included in the acceptance.

3.2 Key Issues Considered

The key issues and concerns identified by the project team, with I&AP input, during the Scoping Phase are detailed below.

<table>
<thead>
<tr>
<th>Key issues identified by the project team, with I&amp;APs input</th>
<th>Manner in which the issues were incorporated, or the reasons for not including them</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Procedural issues</td>
<td>The level of public opposition to the project has been documented in the Scoping and EIA Reports. Where people have registered their opposition to the project, this has been recorded. All objections received have been recorded. The EIA report has attempted to present accurate project information and a realistic assessment of impacts in order that I&amp;APs can make an informed judgement. It is evident that much of the opposition is not directly against the merits of exploration activities as proposed, but rather against the anticipated outcome and risks that, if successful, could result from exploration. No attempt has been made to address issues and objections that are based on concerns that relating to further exploration or future production activities. NEMA does not specifically provide a mechanism to address objections raised in the EIA process. Under the MPRDA unresolved objections would be tabled before the Regional Mining Development and Environmental Committee.</td>
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<tr>
<td>There is strong opposition to the proposed exploration right application. The major themes of the public opposition are the following:</td>
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<td>- Concern, even fear, of the future risks that might arise from production should a resource be found;</td>
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<td>- Concern that given the money involved, if any hydrocarbon resource is found, it will not be possible to stop production regardless of what the future EIA processes may indicate in terms of risk. Thus the only way to avoid such risks is to not open the door to such projects;</td>
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<td>- Hydrocarbon based energy is a flawed concept and countries are moving away from new hydrocarbons in favour of a renewable energy system;</td>
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<td>- A deep mistrust of government institutions and the true motives and people behind such an application;</td>
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<td>- Significant doubt over government’s ability to enforce compliance to the legislation;</td>
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<tr>
<td>- South Africa does not understand unconventional hydrocarbon extraction risks and the necessary legislative framework to protect the environment is not in place; and</td>
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<tr>
<td>- Lack of understanding of how an exploration programme is undertaken and what is actually being authorised.</td>
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<tr>
<td>Numerous objections have been made to the project and EIA process.</td>
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<tr>
<td>The EIA should assess the potential future exploration and production related impacts (including fracking)</td>
<td>The scope of the EIA is aligned with the early-phase exploration as proposed by Rhino Oil and Gas. Should Rhino Oil and Gas propose to conduct exploration activities outside of this scope, this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.</td>
</tr>
<tr>
<td>The Strategic Environmental Assessment (SEA) for Shale Gas Development in the Karoo should be extended to cover this area/application or at least inform current EIA process. Or the findings of the SEA applied to this EIA</td>
<td>The scope and terms of the SEA were finalized by the DEA and is limited to Shale Gas Development in the geographic Karoo. Refer to Section 2.5.5.</td>
</tr>
<tr>
<td>Time available for I&amp;AP consultation and participation is insufficient;</td>
<td>An extension of time for public consultation in the Scoping phase was secured.</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>The adequacy of the public participation process / methodology was challenged, particularly with regards informing rural communities.</td>
<td>Additional efforts were undertaken in order to address this. Refer to section 5.2 of the Scoping Report as well as Box 4 in the EIA. EIA feedback meetings with the I&amp;APs will be held in the towns where Scoping meetings were held within the revised ER area.</td>
</tr>
<tr>
<td>Protected area or other areas incompatible with exploration should be excluded. Cognisance should be given to restrictions imposed by legislation and regulation, particularly the Petroleum Regulations</td>
<td>The extent of the proposed ER has been adjusted to exclude protected areas. The scope of the EIA is aligned with the early-phase exploration as proposed by Rhino Oil and Gas. Restrictions relating to future exploration or production activities have not been detailed in this EIA.</td>
</tr>
<tr>
<td>Provide a detailed baseline description of the affected environment, desktop assessment is not adequate.</td>
<td>Refer to Section 5 of the EIR. The large size of the application area, information constraints of the exploration process and the nature of the early-phase exploration did not allow for, nor warrant, detailed baseline assessments of the whole application area. However, it is noted that the databases that were utilized generally have good coverage, providing adequately accurate representation of the field conditions.</td>
</tr>
<tr>
<td>Confirm the location of the exploration sites and assess impacts at these sites.</td>
<td>The nature of exploration is such that the applicant cannot confirm the location of core hole drilling sites or seismic survey routes until the initial exploration has provided results. Rhino Oil and Gas excluded the core hole drilling and seismic surveying from the proposed ‘early-phase exploration’ work for which they are seeking environmental authorisation. The current focus of the application for environmental authorisation and this EIA is now only on remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey). Refer to section 4.5.1</td>
</tr>
</tbody>
</table>

