

RHINO OIL AND GAS UPDATED EXPLORATION WORK PROGRAMME | SCOPING REPORT

Various farms in the Free State Province

Prepared for: Rhino Oil and Gas Exploration South Africa (Pty) Ltd

Authority Reference: 12/3/318



Rhino Resources Ltd.

SLR 

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EXECUTIVE SUMMARY

1. INTRODUCTION

This Executive Summary provides a synopsis of the Scoping Report prepared as part of the Scoping and Environmental Impact Assessment (S&EIA) process that is being undertaken of Rhino Oil and Gas Exploration South Africa (Pty) Limited’s (Rhino Oil and Gas) proposal to continue exploration within the Exploration Right (ER) area (ER reference: 12/3/318) located within the Free State Province. Rhino Oil and Gas have proposed the drilling of several exploration wells to test for the presence, quantity and quality of gas within specific Target Areas within the ER 318 area (see Figure 1).

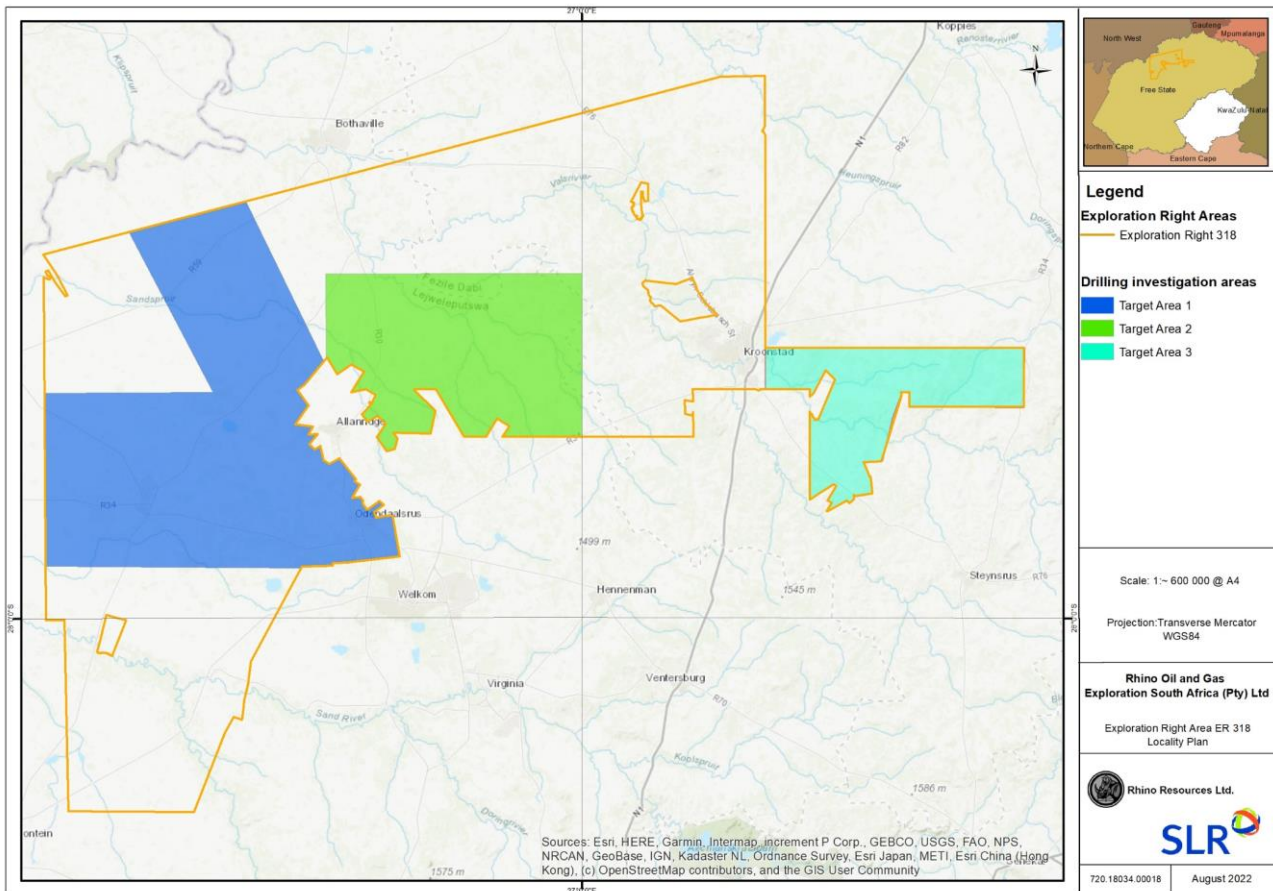


FIGURE 1: LOCALITY OF RHINO OIL AND GAS’S EXPLORATION WELL TARGET AREAS WITHIN ER 318

1.1 Opportunity to Comment

This Scoping Report is being distributed for a 30-day comment period from **10 October to 9 November 2022** to provide I&APs with an opportunity to comment on any aspect of the proposed project and the findings of the S&EIA process to date. Copies of the full report are available electronically on the SLR website (at <https://www.slrconsulting.com/en/public-documents/Rhino-well-ER318>) and in hard copy at the following locations:

Name of Facility	Physical Address and telephone number
Kroonstad Public Library	Address: Steyn Street, Kroonstad, 9499 Tel: 056 216 9911
Kroonstad Local Co-operative Senwes	Address: 9 10th Lane, Industria, Kroonstad Tel: 056 216 0700
Steynrus Public Library	Address: Matlwangtlwang, Steynrus, 9515 Tel: 056 471 0006
Steynsrus: Moqhaka Local Municipality	Address: Van Riebeeck Street, Steynrus, 9515 Tel: 056 216 9600
Welkom Public Library	Address: C/O Tulbagh and Reinett Street, Welkom, 9460 Tel: 057 391 3359
Welkom Local Co-operative Senwes	Address: 151 Jan Hofmeyer Road, 9460 Tel: 053 355 1731
Wesselsbron Public Library	Address: Erwee St, Wesselsbron, 9680 Tel: 057 899 1818
Wesselsbron Local Co-operative Senwes	Address: 10 Louis Kotze Street, 9680 Tel: 057 899 1851

Any comments should be forwarded to SLR at the address, telephone number or e-mail address shown below by no later than **9 November 2022** for them to be included in the updated Scoping Report. All comments received during the review process will be included in the Scoping Report.

SLR Consulting (South Africa) (Pty) Ltd
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1.2 Project Background

In 2019, Rhino Oil and Gas was granted an Environmental Authorisation (EA) and ER, permitting their exploration for natural gas using non-invasive techniques within ER 318. Exploration was to be undertaken in terms of an approved Exploration Work Programme (EWP), over an initial period of three (3) years. The initial EWP entailed: (i) the review of existing literature and datasets from historic drilling campaigns by other exploration companies (Years 1 and 2); (ii) procurement of geological core samples from the Council for Geoscience (Year 3) and (iii) the acquisition of airborne geophysical data. This exploration and analysis has furthered confidence regarding the presence of natural gases within the ER 318 area.

Thus, Rhino Oil and Gas have made applications to renew the ER for a further two (2) year duration and update the exploration work programme (EWP) to allow for the drilling of several exploration wells. Although Rhino Oil and Gas hold an approved EA for exploration in ER 318, the current EA is limited to the use of non-intrusive techniques.

1.3 Summary of Authorisation Requirements

In order to include well drilling in an updated EWP, it is necessary for Rhino Oil and Gas to apply for, and obtain, further EA in terms of Chapter 5 of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA). As exploration activities conducted in terms of an ER are listed in Environmental Impact Assessment (EIA) Regulations Listing Notice 2, 2014 (Government Notice No. R984) an application for EA is required to be informed by a S&EIA process.

Rhino Oil and Gas's exploration activities are being undertaken in terms of a series of sequential approval and authorisation processes based on the activities included in their EWP:

- Further non-intrusive works (e.g. aerial surveys) will be undertaken in terms of the existing EA and approved Environmental Management Programme report (EMPr) granted in 2019, via the pending ER renewal application made in terms of Section 81 of the Mineral and Petroleum Resources Development Act (MPRDA), 2002 (Act 28 of 2002) in January 2022; and
- Exploration well drilling and testing would be undertaken in terms of an EA and EMPr, which are the subject of the current EA application, made in terms of NEMA and submitted to PASA on 30 September 2022.

2. EIA METHODOLOGY

2.1 Scoping Phase

2.1.1 Land owner identification

The Applicant appointed a land surveyor to identify all properties (including farms and portions) that are included in the proposed Target Areas and search against the Deeds Office records to identify the landowner and contact information (where such information was available in the Deeds Office for the landowner). The landowner database included private persons, trusts, communal property associations, companies, organs of State and various government departments.