2. Potential impacts of the proposed exploration

<table>
<thead>
<tr>
<th>Impact on ecology</th>
<th>The potential impacts of core hole drilling and seismic surveys have not been assessed in this EIA as they no longer form part of the proposed ‘early-phase exploration’ work for which Rhino Oil and Gas are seeking environmental authorisation. See Section 4.5.1.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The aerial FTG surveys (see Section 4.5.5) included as part of the proposed ‘early-phase exploration’ would result in almost no interaction with the ground over which the survey is undertaken. Thus impacts on the majority environmental aspects could not occur. For this</td>
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<tr>
<td>Impact to Groundwater</td>
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<tr>
<td>Impact on surface water</td>
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</table>

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<thead>
<tr>
<th>Loss of or disturbance to vegetation and faunal habitats</th>
<th>Altered hydrogeological regime and groundwater availability</th>
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</thead>
<tbody>
<tr>
<td>Disturbance to and mortality of fauna</td>
<td>Contamination of groundwater resources</td>
</tr>
<tr>
<td>Enabling the establishment of alien and invasive species in disturbed areas</td>
<td>Water consumption</td>
</tr>
</tbody>
</table>

<p>| Altered surface water hydrological regime |  |</p>
<table>
<thead>
<tr>
<th>Impact Area</th>
<th>Issues</th>
<th>Reason the issues were not considered further in this EIA.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contamination of surface water resources</td>
<td>Water consumption</td>
<td>Should Rhino Oil and Gas propose to conduct ground-based exploration activities in the future, this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.</td>
</tr>
<tr>
<td>Impacts on geology</td>
<td>Destabilisation of certain geologies</td>
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<td></td>
<td>Risk to underground caverns or mine workings</td>
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<tr>
<td>Impact on soils</td>
<td>Physical impact on soils (increased erosion / compaction)</td>
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<td></td>
<td>Potential contamination of soils</td>
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<tr>
<td>Impact on heritage resources</td>
<td></td>
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<td>Impact on land tenure and access to private property</td>
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<tr>
<td>Impact on current land uses</td>
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<tr>
<td>Structural damage to infrastructure</td>
<td>Structural damage to infrastructure due to shock waves, air overpressure and ground vibration</td>
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<td></td>
<td>Degradation or damage due to exploration vehicles and equipment</td>
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<tr>
<td>Impact on ambient air quality</td>
<td>Dust and vehicle emissions</td>
<td></td>
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<td></td>
<td>Escape or release of gas from exploration boreholes</td>
<td></td>
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<tr>
<td>Safety and security</td>
<td>Public safety due to inter alia, increased traffic volumes, heavy machinery, explosives, hazardous materials, release of gas, etc.</td>
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<td></td>
<td>Fires</td>
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<td></td>
<td>Landowner security</td>
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<td>Contribution or effect on the local economy</td>
<td></td>
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<tr>
<td>Compensation</td>
<td></td>
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<tr>
<td>Rehabilitation and liability</td>
<td></td>
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<tr>
<td>Impact on ambient noise levels</td>
<td></td>
<td>Refer to Section 6.1</td>
</tr>
</tbody>
</table>

### 3.3 EIA Method

In accordance with Appendix 3 of Govt Notice No. R982, the objectives of the EIA are to:

- identify the relevant policies and legislation relevant to the activity;
- present the need and desirability of the proposed activity and its preferred location;
- identify feasible alternatives related to the project proposal;
- ensure that all potential key environmental issues and impacts that would result from the proposed project are identified;
- provide a reasonable opportunity for I&APs to be involved in the EIA process;
- assess potential impacts of the proposed project alternatives during the different phases of project development;
- present appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively; and
- Through the above, to ensure informed, transparent and accountable decision-making by the relevant authorities.
As per the Plan of Study for EIA presented in the Scoping Report, the approach was to commission a number of specialist studies to inform this EIA. However, with the exclusion of core hole drilling and seismic survey activities from the scope of the EIA these studies are no longer applicable.

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, inter alia: the purpose and need for the project; views and concerns of I&APs; social and political norms, and general public interest. SLR used an assessment methodology which considered: the intensity, extent, duration of impacts, the probability of the impact occurring, the reversibility and the degree to which the impacts can be mitigated.

The significance of environmental impacts was rated before and after the implementation of mitigation measures. The method applied to the assessment of environmental impacts was:

- Consequence is a function of intensity, spatial extent and duration;
- Significance is a result of the consequence and probability.

4. Project Description

4.1 Introduction

Rhino Oil and Gas Exploration South Africa (Pty) Ltd is a South African registered subsidiary of Rhino Resources Ltd., an independent oil and gas exploration and development company focused on Africa. Rhino Resources is building a portfolio of both onshore and offshore oil and gas assets with a primary focus on West Africa, East Africa and Southern Africa. Rhino Oil and Gas’s BBBEE status has been provisionally agreed upon with another party and will comply with the Charter on empowering Historically Disadvantaged South Africans in the Petroleum and Liquid Fuels Industry. More information is available on [http://www.rhinoresurcesltd.com](http://www.rhinoresurcesltd.com).