The applicant subsequently identified, and continues to do so, the owners of properties where they may potentially drill wells. Through this process further landowner contacts were obtained. SLR was provided with this database and continues to identify contact information for each landowner of properties adjacent to the properties where Rhino Oil and Gas may potentially drill wells.

It is pointed out that property information was not available for every land parcel, owner information was not available for every property and contact information was not available for every landowner. It is acknowledged that it has not been possible to source contact information for all landowners and occupiers within the Target Areas, and thus certain landowners and occupiers have not been directly notified. However, the task of identifying and notifying landowners and occupiers will be on-going during the course of the EIA process.

2.1.2 Pre-Application Public Participation Process

Although this step is not a legislated requirement of the EIA Regulations 2014 (as amended), a pre-application public participation process was undertaken. This provided an opportunity to notify identified landowners (see above) and other key stakeholders of the proposed project and for them to raise any initial issues or concerns regarding the proposed project. The pre-application public participation process included the following:

- I&AP notification and distribution of a Background Information Document (BID);
- Advertisements in local newspaper and Government Gazette;
- Site notices were placed at various locations within the identified target areas;
- Two stakeholder meetings were held.

All written comments received during the pre-application public participation process have been collated, and responded to, in a Comments and Responses Report attached to the Draft Scoping Report.

2.1.3 Authority Consultation and Application

An “Application Form for Environmental Authorisation” was submitted to PASA on 30 September 2022.

2.1.4 Compilation and Review of Scoping Report

This draft Scoping Report has been prepared in compliance with Appendix 2 of the EIA Regulations 2014 and has been informed by comments received during the pre-application public participation process. This report provides an opportunity for I&APs to comment on the proposed project, findings of the scoping public participation process and the scope of work for the next phase of the EIA.

2.1.5 Completion of the Scoping Phase

After closure of the comment period, the Scoping Report will be updated to incorporate the comments received. The updated Scoping Report will be submitted to DMRE for acceptance. If the Scoping Report is accepted, the project will proceed onto the EIA Phase.

2.2 EIA Phase

2.2.1 Specialist Studies

Four (4) specialist studies will be commissioned to address the key issues that require further investigation and detailed assessment, namely an Aquatic Ecology (including wetlands), Terrestrial Ecology, Geohydrology and Cultural Heritage. The specialist scopes will be focussed on proposed well site locations and outputs will be used to inform micro-siting of well sites to avoid environmental sensitivities.

2.2.2 Land owner and Stakeholder notification

Rhino Oil and Gas and SLR will continue to source contact information for and notify landowners and potential I&APs of the well drilling ER application and the S&EIA process.

2.2.3 Integration and Assessment

The specialist information and other relevant information will be integrated into an EIA Report, which will include an EMPr. The EIA Report will be released for a 30-day comment period and all I&APs on the project database will be notified when the EIA Report is available for comment.

2.2.4 Completion of the EIA

After closure of the comment period, all comments received on the draft report will be incorporated and responded to in a Comments and Responses Report. The draft report will then be updated to a final report, which will include the Comments and Responses Report, and will be submitted to DMRE for consideration and decision-making.

3. NEED AND DESIRABILITY

South Africa, like the rest of the world, is vulnerable to climate change. There is thus global concern of the need to reduce carbon emissions and achieve carbon neutrality by 2050. However, the rapid transition to carbon neutrality presents a potential risk to economic growth and sustainable development. As such, South Africa has committed to a "just" transition in achieving net-zero emission and a climate resilient society, whereby the need to reduce emissions is balanced with the need to grow the economy and create jobs. In this regard, South African Government policy currently promotes the use of natural gas as part of the energy mix up to 2030 to serve as a transition to a carbon-neutral goal and provide the flexibility required to complement renewable energy sources. The proposed project will increase South Africa's understanding as to whether there are any potential biogenic gas, helium and geological hydrogen resources that could be exploited in the future to assist in the just transition process.

The proposed project has no direct influence on South Africa's reliance on hydrocarbons and their contribution to the countries' energy mix. These aspects are influenced by South Africa's energy and climate change related policy, the financial costs of the various energy sources and consumer choices in this regard. These National strategic policy issues relating to energy and climate change fall beyond the scope of this exploration project EIA.

4. PROJECT DESCRIPTION

4.1 The applicant

Applicant details	
Company name	Rhino Oil and Gas Exploration South Africa (Pty) Ltd

Applicant details	
Registration no:	2013/096757/07
Contact person	Travis Smithard
Postal address	3 rd Floor, Icon Building, 24 Hans Strijdom Avenue, Foreshore, Cape Town
E-mail	info@rhinoresourcesltd.com
Web address	http://www.rhinoresourcesltd.com/

4.2 Exploration Right application area

The extent of ER 318 includes approximately 3 000 properties (farms and portions) over an area of approximately 600 000 ha (refer to Figure 1). Rhino Oil and Gas has identified three Target Areas within which the updated well drilling EWP intends to focus. The Target Areas include:

- **Target Area 1** is approximately 200 km² in extent and is located approximately 4 km west of Allanridge and 5 km north of Welkom. The Target Area includes ~680 properties;
- **Target Area 2** is approximately 450 km², approximately 4 km northeast of Allanridge and 20 km west of Kroonstad. The Target Area includes ~325 properties;
- **Target Area 3** is approximately 138 km² in extent in the eastern portion of ER 318, with Steynsrus located 38 km south and 2 km east of Kroonstad. Target Areas includes across ~230 properties.

The location of well drilling sites is subject to a process of geological review, landowner consent and environmental considerations. Areas that are unsuitable will be eliminated from further consideration.

4.3 Description of the Exploration Work Programme

The Drilling Program and Time Schedule proposed by Rhino Oil and Gas is to start drilling at least ten exploration wells (i.e. three to four in each of the Target Areas) within the ER in 2023. If any of the first ten exploration wells result in the identification of commercially viable commodities (hydrocarbons, helium, or hydrogen), Rhino Oil and Gas's Drilling Program and Project Schedule would be updated to include the drilling of additional exploration wells at different locations within the Target Areas.

Completed exploration wells will be tested to evaluate their commerciality. At the end of operations, unsuccessful wells will be plugged and abandoned ("decommissioned"). The drilling time to complete one well is estimated to take approximately 3 to 4 weeks. The results of the first few wells drilled within the Target Areas will influence the positioning and pace of the rest of the drilling campaign based on the interpretation of the geological, geophysical, fluid sampling data. The sequencing of the drilling campaign will be dynamic and influenced by the learnings of each new well.

Based on the overall subsurface rock in each area of interest, it is anticipated that exploratory drilling will be conducted using a truck mounted drilling rig with air and mud drilling capabilities. The truck mounted drilling rig has minimal area of disturbance due to its compact footprint and is highly mobile providing operational flexibility by being able to move from location to location without the need of additional truck support.

Project activities associated with drilling include the following phases:

-
- Mobilisation of the truck mounted rig and supply trucks from drilling contractor base located near Pretoria to the Rhino Oil and Gas Target Area in the Free State Province;
 - Well drilling;
 - Well execution (logging, completion) options;
 - Well testing for successful well options;
 - Well abandonment for unsuccessful well (Plug and Abandonment “decommissioning”); and
 - Demobilisation of the drill rig, supply truck and local logistics base.

4.4 Summary of project alternatives

One of the objectives of an EIA is to investigate alternatives to the project. Despite many advances in geophysical data acquisition and analysis, currently no alternatives exist to definitively establish the presence of hydrocarbon reserves other than through exploration drilling. No activity alternatives have therefore been assessed.

With respect to alternative sites, the selection of each well site location will follow an iterative process based on:

- Lawful entitlement in terms of the MPRDA, namely the full extent of Rhino Oil and Gas’s ER;
- Prospective geology identified as part of previous geophysical surveys;
- Desktop GIS environmental sensitivity taking into consideration hydrological, geohydrological, ecological and cultural heritage constraints and opportunities;
- Consultation with landowners to agree access to the proposed sites; and
- Micro siting by petroleum geologist and environmental specialists considering the local situation and landowner preferences.

In terms of technology alternatives for the drilling rig, Rhino Oil and Gas’s preference is to use the hybrid air/mud drilling rig provided by the local South Africa experienced drilling contractor.

The No-Go alternative entails no change to the status quo, in other words the proposed exploration drilling activities will not be conducted in ER 318. As such, the No-Go Alternative will leave the areas of the potential drilling sites in their current environmental state, with the biogenic gas, helium and geological hydrogen potential remaining unknown. The EIA Regulations, 2014 (as amended) require that the No-Go alternative is assessed.