4.2 Overview of exploration

The conditions necessary for petroleum reserves to have accumulated are complex and largely dependent on past geological history and present geological formations and structures. Discovering petroleum/gas reservoirs and estimating the likelihood of them containing oil and / or gas is a technically complex process consisting of a number of different stages, requiring a range of techniques. Exploration begins with the identification of target regions based on a general geological understanding. These areas are subjected to early-phase exploration that is focused on large-scale regional analysis. Exploration in areas identified as prospective would progress to the appraisal stage. This work is aimed at identifying and defining the extent of target areas with high potential for reserves of oil and / or gas. In order to fully define the commercial viability of an oil and / or gas resource a well drilling stage is generally undertaken. The type of wells and tests would depend entirely on the nature of the resource that has
been identified. Exploration typically requires early-phase exploration, appraisal and well drilling stages, undertaken over a period of up to 10 years, to inform a decision on a production right application.

Rhino Oil and Gas is at the beginning of an oil and gas exploration process and at this stage is only seeking authorisation to undertake a portion of activities necessary to inform an early-phase exploration stage.

4.2 Need and Desirability
This section in the report aims to provide an overview of the need and desirability for the proposed project by firstly, highlighting the applications for the use of natural gas (particularly with reference to the electricity generation sector) and, secondly, indicating how these applications are aligned within the strategic context of national policy and energy planning, broader societal needs and regional planning, as appropriate.

Use of Natural Gas
Natural gas is a fossil fuel, used globally as a source of energy for heating, cooking, and electricity generation, amongst others. The fastest growing use of natural gas is for the generation of electric power. Of the three fossil fuels used for electric power generation (coal, oil and natural gas), natural gas emits the least carbon dioxide per unit of energy produced. Burning natural gas also releases lower amounts of nitrogen oxides, sulphur dioxide, particulates and mercury when compared to coal and oil (Union of Concerned Scientists, n.d.).

As economic growth is dependent on the availability of electricity, ensuring a sustainable and reliable supply of electricity with sufficient capacity is a key aspect to growing the economy of South Africa. The electricity shortages experienced in South Africa over the past decade were a contributing factor to the significant slowdown in economic growth rate. In the context of the above, the use of natural gas for electricity generation is considered to have substantial benefits and is identified in national policy, together with renewable energy technologies, toward diversifying the domestic energy supply away from coal. The economic feasibility of using natural gas for domestic power generation is dependent on the availability of domestic reserves of natural gas, as well as the financial cost of importing natural gas.

At present, domestic resources are limited to offshore gas fields close to Mossel Bay (F-A field), which are understood to be in decline. The F-O offshore field (Project Ikhwezi) is envisioned to complement this supply in the short- to medium-term. Other proven offshore reserves include the Ibhubesi Gas Field off the West Coast of South Africa. The development of this field to supply gas to the existing Ankerlig Power Station is currently being considered. Neighbouring countries (Mozambique and Namibia) and regional African nations (Angola and Tanzania) have substantial gas reserves.
Although limited, gas infrastructure and consumption do exist in South Africa. Presently, gas is imported to South Africa through the Republic of Mozambique Pipeline Company (ROMPCO) pipeline from Mozambique. This gas is mostly used in Sasol’s coal-to-liquid (CTL) process in Secunda (Bischof-Niemz, et al., 2016). In Johannesburg, Egoli Gas supplies industry and households in some suburbs with reticulated natural gas that is sourced from Sasol. In 2013, the total natural gas supply in South Africa (domestic production and import) equated to approximately 2.5% of total primary energy supply for the country (Bischof-Niemz, et al., 2016). Thus, an increase in domestic natural gas reserves would enable South Africa to take steps to secure the countries’ energy supply (through diversification), assist in reducing the emissions of greenhouse gases (by reducing the country’s reliance on coal for electricity generation) and reduce the need for the importation of gas. As such, exploration for additional domestic hydrocarbon reserves is considered important and supported by national policy, and any discoveries would be well received by the local market.

**National Policy and Planning Context**

An overview of the national policy and planning context relating to the promotion of economic development in general within South Africa, development of the energy sector (with specific reference to natural gas and renewable energy) and response to climate change is provided. The following documents were considered:

- National Gas Infrastructure Plan (2005)
- New Growth Path (2011)
- National Development Plan (2012)
- Gas Utilisation Master Plan (GUMP)
- Paris Agreement, United Nations Framework Convention on Climate Change
- National Climate Change Response White Paper

Consideration was also given to regional policy and planning context relating to development within the KwaZulu-Natal in general.

**4.3 Exploration Work Programme**

Rhino Oil and Gas proposes to undertake early-phase exploration for oil and gas resources which may be located within suitable geological strata. A three-year exploration work programme has been proposed.

The initial ER application area included approximately 10 000 properties over an area of approximately 1 500 000 ha. The applicant has reduced the extent of the ER application area through the exclusion of
known protected areas and areas not considered prospective to an area of approximately 850 000 ha. The ER application area excludes all land as identified in Section 48 (1) of the MPRDA.

As indicated previously, Rhino Oil and Gas has now excluded the core hole drilling and seismic surveying from the proposed ‘early-phase exploration’ work for which they are seeking environmental authorisation. The current focus of the application for environmental authorisation and this EIA is now only on remote exploration techniques (including analysis of existing data and an aerial full tensor gradiometry gravity survey). If the revised application is approved, Rhino Oil and Gas would only be in a position to conduct remote exploration techniques and to develop a more detailed understanding of the potential oil and gas resources in the application area. Thereafter, should Rhino Oil and Gas propose to conduct ground based exploration activities this would need to be informed by a further application to PASA and a separate environmental assessment and authorisation process.

The initial exploration work would be desktop based and include the evaluation of geological data and the assessment of source-rock geochemistry. Full tensor gravity gradiometry (“FTG”) surveys may be undertaken to provide information that would lead to the identification of target sites for core hole drilling and alignment of seismic survey routes. FTG is used by oil and gas companies to measure the density of the subsurface in order to assist in the building of geological models to aid exploration. FTG uses multiple pairs of accelerometers to measure the rate of change of the gravity field in three directions and render a detailed interpretation of subsurface geology. FTG surveys involve grid-based flights using a light fixed wing aircraft (fitted with the FTG equipment) at slow speeds (~ 130 knots) and at an altitude of between 80 and 300 m above ground. It is envisaged that up to a maximum of 4 000 km² could be surveyed with a spacing of between 2 and 6 km between lines. In good weather the survey would take less than 7 days to complete.

No further ground-based exploration, appraisal or well drilling and future production forms part of the current ER application. Thus no extraction of hydrocarbons or water, no stimulation of wells or hydraulic fracturing (fracking) is proposed in the initial three-year exploration work programme for which approval is sought. If the early-phase exploration were to confirm the presence of a potential resource, then Rhino Oil and Gas would need to seek further authorisation / approval from PASA for any additional exploration work required to appraise the resource. Any further approval would be subject to an additional environmental assessment (or environmental authorisation amendment) process with further public consultation and specialist input. Approvals are also likely to be required in terms of other legislation.

5. Description of the baseline environment

5.1 Biophysical Environment

Climate

The proposed ER area experiences a typical escarpment climate with warm summers and mild winter that includes periods of very cold conditions with snow. Mean annual rainfall varies across the proposed
area with the southern section receiving between 800 to 1000 mm while the northern section receives between 600 to 800 mm (WR, 2005). The majority of this precipitation comes through summer thunderstorms.

**Geology**

Archaean outcrops of metamorphosed basement greenstones, granitoids and gneiss Kaapvaal Craton can be found outcropping in the north-western sector of the ER area. Minor distribution of the Mesoarchaean volcanic-volcanoclastic and sedimentary rocks of the Pongola Supergroup overlay the basement and have been subsequently intruded by the Pongola Granites.

To the east of the application area (minor surface distribution within the ER area), granites and gneissses of the Natal Metamorphic Province juxtapose Archaean rocks of the Kaapvaal Craton and Pongola Supergroup and subsequently overlain by sandstones of the Natal Group. These geological formations are overlain by sedimentary successions of Sedimentary successions of tillite, mudstone, siltstone, shales, sandstones, intrusive dolerites and flood basalts of the Karoo Supergroup.

**Soils**

The ER area consists of seven main landforms. Level land which includes depressions (level land at a lower position than the surrounding land) and valley floors at different levels forms 23 % of the application area. Sloping land which includes medium gradient mountain (15 – 30 % slope), medium gradient hill ((8 – 30 % slope) and dissected plain (10 – 30 % gradient) comprises 73 % of the application area. High gradient hills with slope of more than 30% occur on 3% of the application area.

Fourteen dominant soil classes were identified within the proposed ER area namely:

- Freely drained, structureless soils;
- Soils with pedocutanic horizon;
- Imperfectly drained soils, often shallow and often with a plinthic horizon;
- Lithosols (shallow soils on hard or weathering rock);
- Texture contrast soils often poorly drained;
- Non soil classes;
- Undifferentiated structureless soils which may have humic or, red and yellow topsoil horizons or may be freely drained or imperfectly drained structureless and sandy soils;
- Undifferentiated clays which are an association of swelling clay soils, dark clay soils which are not strongly swelling, poorly drained dark clay soils which are not strongly swelling, poorly drained swelling clay soils and dark clay soils, often shallow on hard or weathering rock;
- Undifferentiated texture contrast soils, often poorly drained and with a pedocutanic horizon;
- Undifferentiated shallow soils which include Lithosols (shallow soils on hard or weathering rock) and non-soil land classes;
- Undifferentiated structureless soils and clays;
• Structureless and textural contrast soils;
• Structureless and poorly drained soils;
• Structureless soils, shallow soils and land classes

Seven different land capability classes are present within the prospecting area. In total, 375 948 ha of land with potential for arable agriculture is present of which 73 297 ha has high arable potential. These areas are mainly located in valley bottoms where slope is the least and pockets of arable land makes crop farming possible.