4.5 Related Applications

Rhino Oil and Gas is also the holder of ER 294, which is located to the east of ER 318. As with ER 318, Rhino Oil and Gas has made application for the renewal of ER 294 and is also applying for Environmental Authorisation for well drilling. SLR is undertaking the S&EIA process for ER 318 concurrently with the application in ER 294. The Drilling Program proposed by Rhino Oil and Gas would see activities being undertaken in both ERs concurrently.

4.6 Further exploration or future production

If the exploration well drilling activities were to confirm the presence of a potential resource, then Rhino Oil and Gas would need to seek further approval from PASA for the additional exploration work required to appraise the resource. Any further approval would be subject to an additional environmental assessment process with further public consultation. Approvals are also likely to be required in terms of other legislation.

Similarly, if the later exploration led to the discovery of a commercial resource suitable for development then Rhino Oil and Gas would need to secure a production right from DMRE. An application for a production right has to be subject to an EIA process with further public consultation. Approvals are also likely to be required in terms of other legislation.

5. DESCRIPTION OF THE AFFECTED ENVIRONMENT

General information on relevant environmental (geographical, physical, biological, social, economic, heritage and cultural) aspects associated with the ER and Target Areas have been included in the Scoping Report using information sourced from studies that have been conducted by various government departments and non-government environmental organisations responsible for the area covered by the Well Drilling ER application.

5.1 Climate

Rainfall across the Target Areas is limited to the summer months and is mostly in the form of thunderstorms. Regional Mean Annual Precipitation can vary between 544 mm to 668 mm per annum. Day temperatures reach a maximum of up to 28°C in the months of January and December (the hottest months of the year), whilst the lowest night temperatures can drop to a minimum of -5°C.

5.2 Geology

The ER area lies in the north east of the Karoo Basin which formed as a result of compression during the assembly of the Gondwana super-continent. The Karoo Basin represents a diverse and complex suite of rock units with an aerial extent of roughly 600 000 square kilometres.

Resource assessments of the Karoo Basin have historically emphasised the world-class coal reserves that have dominated the energy history of South Africa. Some limited onshore exploration for hydrocarbon occurrences was undertaken in the 1960s, but no commercial hydrocarbon occurrences were discovered. However, it is expected that the north-east Karoo Basin has potential for a tremendous diversity of hydrocarbon resources including shale oil and shale gas, coalbed methane, helium and biogenic gas.

In general, the ER area is not located in a region with high levels of seismicity although minor earth tremors have been recorded in the recent past.

5.3 Soils and Land Capability

Soils across the ER area are extremely diverse with soils ranging in structure and composition. The majority of soils within the study area are considered Lithic and Duplex and to lesser degree Oxidic. Lithic soils are young soils with orthic topsoil but weakly developed subsoil. Oxidic and Duplex soils both have orthic topsoils and are soils with a special subsoil relating to their pedogenic accumulation. Other less common or in lesser concentration soils include Cumulic and Gleyic soils. Land capability of the region is largely tied to topography (slope), rainfall and altitude. Regions with steeper gradients and higher altitudes generally have lower agricultural potential.

5.4 Land Cover

The main towns located within the proposed Well Drilling exploration area include Kroonstad, Wesselsbron; and Odendaalsrus. Numerous tarred provincial roads are located within the proposed exploration area. These include the following, the R76 from Kroonstad to Viljoenskroon, the R30 from Bothaville to Odendaalsrus and Welkom and the R719 between Bultfontein and Wesselsbron.

The ER area is home to significant commercial agriculture activities comprising a combination of crop production, animal production, horticulture, dairy farming, game farming, aquaculture, fruit production and agro-processing. Major crops are maize, soybeans, wheat, sorghum, sunflowers, potatoes, groundnuts and wool. The large majority of the land is used for extensive livestock grazing (cattle and sheep).

5.5 Hydrology

The well drilling ER area falls within the Middle Vaal Water Management Area (WMA). The Middle Vaal WMA covers a catchment area of approximately 44 803 km². The Vaal River is located within the ER and is one of South Africa's strongest-flowing rivers, however, the Vaal dam itself falls outside of the ER. Several other small dams and numerous farm dams are located within the proposed Well Drilling ER area, which are largely used for livestock and domestic purposes.

Based on the National Freshwater Ecosystem Priority (NFEPA) wetland database (2011) the Target Areas include a significant number of wetlands ranging in hydrogeomorphic classification, including:

- Channelled valley-bottom wetlands;
- Depressions;
- Flat;
- Floodplain wetlands;
- Seep;
- Unchannelled valley-bottom wetlands; and
- Valleyhead seeps.

Surface water use consists of a combination of domestic, livestock use and irrigation for crop production on farms. Rivers within the Target Areas are tributaries of the Vaal Dam which is utilised for domestic, industrial

and recreational purposes such as water sports and fishing. The Vaal Dam is a vital resource for water supply to Gauteng.

5.6 Groundwater

The Target Areas are located within an area classified as a minor aquifer region, which implies a moderately yielding aquifer system of variable water quality in terms of the Aquifer Classification Map of South Africa. Certain parts of the Well Drilling ER area are classified as poor aquifer regions, which implies a low to negligible yielding aquifer system with moderate to poor water quality. Although borehole yields in the deeper aquifer are generally, considered low, structural features such as faults and fractures can produce higher yielding boreholes.

In terms of national mapping, the ER area is deemed to have 'least' and 'moderate' aquifer vulnerability, be a 'low' to 'medium' susceptibility aquifer and have groundwater quality of electrical conductivity concentrations from low (0 – 70 mS/m) to 150 – 370 mS/m where the water will have a noticeable salty taste.

There is significant groundwater use at a local scale with many farmers dependent on the abstraction of groundwater for both potable water as well as for stock watering and in some cases irrigation. More detailed information will be provided in the EIA report, following the Geohydrology Study.

5.7 Air Quality

The majority of the ER area is rural in nature and is comprised mostly of small towns, isolated farmsteads, scattered communities and agricultural activities such as livestock grazing and crop cultivation. It follows that the air quality associated with majority of the area is expected to be good. Existing emission sources include fugitive dust from paved and unpaved roads, wind erosion from open areas, household fuel combustion (fuel and coal), vehicle exhaust emissions and smoke from veld fires in winter and stack emissions from industries.

5.8 Biodiversity

The proposed Target Areas are located within the Grassland Biome and the Savannah Biome. The Grassland Biome comprises the Dry Highveld Grassland Bioregion and Sub-escarpment Savanna including an Inland Azonal Vegetation area.

Numerous faunal species such as birds, amphibians, reptiles, mammals, fish and insects are associated with the various vegetation units located in the ER area. Various species of concern are considered likely to occur within the proposed Target Areas. The Target Areas also overlap with several areas classified by the Free State Biodiversity Sector Plan, 2016 as Critical Biodiversity Areas and Ecological Support Areas, however the majority of the Target Areas are mapped as Degraded or Other. It is noted that the final locations for well sites would be adjusted to avoid locations that host flora and/or fauna of conservation concern.

5.9 Heritage

The Target Areas are likely to include numerous heritage sites that are documented in the national and provincial heritage databases as well as many undiscovered sites. The Target Areas are also located in a region that is generally regarded as having a very high to moderate palaeontological sensitivity. It follows that there is a high likelihood of fossil occurrence within most of the ER application area.

5.10 Socio-Economic Environment

The ER area is largely located within three Local Municipalities in the Free State Province, namely Nala Local Municipality, Moqhaka Local Municipality, and Matjhabeng Local Municipality. The ER area also has a small overlap with the Ngwathe (in the northeast corner) and Tswelopele (in the southwest corner) Local Municipalities. However, due to the limited overlap, these are not discussed in detail.

The population of the Nala Local Municipality has decreased 3.3% from 2011 to 2016. The population of the Moqhaka Local Municipality has decreased by 4.4% from 2001 to 2011. The Matjhabeng Local Municipality experienced a 5.14% growth rate from 2011 to 2016.

With respect to employment, the Nala and Moqhaka Local Municipalities have an unemployment rate of 35.9% and 35.2%, respectively. In the Matjhabeng Local Municipality, the unemployment rate stands at 37%.

In all three municipalities, the average household size varies from 3.1 to 3.7 persons. More than 40% of households in all three municipalities have access to piped water in their dwelling or in the yard and between 1 and 2% of households do not have access to piped water.

6. POTENTIAL PROJECT ISSUES AND IMPACTS

A scoping-level identification of environmental impacts (physical, biological, social and economic) associated with the proposed well drilling has been undertaken. A number of potential impacts that could potentially result from the proposed exploration activities have been identified for further assessment during the EIA phase are summarised below.