The remaining part of the application area (388 016 ha) is considered non-arable for the purposes of crop cultivation and have moderate to low suitability as grazing land. A smaller section on the northern portion (94 556 ha) has wilderness land capability and should only be used for wildlife and habitat conservation.

Land Cover
According the National Land Cover Data Set (2013/2014), the great majority (66%) of the ER area comprises natural vegetation made up primarily of grasslands in the central and woody bushveld type vegetation in the northern portions of the ER. Indigenous forests are located in the central and south portions of the ER with the most extensive area being located in the Karkloof.

Cultivation and afforestation contribute a combined 24% (12% each) of the ER. The majority the forestry occurs within the central areas around Greytown and in the south near to Richmond. Cultivation occurs throughout the ER but most intensely in central and southern portions of the ER.

The remaining 9% of the land cover is comprised of built-up areas (6%), waterbodies (1%) and degraded and mining areas making up the remaining 2%.

Hydrology
The proposed exploration area is located within the Mvoti to Umzimkulu, Thukela and Usutu to Mhlatauze water management areas.

The Thukela water management area corresponds fully to the catchment area of the Thukela River and lies predominantly in the KwaZulu-Natal province. This water management area comprises several tributaries which originate in the Drakensberg Mountains and flow together with the Thukela River, the primary river in the catchment, to discharge into the Indian Ocean on the eastern side of the water management area. Main tributaries to the Thukela River include the Buffalo and Sundays Rivers which drain the northern part of the catchment, and the Bushman’s and Mooi Rivers flowing from a southerly direction. The mean annual runoff for the Thukela catchment is approximately 3 799 million m³/annum. The total water requirements for the Thukela water management area is 840 million m³/annum of which
60% is for irrigation, 17% is for urban purposes, 14% for mining and industry and 9% for rural domestic use for livestock watering (NWRS, September 2003).

The Usutu to Mhlatuze water management areas consist of two major rivers, namely the Usutu and the Pongola River. The tributaries within this catchment flow eastwards, crossing the Zululand coastal plain and discharging into the Indian Ocean. The Usutu to Mhlatuze water management area has a mean annual runoff of 4 780 million m\(^3\)/annum. The total water requirements for the Usutu to Mhlatuze water management area is 954 million m\(^3\)/annum of which 54% is used for irrigation, 7% for urban purposes, 4% for rural purposes, 10% for mining and industry, 11% for afforestation and 14% is transferred out (NWRS, September 2003).

The Mvoti to Umzimkulu water management area is drained by several parallel rivers which all flow in a south-easterly direction to discharge into the Indian Ocean. The main rivers in this water management area include the Mvoti, Mgeni, Mkomazi, Umzimkulu and Mtamvuna Rivers, with several smaller coastal rivers in between. The border with Lesotho is demarcated by the divide between the Orange River basin and the catchments of the Mkomazi and Umzimkulu Rivers, which also corresponds with the rim of the Drakensberg escarpment. The Mvoti to Umzimkulu has a total mean annual runoff of 4 798 million m\(^3\)/annum. The total water requirement for this water management area is 797 million m\(^3\)/annum of which 60% is used for urban and industrial use, 25% for irrigation, 5% for rural water supply and 10% for afforestation (NWRS, September 2003).

**Groundwater**

The exploration area is classified as a minor aquifer region. On a regional level, the hydrogeology of the proposed ER area comprises fractured and intergranular aquifers with yields in the range of 0.2 to 15 L/s. Aquifer types are related to the lithology but are typically fractured and intergranular. These aquifers are generally of ‘least’ or ‘moderate’ vulnerability, with a ‘low’ to ‘medium’ susceptibility.

On a regional level, the hydrogeology of the proposed ER area comprises fractured and intergranular aquifers with yields in the range of 0.2 to 15 L/s. The aquifer types within the proposed ER area can be further refined according to lithology:

- Metamorphic and igneous rock comprising fractured and intergranular aquifer of the metamorphic and igneous rock units.
- Natal Group sandstones.
- Sedimentary units of the Karoo Supergroup.
- Basalts and rhyolites of the Lebombo and Drakensberg Groups.
- Karoo dolerites
Groundwater quality varies largely based on the aquifer classification.

- Metamorphic and igneous rock aquifers: Water abstracted from metamorphic and igneous rock aquifers generally exhibit a sodium magnesium bicarbonate water types indicative of their host rocks mature crystalline nature and have low fluoride (2 mg/L) (King, 2002).

- The groundwater of Natal Group Sandstones has an electrical conductivity of less than 100 mS/m, unless localised pollution has occurred. Water is generally corrosive and high in iron and manganese while rich in calcium and magnesium bicarbonate type, which generally represents recently recharged water.

- Water quality of the Dwyka Group tillite is considered to usually be of good quality and fit for human consumption.

- Water quality of the Karoo Supergroup is understood to be rich in sodium, chloride and magnesium which are typical of shale rich aquifers and have an average electrical conductivity of 90mS/m. However, EC values have been found to be as high as 1000 mS/m in localised areas.

- Water abstracted from basalt and rhyolite aquifers has a highly variable water quality with some being fit for human consumption and other that is totally unpotable. The EC values are on average 150 mS/m. The water type has a sodium chloride bicarbonate mineral signature while high fluoride content makes water unfavourable for long term human consumption.

- Karoo dolerites water quality is variable and often correlated to that of the host rock

Biodiversity

The proposed project area is located within the Grassland and Savannah Biomes. The Grassland Biome comprises the Sub-Escarpment Grassland, the inland azonal vegetation area and the Afro-temperate subtropical and azonal forest area bioregions. The Savannah Biome comprises the Sub-escarpment Savanna and Lowveld bioregions. These bioregions are comprised of various vegetation types.

Numerous faunal species such as birds, amphibians, reptiles, mammals, fish and insects are associated with the various vegetation units located in the proposed ER area. A number of these are identified as species of conservation with red data species status in terms of the International Union Conservation of Nature (IUCN) categories. The most notable examples include the Oribi, various vulture species, the three crane species, Blue Swallow, Cape Parrot and various dwarf chameleon species. Reptiles, amphibians, butterflies and dragonflies are also represented.

Numerous protected areas of various forms are located within the boundary of the proposed exploration area but the properties are excluded from the application area along with any other areas declared in terms of the Biodiversity Act, 2004 (Act 10 of 2004); National Forests Act, 1998 (No. 84 of 1998) and Mountain Catchment Areas Act 1970 (No. 63 of 1970).
Air Quality
There are few emission sources in this exploration area. Industrial and manufacturing activity is limited to urban areas like Pietermaritzburg. Motor vehicle emissions, particularly from the N3 highway contribute to emissions. Across KZN, biomass burning for land management contributes to emissions, as well as agricultural activities.

Air quality is generally good, with the exception of areas in Pietermaritzburg in close proximity to industrial activity and during episodic biomass burning.

5.2 Cultural Environment
Numerous Iron Age and some Stone Age sites occur in the project area. Of the almost 200 heritage sites known in the area, 140 of these are archaeological sites. It is highly likely that more sites are present in the area. None of these sites have provincial or national heritage rating. However, the majority are rated as locally significant or Grade III. Several provincial heritage sites occur in the project area. These are mostly Battle Sites and associated graves relating to the Anglo-Zulu War of 1879 and the Anglo-Boer War of 1899-1901. There is very limited data on sites from the historical period, cultural landscape or living resources in the project area. This is more likely due to a lack of field surveys rather than an indication of their absence.

Paleontological surveys of the area are also limited. The higher elevation sections toward the west of the proposed ER area are underlain by formations of high (Clarens Formation, Stormberg Subgroup, Karoo Supergroup) and very high sensitivity (Molteno and Elliot Formations). Moderate to insignificant sensitivity areas are found to the east and north-east of the proposed ER area. Taking the above into consideration there is a high likelihood of fossil occurrence within the proposed ER area.

5.3 Socio-Economic Environment
The proposed exploration area is located within six District Municipalities, which include the following:

- Harry Gwala (Sisonke) District Municipality;
- Umgungundlovu District Municipality;
- Umzinyathi District Municipality;
- Uthukela District Municipality;
- Zululand District Municipality; and a minor encroachment into the western most portion of
- Uthungulu District Municipality;

These municipal areas have population in excess of four million people, with a high proportion of females. Unemployment is high with the majority of districts reporting unemployment rates around 45%. Access to drinking water is high in the relevant district municipalities with the exception of the uMzinyathi District. Access to sanitation is high throughout while access to power varies from medium (50%) to high (75%) with the Harry Gwala District Municipality not being taken into account.
Primary land uses within the ER are agriculture, including forestry (both commercial and subsistence), eco-tourism, road and rail networks, mining, and towns.

6. Impact Description and Assessment

Only those potential impacts associated with the remote exploration techniques included in the exploration work programme have been assessed. The potential impacts of core hole drilling and seismic surveys have not been assessed in this EIA as they do not form part of the proposed ‘early-phase exploration’ work for which Rhino Oil and Gas are seeking environmental authorisation.

6.1 Biophysical Impacts

The flying of a light aircraft to undertake an FTG survey is not anticipated to have any impact of significance on the biophysical environment. Overpass flights of light aircraft are not uncommon over the region, even protected areas. Other than a momentary flight response, it is estimated that the impact of noise on wildlife would be insignificant.

6.2 Cultural/Heritage Impacts

The flying of a light aircraft to undertake an FTG survey is not anticipated to have any impact of significance on the cultural or heritage environment. Any noise impact would be as described below.