ASPECT	POTENTIAL IMPACTS
Geology	Remote risk of destabilising certain geologies, underground caverns or mine workings.
Soils	Project activities may result in contamination of soils. Vehicles and project activities on soils may damage soil structure and/or cause compaction or erosion.
Groundwater	Contamination of groundwater by drilling fluids, accidental spills and other sources.
Freshwater	Contamination of freshwater by drilling fluids, accidental spills and other sources. Physical disturbances of the beds and banks of watercourses.
Noise	Project activities could result in changes to the ambient noise levels during operation around the proposed well drilling site.

ASPECT	POTENTIAL IMPACTS
Air Quality	Project activities could result in changes to the ambient air quality during operation around the proposed well drilling site.
Health Risks	Activities may pose a risk of injury to public.
Ecology and Biodiversity	Damage or destruction of the vegetation, habitat and the disturbance or loss of species of conservation concern.
Heritage and Palaeontology	Disturbance of heritage resources by exploration.
Land Use	Access to private land and the associated inconvenience, damage to infrastructure, interference with land use, safety and security risk.
Contribution to Local Economy	Project activities would contribute to local economy through payment of local service providers.

7. PLAN OF STUDY FOR EIA

7.1 Method of Impact Assessment

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 exploration programme. 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.

Identified impacts will be described in terms of the nature of the impact, compliance with legislation and accepted standards, receptor sensitivity and the significance of the predicted environmental change (before and after mitigation). Mitigation measures may be existing measures or additional measures that were identified through the impact assessment and associated specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of mitigation. SLR's standard convention for assessing the significance of impacts is included in Section 9.3.8 of the Scoping Report.

7.2 Key Tasks (and Indicative Timing) of the EIA Phase

The EIA Phase approach has been developed to ensure that it complies with Section 23 of GN R326 and in particular Appendices 3 and 4 to the EIA Regulations 2014 (as amended). The various tasks / activities (including the indicative timing thereof) that will be undertaken during the EIA Phase are described in the table below.

TABLE 7-1: EIA TASKS AND TIMING

Phase	EAP activity	Opportunities for Consultation and Participation		SCHEDULE
		Competent Authorities	I&APs, State Departments and Organs of State	
Scoping	Submit Final Scoping Report to authority by 14 November 2022.	Authority to Accept scoping report OR Refuse environmental authorisation (43 days of receipt)	Advise I&APs of authority decision on Scoping Report	Nov 2022 to January 2023
Specialist Assessments	EAP to manage specialist activities and receive inputs for EIA.		Ongoing consultation, particularly with key stakeholders and potentially affected land owners	January to March 2023
	Assess environmental impacts and identify management measures. Compile draft EIA Report (including EMPr)			January to March 2023
EIA Phase	Submit draft EIA report to I&APs & authorities.	Review of draft EIA report (30 days). Comments to EAP	Review of draft EIA report (30 days). Comments to EAP	March to April 2023
	Address public comment and finalise EIA and EMPr reports			April to May 2023
	Final EIA report to Authority (106 days from acceptance of scoping).	Authority Acknowledge Receipt of EIA report (10 days).		May 2023
Authority review and Authorisation Phase		Environmental Authorisation Granted / Refused (107 days).	Notifications to I&APs regarding environmental authorisation (granted or refused).	September 2023
Appeal Phase	EAP to provide guidance regarding the appeal process as and when required.	Consultation during processing of appeal if relevant.	Submit appeal in terms of National Appeal Regulations	20 days from date of notification of decision to grant/refuse EA

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
AEL	Atmospheric Emission Licence
BID	Background Information Document
CARA	Conservation of Agricultural Resources Act (No. 43 of 1983)
CBA	Critical Biodiversity Area
CH ₄	Methane
CO ₂	carbon dioxide
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMPr	Environmental Management Programme
ER	Exploration Right
EWP	Exploration Work Programme
Government Notice	GN
I&APs	Interested and Affected Parties
IBA	Important Bird Areas
IEM	Integrated Environmental Management
IEP	Integrated Energy Plan
GA	General Authorisation
GHG	greenhouse gas
H ₂	Hydrogen
H ₂ O	Water
H ₂ S	Hydrogen sulfide
He	Helium
Hg	Mercury
HIA	Heritage Impact Assessment
IDPs	Integrated Development Plans
IEA	International Energy Agency
IRP	Integrated Resource Plan
IPCC	Intergovernmental Panel on Climate Change
IPPO	Independent Power Producer Office
IUCN	International Union for Conservation of Nature
MAP	Mean Annual Precipitation
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)

Acronym / Abbreviation	Definition
NDP	National Development Plan
NGP	New Growth Path
NEMA	National Environmental Management Act, 1998 (No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act, 2004 (No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act, 2003 (No. 57 of 2003)
NEM:WA	National Environmental Management: Waste Act, 2008 (No. 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority
NHRA	National Heritage Resources Act, 1999 (No. 25 of 1999)
NPAES	National Protected Area Expansion Strategy
NWA	National Water Act, 1998 (No. 36 of 1998)
P&A	Plug and abandonment
PASA	Petroleum Agency of South Africa
PCC	Presidential Climate Commission
PR	Production Right
PSDF	Provincial Spatial Development Framework
RCD	Rotative Control Device
RFI	Radio Frequency Interference
SA-LEDS	South Africa's Low-Emission Development Strategy
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANDF	South African National Defence Force
S&EIA	Scoping and Environmental Impact Assessment
SDFs	Spatial Development Frameworks
SEA	Strategic Environmental Assessment
SDF	Spatial Development Framework
SPLUMA	Spatial Planning and Land Use Management Act, 2013 (No. 6 of 2013)
VOCs	volatile organic compounds
WMA	Water Management Area
WHCA	World Heritage Convention Act, 1999 (No. 49 of 1999)
WWF	World Wildlife Fund

Rhino Oil and Gas updated Exploration Work Programme | Scoping Report

1. INTRODUCTION

This chapter describes the purpose of this report, briefly describes the project, summarises the legislative authorisation requirements, provides the terms of reference for the Scoping and Environmental Impact Assessment process (S&EIA), and describes the structure of the report.

1.1 PROJECT BACKGROUND

In 2019, Rhino Oil and Gas Exploration South Africa (Pty) Limited (Rhino Oil and Gas) was granted an Environmental Authorisation (EA) and Exploration Right (ER), permitting their exploration for natural gas using non-invasive techniques on various farms in the Magisterial District of Bultfontein, Wesselsbron, Welkom, Odendaalsrus, Wolmaransstad, Bothaville, Viljoenskroon, Kroonstad, Koppies & Heilbron, Free State and North-West Provinces (ER reference: 12/3/318). The extent of ER 318 is shown in Figure 1-1. Exploration was to be undertaken in terms of an approved Exploration Work Programme (EWP), over an initial period of three (3) years.

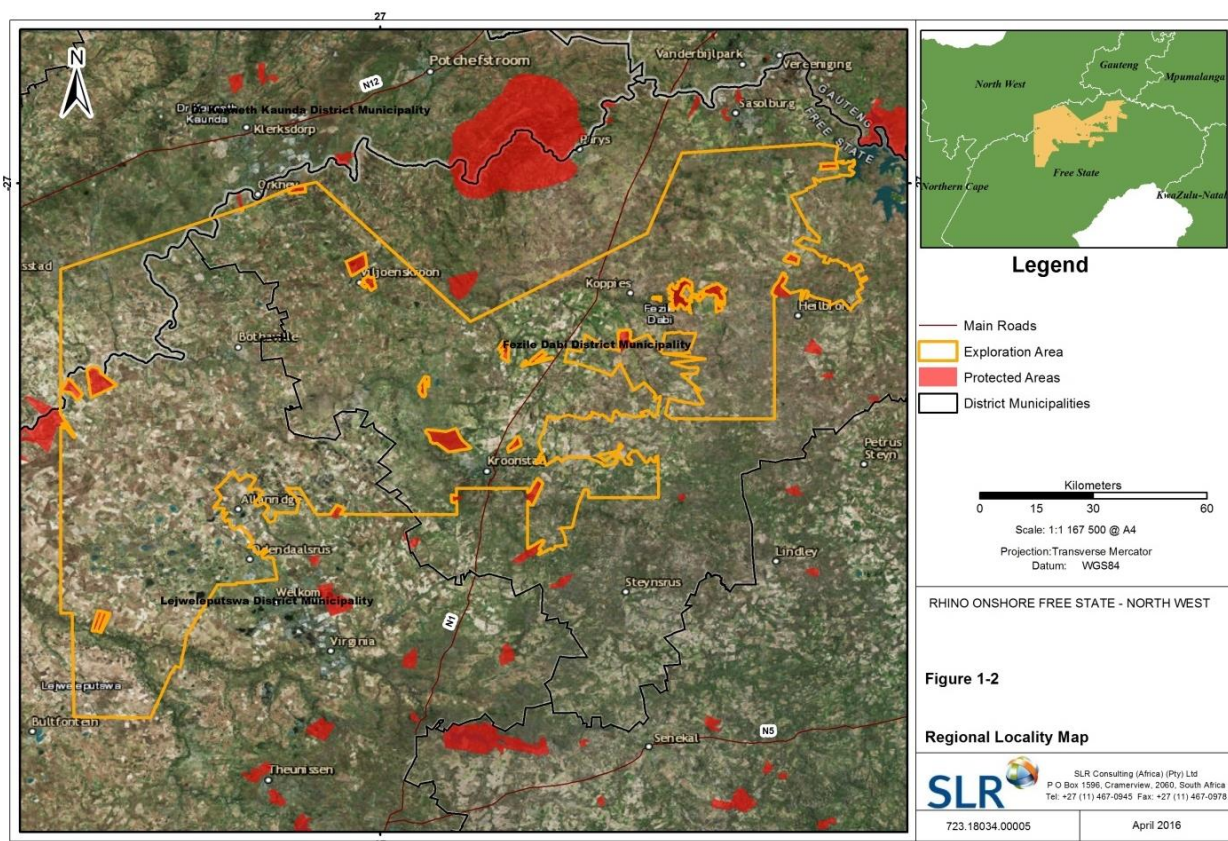


FIGURE 1-1: ORIGINAL LOCALITY MAP SHOWING EXTENT OF ER 318 (PRIOR TO ANY RELINQUISHMENTS)

Natural gas is found in deep underground rock formations or associated with other hydrocarbon reservoirs in coal beds and generally consists primarily of methane (CH₄), but commonly includes varying amounts of other higher alkanes and sometimes (usually a lesser percentage of) carbon dioxide, nitrogen, and/or

hydrogen sulfide. Once extracted, natural gas is a versatile source of energy and one of the cleanest fossil fuels.

Rhino Oil and Gas’s initial EWP included for:

- The review of existing literature such as the positions of mapped hydrocarbon seeps (where hydrocarbon leaks to the surface through natural fractures or exposed reservoir zones) and hydrocarbon shows, found during the drilling campaigns of SOEKOR and other exploration companies in the 1960-1980’s (Year 1);
- Review of existing legacy geological, geophysical and geochemical datasets (Year 2);
- Procurement of geological core samples from the Council for Geoscience (Year 3);
- Acquisition of airborne geophysical data.

Over the course of the previous three years, the exploration and analysis undertaken by Rhino Oil and Gas has furthered confidence regarding the presence of natural gases within the ER 318 area. Their intention is therefore to continue the exploration activities by renewing the ER for a further two (2) year duration and updating the exploration work programme. The proposed addition to the EWP is for the drilling of several exploration wells to test for the presence, quantity and quality of gas within specific Target Areas within the current ER area (see Figure 1-2).

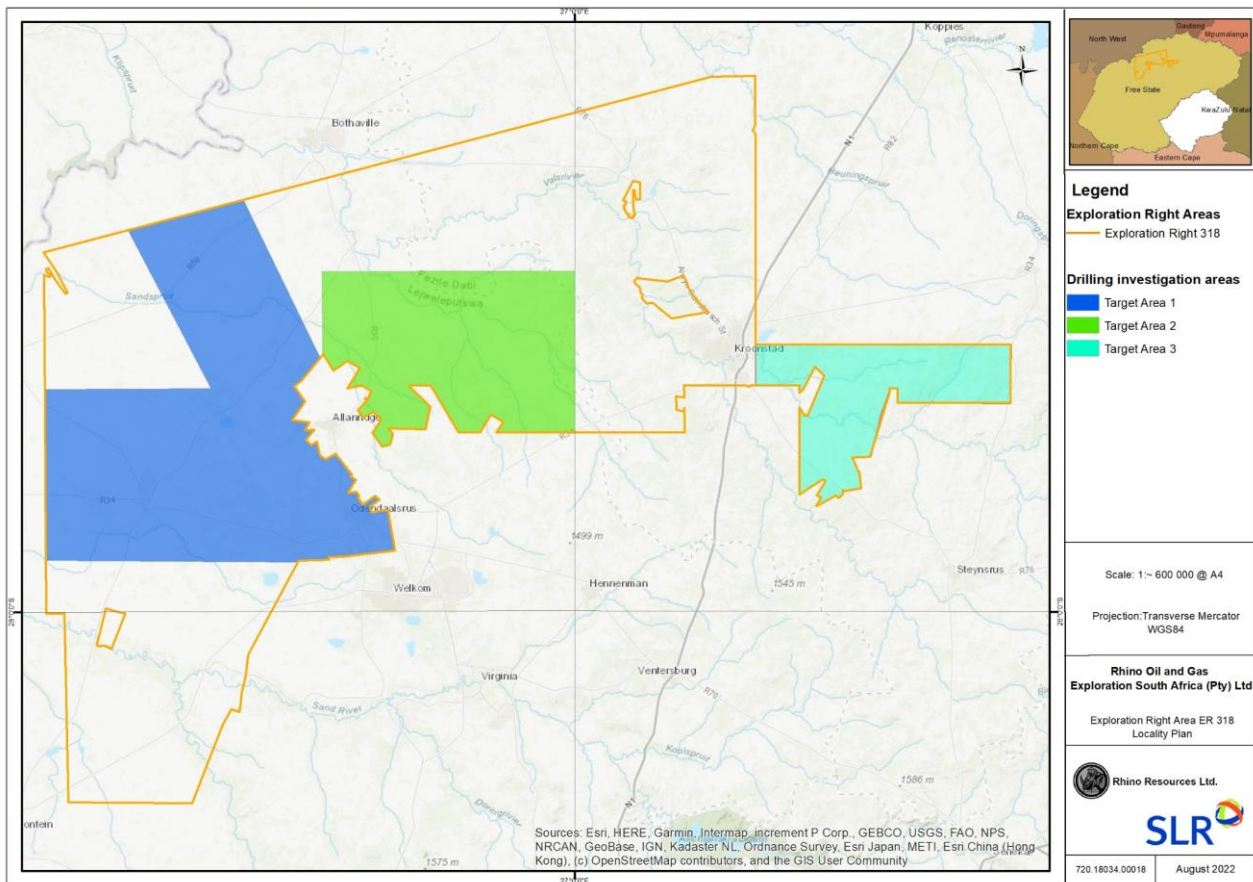


FIGURE 1-2: LOCALITY OF RHINO OIL AND GAS’S EXPLORATION WELL TARGET AREAS WITHIN ER 318

Although Rhino Oil and Gas hold an approved EA for exploration in ER 318, the current EA is limited to the use of non-intrusive techniques and the drilling of wells was not considered in the previous EWP. In order to include well drilling in an updated EWP, it is necessary for Rhino Oil and Gas to apply for, and obtain, further Environmental Authorisation in terms of Chapter 5 of the National Environmental Management Act, 1998 (No. 107 of 1998) (NEMA). As exploration activities conducted in terms of an ER are listed in Environmental Impact Assessment (EIA) Regulations Listing Notice 2, 2014 (Government Notice (GN) No. R984) an application for EA is required to be informed by a Scoping and Environmental Impact Assessment (S&EIA) process.

1.2 PURPOSE OF THIS REPORT

This Scoping Report was compiled and distributed for review and comment as part of S&EIA process being undertaken for Rhino Oil and Gas's application to update the EWP in terms the Minerals and Petroleum Resources Development Act, 2002 (No. 28 of 2002) (MPRDA) (Existing ER: 12/3/318).

This Scoping Report describes the proposed project and the potentially affected environment; summarises the S&EIA process followed to date and identifies the key project issues that will be further investigated, assessed and addressed in the EIA phase.

Interested and Affected Parties (I&APs) are invited to comment on this Scoping Report (see Section 1.6). Subsequent to the commenting period, the document will be updated into a final report, considering the comments received. The Scoping Report will be submitted to the Petroleum Agency of South Africa (PASA), For consideration and review. PASA will then make a recommendation on the acceptance or rejection of the report to the Minister of the Department of Mineral Resources and Energy (DMRE), who will make the final decision to accept or reject the report, as part of the application for EA.