6.3 Socio-economic Impacts

Noise Impacts

The noise generated by a light aircraft flying at a low altitude (approximately 100 m) could be a nuisance to or result in the localised disturbance of a receptor. No health impacts (such as loss of hearing or increased blood pressure) are anticipated based on the proposed FTG survey.

Based on a light aircraft (e.g. Cessna) flying at a low altitude of + 80 m, it is estimated that the maximum noise level would not exceed 70 dBA outdoors and 60 dBA indoors. The latter is similar to conversational speech measured at 1 m. At any one location the duration of the overflight would be tens of seconds. Indoors the noise generated would probably not be noticed. Although the survey would cover wide areas, the extent of the impact is localised for each receptor. Where there are no receptors there would be no impact. Thus, depending on the selected flight path, an impact is possible.

Although aircraft noise would increase noise levels in what are largely quiet rural and agricultural areas, only a slight disturbance or nuisance is anticipated (i.e. low intensity). Based on these considerations and the fact that disturbances from light aircraft are not uncommon with a multitude of light aircraft working in and traversing the region, the significance of this impact is considered to be very low before and after mitigation.
All planned survey flights should comply with local civil aviation rules. Flight paths must be pre-planned to avoid special nature reserves, national parks and world heritage sites. Where this is not possible, an altitude of 2,500 feet (762 m) should be maintained (as per Section 47(1) of NEMPRAA), unless permission is obtained from the management authority or in an emergency. Where flights are planned to occur over game farms, landowners should be notified of the survey programme prior to survey commencement.

Local limitations
As discussed in the preceding sections, the flying of a light aircraft to undertake an FTG survey would be unlikely to pose significant risk to the environment. As a result there are relatively few constraints arising from legislation, regulation, guidelines and best practice that would apply. The FTG survey would have no effect on water use or availability and could therefore be undertaken without regard for water related constraints and restrictions.

At the time of completion of the EIA report there was no indication of any change to the public or landowner position with regards the application. The majority opinion is opposed to exploration for unconventional gas or petroleum resources in the ER application area.

Granting of a Right
There is strong public opinion and I&APs refer to a significant body of evidence from around the world (not least that fracking is banned in a growing number of countries and territories), that late phase exploration and production of unconventional gas has huge risks to society and the environment. Such risks are borne by the landowners and local communities who do not participate in the economic benefits that accrue to the right holder and government. While there may be a consumer driven need for hydrocarbon extraction, the risks and costs to society and the environment far outweigh the benefits. The extraction of unconventional hydrocarbons is therefore not wanted in KwaZulu-Natal.

Even though early-phase exploration may have impacts of low significance, the public have raised concern that the granting of an exploration right would set in motion the development of a petroleum extraction project that would be extremely difficult to stop. Because the future process has unknown outcome and risk, this exploration right should not be approved.

The MPRDA provides that the State, as custodian of mineral and petroleum resources in South Africa, may issue mineral and petroleum rights to applicants. Such rights must enable the sustainable development of South Africa’s mineral and petroleum resources within a framework of national environmental policy, while promoting economic and social development.

The granting of a right has no effect on the presence or absence of a resource, merely on whom has the entitlement to that mineral (i.e. minerals and petroleum exist regardless of the holder). A mineral and/or
A holder must also have obtained environmental authorisation in terms of Chapter 5 of the NEMA. Furthermore, a mineral and/or petroleum right and environmental authorisation do not provide blanket approval for any conceived operation, but are both particular to the specific activities that the holder has detailed in an application. The holder is also required to negotiate access with the land owner and determine payment of compensation for loss or damages due to the specific activities. It is therefore presented that the grant of a right over a parcel of land does provide the holder carte blanche with respect to the mineral and land in question. There is thus not necessarily a direct conflict with the land owners’ right to use the surface. It would in fact be the undertaking of specified activities that could result in an impact on or conflict between the land owner and the mineral and/or petroleum rights holder (if any). Such specified activities would have been subject to approval through an environmental authorisation process. In the case of this application by Rhino Oil and Gas, only remote sensing activities are included which have been shown not to have any impact on the environment.

Any further exploration (beyond what may be approved in an environmental authorisation) would have to be subject to the requisite environmental assessment and authorisation process under the NEMA and an amendment to the ER in terms of the MPRDA. Such processes assess the merits of an application in light of the principles of sustainable development as set out in Section 2 of NEMA. An environmental authorisation process would not grant approval for the undertaking of activities resulting in impacts of unacceptable significance. Each of the petroleum right approval sections in the MPRDA (80 and 84) set out that such rights may only be granted if the activity will not result in unacceptable pollution, ecological degradation or damage to the environment. Thus a decision to grant the current ER application by Rhino Oil and Gas (for remote sensing activities only) does not presuppose that future applications for further exploration or production would be approved.

It is also noted that the specified activities associated with a mineral and/or petroleum right may also be subject to approval requirements under other legislation. The need for such authorisations (e.g. water use licence, land use planning permission etc.) provide further permitting frameworks for impact assessment and management.