1.3 OVERVIEW OF ENVIRONMENTAL AUTHORISATIONS REQUIRED

Rhino Oil and Gas's exploration activities are being undertaken in terms of a series of sequential approval and authorisation processes based on the activities included in their exploration work programme (see Figure 1-3):

- Further non-intrusive works (e.g. aerial surveys) will be undertaken in terms of the existing EA and approved Environmental Management Programme (EMPr) granted in 2019, via the pending ER renewal application made in terms of Section 81 of the MPRDA in January 2022; and
- Exploration well drilling and testing would be undertaken in terms of an approved EA and EMPr, which are the subject of the current EA application, made in terms of NEMA and submitted to PASA on 30 September 2022.

1.4 RELATED APPLICATIONS

Rhino Oil and Gas is also the holder of ER 294, which is located to the east of ER 318. As with ER 318, Rhino Oil and Gas has made application for the renewal of ER 294 and is also applying for Environmental Authorisation for well drilling. SLR is undertaking the S&EIA process for ER 318 concurrently with the

application in ER 294. The Drilling Program proposed by Rhino Oil and Gas would see activities being undertaken in both ERs concurrently.

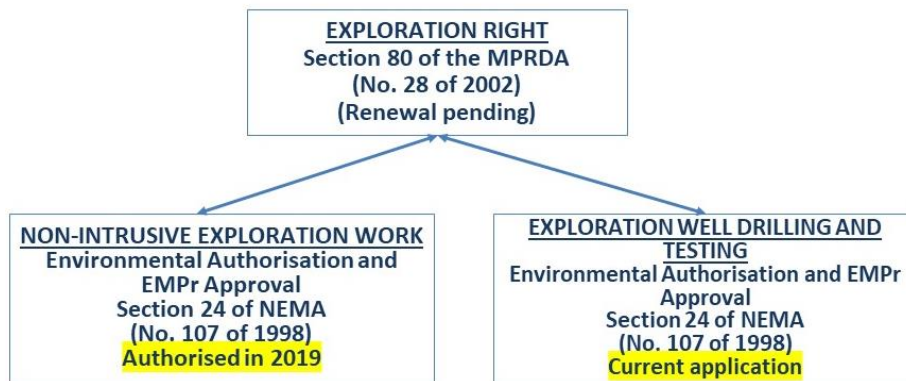


FIGURE 1-3: OVERVIEW OF RHINO OIL AND GAS'S ENVIRONMENTAL AUTHORISATION REQUIREMENTS

Source: Rhino Oil and Gas

1.5 TERMS OF REFERENCE

SLR, as the independent Environmental Assessment Practitioner (EAP), is responsible for undertaking the environmental regulatory process and conducting the public participation process. The terms of reference for the environmental regulatory process are to:

- make an application for Environmental Authorisation of the project in terms of NEMA;
- ensure the S&EIA is undertaken in accordance with the requirements of NEMA and the EIA Regulations 2014;
- ensure the S&EIA is undertaken in an open, participatory manner to ensure that all potential impacts are identified;
- undertake a formal public participation process, which includes the distribution of information to I&APs and provides the opportunity for I&APs to raise any concerns/issues, as well as an opportunity to comment on all S&EIA documentation; and
- integrate all the information into an EIA Report to allow the authorities to take an informed decision on the Environmental Authorisation.

1.6 STRUCTURE OF THIS REPORT

This Scoping Report has been prepared in compliance with Appendix 2 of the EIA Regulations, 2014 and is divided into various chapters and appendices, the contents of which are outlined below.

Section	Contents
Executive Summary	Provides a comprehensive synopsis of the Scoping Report.
Chapter 1	Introduction Provides a brief description of the project background, describes the purpose of this report, summarises the legislative authorisation requirements, contextualises the applications related to this

Section	Contents
	current application, provides the terms of reference, describes the structure of the report, and outlines the opportunity for comment.
Chapter 2	Administrative and Legal Framework Outlines the key South African administrative authorities and legislative framework applicable to the proposed project.
Chapter 3	Scoping and Environmental Impact Assessment methodology Presents the S&EIA Project Team, S&EIA assumptions and limitations, and outlines the approach and process followed during the S&EIA.
Chapter 4	Need and desirability Provides an overview of the need and desirability for the proposed project by considering how the project is aligned with the strategic context of national development policy and planning, broader societal needs and regional and local planning, as appropriate.
Chapter 5	Project description Provides general project information; presents a description of the proposed project; and presents a description of the project alternatives.
Chapter 6	Description of the affected environment Describes the existing biophysical and social environment that could potentially be affected by the proposed project.
Chapter 7	Potential project issues and impacts Describes key issues and impacts associated with the proposed project.
Chapter 8	Preliminary assessment of project alternatives Compares the environmental impacts and risks of the project alternatives.
Chapter 9	Plan of Study for Environmental Impact Assessment Describes the nature and extent of further investigations to be undertaken during the EIA phase and sets out the proposed approach to the EIA process.
Chapter 10	References Provides a list of the references used in compiling this report.
Appendices	<p>Appendix 1: EAP undertaking</p> <p>Appendix 2: Curricula Vitae (including registrations) of the Project Team</p> <p>Appendix 3: Public Participation Process:</p> <ul style="list-style-type: none"> Appendix 3.1: PASA correspondence Appendix 3.2: I&AP database* Appendix 3.3: Written notice Appendix 3.4: Notice in Provincial Gazette Appendix 3.5: Background Information Document Appendix 3.6: Advertisements Appendix 3.7: Site notices Appendix 3.8: Minutes of public information meetings Appendix 3.9: Correspondence received during the pre-application public participation process* Appendix 3.10: Comments and Responses Report Appendix 3.11: Comments from Scoping Report Review* <p>Appendix 4: Petroleum Exploration Well Drilling Application Area</p> <ul style="list-style-type: none"> Appendix 4.1: Regulation 2(2) plan of the Well Drilling ER Application Area Appendix 4.2: List of properties within the Target Areas Appendix 4.3: Corner points of the Target Areas

Section	Contents
	Appendix 5: Department of Forestry, Fisheries & the Environment Screening Report

* Only to be included in updated scoping report to PASA

1.7 OPPORTUNITY TO COMMENT

This Scoping Report is being distributed for a 30-day comment period from **10 October to 9 November 2022** to provide I&APs with an opportunity to comment on any aspect of the proposed project and the findings of the S&EIA process to date. Copies of the full report are available electronically on the SLR website (at <https://www.slrconsulting.com/en/public-documents/Rhino-well-ER318>) and in hard copy at the following locations:

Name of Facility	Physical Address and telephone number
Kroonstad Public Library	Address: Steyn Street, Kroonstad, 9499 Tel: 056 216 9911
Kroonstad Local Co-operative Senwes	Address: 9 10th Lane, Industria, Kroonstad Tel: 056 216 0700
Steynrus Public Library	Address: Matlwangtlwang, Steynrrus, 9515 Tel: 056 471 0006
Steynsrus: Moqhaka Local Municipality	Address: Van Riebeeck Street, Steynsrus, 9515 Tel: 056 216 9600
Welkom Public Library	Address: C/O Tulbagh and Reinett Street, Welkom, 9460 Tel: 057 391 3359
Welkom Local Co-operative Senwes	Address: 151 Jan Hofmeyer Road, 9460 Tel: 053 355 1731
Wesselsbron Public Library	Address: Erwee St, Wesselsbron, 9680 Tel: 057 899 1818
Wesselsbron Local Co-operative Senwes	Address: 10 Louis Kotze Street, 9680 Tel: 057 899 1851

Please send your comments to SLR at the address, telephone number or e-mail address shown below by no later than **9 November 2022** for them to be included in the updated Scoping Report. All comments received during the review process will be included in the Scoping Report.

SLR Consulting (South Africa) (Pty) Ltd
 Attention: Nicholas Arnott or Gugu Dhlamini
 PO Box 1596, Cramerview 2060 (if using post please call SLR to notify us of your submission)
 Tel: (011) 467 0945
 Whatsapp: 066 171 3677
 E-mail: RhinoER318@slrconsulting.com

2. ADMINISTRATIVE AND LEGAL FRAMEWORK

This chapter outlines the South African administrative framework, key legislative requirements and other relevant local legislation and international conventions applicable to the proposed exploration activities and the S&EIA process.

2.1 SOUTH AFRICAN INSTITUTIONAL AND ADMINISTRATIVE FRAMEWORK

2.1.1 Department of Mineral Resources and Energy

The DMRE is the public trustee of South Africa's mineral and petroleum resources. According to the MPRDA, read with the NEMA, the Minister (or designated authority) is responsible for the following:

- Approving or refusing an Environmental Authorisation on the basis of environmental reporting prepared in terms of Chapter 5 of the NEMA as part of Exploration or Production Right applications;
- Granting or refusing Exploration Rights and Production Rights; and
- Prescribing and levying any fee, in consultation with the Minister of Finance, payable in terms of the MPRDA.

The Minister is required to consider environmental policy, norms and standards, while promoting economic and social development, in order to ensure that the development of South Africa's mineral and petroleum resources is undertaken in a sustainable manner.

2.1.2 Petroleum Agency of South Africa

In terms of Section 70 of the MPRDA, the Minister of Mineral Resources and Energy in June 2004, designated various duties pertaining to petroleum exploration and production to PASA. Section 71 of MPRDA deals with the functions of the designated agency. Functions include the receipt of applications for different types of permits and rights (Section 71i), some of which require Environmental Authorisations. Section 71(i) provides that the designated agency must review and make recommendations to the Minister with regards to the acceptance of environmental reports and the conditions of Environmental Authorisations and amendments thereto.

PASA is responsible for promoting the exploration of oil and gas resources (Section 71a) and the optimal development thereof on behalf of the South African government. As such, PASA deals with the regulation and monitoring of exploration and production activities and endeavours to make sure that all such activities have long-term economic benefit for South Africa. In addition, PASA is the custodian of the national exploration and production database for petroleum.

2.1.3 Department of Forestry, Fisheries and the Environment

Department of Forestry, Fisheries and the Environment (DFFE) is the custodian of environmental matters and is tasked with ensuring protection of the environment and conservation of natural resources in the context of sustainable development. DFFE is responsible for the administration of applications for and the

issuing of Environmental Authorisations in terms of NEMA and the EIA Regulations 2014, excluding applications related to mining and petroleum for which DMRE is the competent authority. The Minister of Forestry, Fisheries and the Environment, however, remains the competent authority for dealing with appeals in respect of environmental authorisation decisions for mining and petroleum applications and serves as the appeals administrator.

2.1.4 South African Heritage Resources Agency

The South African Heritage Resources Agency (SAHRA) is a statutory organisation established under the National Heritage Resources Act, 1999 (No. 25 of 1999), and serves as the national administrative body responsible for the protection of South Africa's cultural heritage.

SAHRA is responsible for establishing national principles, standards and policy for the purposes of identifying, recording and managing the national estate. SAHRA also manages South Africa's national cultural heritage, identifies and keeps record of nationally significant heritage resources and provides expertise to provincial and local heritage authorities where required.

2.2 SOUTH AFRICAN LEGISLATION

2.2.1 Constitution of the Republic of South Africa, 1996

In terms of Section 24 of the Constitution of South Africa, 1996 (No. 108 of 1996) (the Constitution), *“everyone has the right:*

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

The NEMA was gazetted to give specific effect to these rights and provides for the incorporation of environmental considerations in decision-making. It applies alongside the State's responsibility to respect, protect, promote and fulfil the social and economic rights in Chapter 2 of the Constitution, together with the basic needs of categories of persons disadvantaged by unfair discrimination.

The MPRDA gives effect to Section 24 of the Constitution by ensuring that South Africa's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development.

The above Acts and other laws listed below are the statutes in terms of which authorisation / approval is required in order for Rhino Oil and Gas to undertake the proposed exploration activities. These laws govern the legal requirements, the application processes to be followed and stipulate where exploration activities may or may not occur.

2.2.2 Minerals and Petroleum Resources Development Act, 2002

The MPRDA is the principal legislation governing prospecting and mining and the exploration and production of oil and natural gas. The Act provides for the equitable access to and sustainable development of mineral and petroleum resources. The MPRDA Regulations (GN R527 of 2004) provide for the application for and issuing of Reconnaissance Permits, Prospecting Rights, Exploration Rights, Mining Rights and Production Rights.

In addition to providing for the application for and issuing of rights and permits, the MPRDA provides for the renewal of rights and permit. Exploration Right are valid for a period not longer than 3-years and are then renewable through Section 81 of the MPRDA for a maximum of three periods not exceeding two years each. In terms of Section 102 of the MPRDA, an ER, EWP, EA or EMPr, may not be amended without the approval of the Minister (of Minerals and Energy).

Since 8 December 2014, environmental regulation of prospecting, mining, exploration and production and related activities was removed from the MPRDA and transferred to NEMA, as set out in Section 2.2.3 below. As stated above, the Minister of the DMRE is the competent authority that authorises an application for an Environmental Authorisation, while the Minister of Forestry, Fisheries and the Environment remains the appeal authority for such an authorisation.

As noted previously, Rhino Oil and Gas currently hold Exploration Right 12/3/318 (refer to Section 1.2), and have made application to renew the ER in terms of Section 81 of the MPRDA (refer to Section 1.3).

2.2.3 National Environmental Management Act, 1998

Chapter 2 of NEMA sets out a range of environmental and social principles that are 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. It requires that environmental management must place people and their needs at the forefront of its concern, and must serve their physical, psychological, developmental, cultural and social interests equitably. NEMA also provides for the participation of I&APs and stipulates that decisions must consider the interests, needs and values of all of them.

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 development proposals. Section 24 of the NEMA provides a framework for the granting of an Environmental Authorisation. In order to give effect to the general objectives of IEM, the potential impacts on the environment of listed activities must be considered, investigated, assessed and reported on to the competent authority. Section 24(4) provides the minimum requirements for procedures for the investigation, assessment and communication of the potential impact of activities.

The EIA Regulations 2014 (as amended) promulgated in terms of Chapter 5 of NEMA and published in Government Notice (GN) No. R982, provide for the control of certain listed activities. These activities are listed in GN No. R983 (Listing Notice 1), R984 (Listing Notice 2) and R985 (Listing Notice 3) of 4 December 2014 (as amended) and are prohibited until an Environmental Authorisation has been obtained from the competent authority. The Minister of Mineral Resources and Energy (the Minister) is responsible for the granting or refusing of an Environmental Authorisation for the application to undertake exploration activities in terms of the NEMA. Such Environmental Authorisation, which may be granted subject to conditions, will only be considered once there has been compliance with GN No. R982. For oil and gas exploration, the responsibility for processing applications has been delegated to PASA (see Section 2.1.2). However, DMRE remains the competent authority for the Environmental Authorisation decision-making.

The EIA Regulations, 2014 sets out the procedures and documentation that need to be complied with when applying for an Environmental Authorisation. A Basic Assessment process must be undertaken if the authorisation applied for is in respect of an activity or activities listed in Listing Notice 1 and/or 3, while an EIA process (scoping and impact assessment) must be undertaken if the authorisation applied for is in respect of an activity or activities listed in Listing Notice 2.

The proposed exploration project triggers activities contained in both Listing Notice 1 and 2 (see Table 2-1), thus an EIA process must be undertaken for PASA and DMRE to consider the application. As noted previously, Rhino Oil and Gas have made application for an EA in terms of Section 24 of the NEMA (see Section 1.3).

TABLE 2-1: LIST OF APPLICABLE ACTIVITIES IN TERMS OF LISTING NOTICE 1 AND 2

No.	Activity description	Description of activity in relation to the proposed project
Listing Notice 1 (as amended by GN No. 327 of April 2017)		
21D	Any activity including the operation of that activity which requires an amendment or variation to a right or permit in terms of section 102 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity contained in this Listing Notice or in Listing Notice 3 of 2014, required for such amendment.	Rhino Oil and Gas currently hold an exploration right for ER 318 which limits their work programme to non-invasive and desktop exploration activities. To undertake the proposed well exploration and to further the exploration work programme, it is necessary for Rhino Oil and Gas to amend their existing ER in terms of Section 102 of the MPRDA.
Listing Notice 2 (as amended by GN No. 325 of April 2017)		
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 - (a) associated infrastructure, structures and earthworks; or (b) the primary processing of a petroleum resource including winning, extraction, classifying, concentrating or water removal;	Rhino Oil and Gas is proposing to drill several exploration wells within identified Target Areas. Since the activity (namely drilling) requires an Exploration Right (although Rhino Oil and Gas already holds an Exploration Right for ER 318) and drilling was not previously

No.	Activity description	Description of activity in relation to the proposed project
	but excluding the secondary processing of a petroleum resource, including the beneficiation or refining of gas, oil or petroleum products in which case activity 5 in this Notice applies.	authorised, this activity is deemed applicable.