6.4 No-go Alternative

The positive implications of not going ahead with the proposed exploration are:

- no impacts resulting from the FTG survey within the exploration right area;
- no (reduced) chance of any risks arising from further exploration or future production; and
- allayment of the current majority opposition from the public.

The negative implications of not going ahead with the proposed exploration are as follows:
- South Africa would lose the opportunity to further establish the extent of indigenous oil or gas reserves in the KwaZulu-Natal;
- Lost economic opportunities related to sunken costs (i.e. costs already incurred) of initial desktop investigations in the proposed exploration licence area;
- If economic oil and gas reserves do exist and are not developed, South Africa / Rhino Oil and Gas would lose the opportunity to maximise the use of its own indigenous oil and gas reserves; and
- Other sources of energy would need to be identified and developed in order to meet the growing demand in South Africa.

The great majority of I&APs that have participated in the EIA process have expressed their opposition to all forms of oil and gas exploration in the KwaZulu-Natal and to this application in particular. Thus the “no-go” alternative would alleviate much of the anxiety and concerns related to potential future shale gas development should reserves be identified for further exploration and/or future production.

Given the wide array of unknown facts regarding the potential for economic growth and the potential for environmental impacts arising from unconventional gas production, as well as the unknown facts of the future energy mix in the absence of gas, the overall impact associated with the “no-go” alternative is considered to be of unknown significance.

7. Conclusions and Recommendations

SLR, as the environmental assessment practitioner appointed by Rhino Oil and Gas, has undertaken a Scoping and EIA process in terms of the EIA Regulations 2014 to inform an authority decision on the application made for environmental authorisation under the NEMA. The current ER application only includes remote exploration techniques, restricted to analysis of existing data and an aerial full tensor gradiometry gravity survey. If the application is approved Rhino Oil and Gas would be in a position to conduct the remote exploration techniques. Thereafter, should Rhino Oil and Gas propose to conduct ground based exploration activities (core boreholes and seismic surveys) this would necessitate a further application to PASA and a separate environmental assessment and authorisation process in terms of NEMA.

The key finding of the EIA is of a contrast between very low significance impacts resulting from an exploration work programme which is limited to desktop and remote sensing methods and extremely strong public opposition to all forms of exploration for onshore unconventional gas.

The assessment concluded that the impacts of proposed exploration activities would be extremely limited in extent, widely dispersed, of very short duration and very low intensity and would there have very low significance. On the simple merits of the application there is therefore no environmental reason why the exploration activities should not be approved. All of the ER application area would be suitable for the undertaking of the remote sensing exploration methods as proposed. It is noted however that the
proposed activities are likely to be the first in a series of exploration stages comprising activities that would likely increase in impact significance (if exploration was successful and the project proceeded to the following stages). The intensity and duration of such impacts would likely increase with each subsequent phase, but would likely become confined to increasingly limited target areas.

The public opposition to the exploration right application has been strongly voiced and have been received almost unanimously from all the sectors of society that have participated in the EIA. It is evident however that the majority of the opposition is not directly against the merits of exploration activities as proposed, but rather against the anticipated outcome and risks that, if exploration is successful, could result from production. The public perception is interpreted to be that issuing of an exploration right could lead to successful exploration; that would ultimately result in an application for production with the potential use of hydraulic fracturing. It is further perceived that this could lead to widespread impacts on water and land causing devastation to local livelihoods. The perception is informed by the widely publicised, purported negative effects of hydraulic fracturing and the decisions taken by many governing bodies from around the world to suspend such activities. The related concern is that once an exploration right is granted, it will be nearly impossible to stop the process later, even if the environmental risks to local receptors outweigh the benefits. This is seen to arise from a mistrust and or misunderstanding of the governance framework that is in place to regulate petroleum exploration and production; concern as to whether government can balance the needs and interests of local people against such development, and an expectation that enforcement of compliance with environmental management obligations would be poor. For these reasons the public approach is to ‘close the door on exploration before it opens’, thereby preventing any future risk, or potential benefit, from resulting.

It is the opinion of SLR in terms of the sustainability criteria described above and the nature and extent of the proposed early-phase exploration programme (remote sensing only), that the generally very low significance of the impacts, with the implementation of the proposed mitigation measures, should support a positive decision being made by the Minister of Mineral Resources (or delegated authority) in this regard. Since the proposed exploration activities are associated with Rhino Oil and Gas’s initial three-year exploration work programme, the applicant requests that that Environmental Authorisation (should it be granted) be issued and remain valid for a period of three years or more.

The estimated cost for management and / or rehabilitation of potential negative environmental impacts that might be incurred during the proposed remote sensing exploration activities is nil.

8. Environmental Management Programme
The EMPR, once approved by the competent authority, is a legal document and Rhino Oil and Gas is overall accountable and responsible for the implementation thereof. The EMPR is set out to provide environmental management i) objectives, ii) outcomes and iii) actions for the planning and design, undertaking of exploration; and rehabilitation and post closure phases.