In terms of Section 24P of NEMA, where prescribed, an applicant for an Environmental Authorisation relating to exploration, must, before the Competent Authority issues an Environmental Authorisation, determine the financial provision, which is required for undertaking progressive rehabilitation, decommissioning, closure and post-closure activities. The Regulations pertaining to Financial Provision (GNR No. R1147 of 2015, as amended) set out the methods for determining and making Financial Provision to guarantee the availability of sufficient funds to undertake rehabilitation and remediation of the adverse environmental impacts caused by exploration. Refer to Section 9.8.1 for further detail on the Financial Provision for this project.

2.2.4 National Environmental Management: Waste Act, 2008

The National Environmental Management: Waste Act, 2008 (No. 59 of 2008) (NEM:WA) regulates all aspects of waste management and has an emphasis on waste avoidance and minimisation. NEM:WA creates a system for listing and licensing waste management activities which may have a detrimental effect on the environment.

Listed waste management activities (GN R 921, November 2013) above certain thresholds are subject to an impact assessment and licensing process. The assessment and reporting process in support of a Waste Management Licence application must be undertaken in accordance with the EIA Regulations, 2014. These Regulations define the requirements for the submission; processing, consideration and decision of applications authorisation of listed activities (refer to Section 2.2). Activities listed in Category A require a Basic Assessment process, while activities listed in Category B require a Scoping and EIA process in order for authorities to consider an application in terms of NEM:WA.

While waste material will be generated and temporarily stored, the updated EWP does not include for any activity listed in Category A or B and thus there is no requirement for a Waste Management Licence.

2.2.5 National Environmental Management: Air Quality Act, 2004

The National Environmental Management: Air Quality Act, 2004 (No. 39 of 2004) (NEM:AQA) regulates all aspects of air quality, including: prevention of pollution and environmental degradation; providing for national norms and standards (through a National Framework for Air Quality Management) regulating air quality monitoring, management and control; and licencing of activities that result in atmospheric emissions and have or may have a significant detrimental effect on the environment.

In terms of Section 22 of NEM:AQA no person may conduct a listed activity (as per GN No. 893, 22 November 2013) without an Atmospheric Emission Licence (AEL). The proposed well drilling activities in the updated

EWP do not trigger any activity set out in the listing notice and thus there is no requirement for an Atmospheric Emissions Licence.

2.2.6 National Heritage Resources Act, 1999

The National Heritage Resources Act, 1999 (No. 25 of 1999) (NHRA) provides for the identification, assessment and management of the heritage resources of South Africa. The NHRA requires that a person who intends to undertake a listed activity notify the relevant provincial heritage authority at the earliest stages of initiating such a development. The relevant provincial heritage authority would then, notify the person whether a Heritage Impact Assessment (HIA) should be submitted.

Section 38(1) of the NHRA lists development activities that would require authorisation by the responsible heritage resources authority. The proposed well drilling activities in the updated EWP do not trigger any activity set out in this section of the NHRA and thus there is no requirement for approval from the heritage authority.

2.2.7 National Water Act, 1998

The National Water Act, 1998 (No. 36 of 1998) (NWA) provides a legal framework for the effective and sustainable management of water resources in South Africa. It serves to protect, use, develop, conserve, manage and control water resources as a whole, promoting the integrated management of water resources with the participation of all stakeholders. This Act also provides national norms and standards, and the requirement for authorisation (either a Water Use Licence or General Authorisation) of water uses listed in Section 21 of the Act. The Minister has published General Authorisations, which replace the need for a water user to apply for a licence in terms of the NWA, provided that the water use is within the limits and conditions of the General Authorisation (GA).

The Minister of Water and Sanitation declared *"the exploration and or production of onshore naturally occurring hydrocarbons that requires stimulation, including but not limited to hydraulic fracturing and or underground gasification, to extract, and any activity incidental thereto that may impact detrimentally on the water resource"* (GN 999 of 2015) as a controlled activity in terms of section 38(1) of the NWA.

The proposed well drilling activities in the updated EWP do not allow for stimulation of naturally occurring hydrocarbons and as a result do not trigger this water use activity as set out in Section 21 of the NWA, nor a controlled activity, and thus there is no requirement for a Water Use Licence.

2.2.8 National Environmental Management: Protected Areas Act, 2003

The National Environmental Management: Protected Areas Act, 2003 (No. 57 of 2003) (NEM:PAA), as amended, provides for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes. Section 48 of the NEM:PAA sets out that *"despite other legislation, no person may conduct commercial prospecting, mining, exploration, production or related activities –*

- a) *in a special nature reserve, national park or nature reserve;*
- b) *in a protected environment without the written permission of the Minister and the Cabinet member responsible for minerals and energy affairs; or*
- c) *in a protected area referred to in section 9(b), (c) or (d)."*

The ER, and the proposed target areas with the ER, exclude all areas protected in terms of NEM:PAA (in so far as the available information is accurate). See Section 6.9.1 for further information on protected areas. Further exclusions may be identified in the course of the S&EIA process and the ER application area will be adjusted accordingly.

2.2.9 National Environmental Management: Biodiversity Act, 2004

National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004) (NEM:BA) provides for the management and conservation of South Africa's biodiversity and the protection of species and ecosystems that warrant national protection.

NEM:BA regulates restricted activities that may harm listed threatened or protected species or activities that encourage the spread of alien or invasive species. NEM:BA also makes provision for the publication of bioregional plans and the listing of ecosystems and species that are threatened or in need of protection. Within the published bioregional (spatial) plan, terrestrial and aquatic features that are critical for conserving biodiversity and maintaining ecosystem functioning are indicated as Critical Biodiversity Areas (CBAs). Bioregional plans provide the guidelines for avoiding the loss or degradation of natural habitat in CBAs with the aim of informing EIAs and land-use planning, including Environmental Management Frameworks (EMFs), Spatial Development Frameworks (SDFs) and Integrated Development Plans (IDPs).

Chapter 3 of the "Guideline regarding the determination of bioregions and the preparation of and publication of bioregional plans" requires environmental decision-makers who are required by NEMA to apply the NEMA Section 2 principles in their decision-making to consider, amongst other things, sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands and similar systems, which require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure. CBAs identified in a bioregional plan should be considered to be such areas and should, therefore, be considered by decision-makers in the course of the decision-making process. Thus, bioregional plans should be considered by competent authorities in their decision-making regarding an application for Environmental Authorisation.

Alien and Invasive Species Regulations (GN R 598 of 2014) as well as the Alien and Invasive Species List (GN R 864 of 2016) have been published to regulate the monitoring, control and eradication for listed invasive species. The Regulations are effective from 1 October 2014 and it is therefore necessary for all land owners on whose land alien and invasive species occur to make the necessary arrangements to be compliant with these Regulations. This may include studies to identify the existence of alien and invasive species, the determination of the category in the Alien and Invasive Species List and the implementation of programmes to combat or control such species.

The requirements of NEM:BA are not applicable to the well drilling application as no activities are proposed that would trigger any obligations under NEM:BA.

2.2.10 World Heritage Convention Act, 1999

The World Heritage Convention Act, 1999 (No. 49 of 1999) (WHCA) provides for the incorporation of the World Heritage Convention into South African law, enables the establishment of World Heritage Sites and provides for the management thereof to safeguard the integrity of World Heritage Sites.

World Heritage Sites are recognised as a protected area in terms of Section 9 of the NEM:PAA and are therefore excluded from the Well Drilling ER application area.

2.3 OTHER LEGISLATION CONSIDERED IN THE PREPARATION OF THIS SCOPING REPORT

Table 2-2 below provides a summary of the additional legislative with potential relevance to the project.

TABLE 2-2: LEGAL FRAMEWORK

Applicable legislation and guidelines	Relevance or reference
National Forests Act, 1998 (No 84 of 1998)	This Act provides for the sustainable management and development of forests for the benefit of all, including providing special measures for the protection of certain forests and trees. Licensing is required for the destruction of certain indigenous trees. The proposed project would not entail any activities to which the Act applies.
Mountain Catchment Areas Act, 1970 (No 63 of 1970)	This Act provides for the conservation, use, management and control of land situated in mountain catchment areas. The proposed project would not entail any activities to which the Act applies.
Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) and the Conservation of Agricultural Resources Act Regulations, 1984 (GN No. 1048)	The CARA provides for control over the utilization of the natural agricultural resources in order to promote the conservation of the soil, water sources, vegetation and the combating of weeds and invader plants. Landowners on whose land declared weed species occur must make the necessary arrangements to be compliant with the CARA Regulations.
Occupational Health and Safety Act, 1993 (No. 85 of 1993) and Major Hazard Installation Regulations	This Act provides for the health and safety of persons at work and the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work. Every employer shall provide and maintain, as far as is reasonably practicable, a working environment that is safe and without risk to the health of his employees. The applicant will need to ensure compliance with the requirements of the Act during both construction and operations. Such requirements are not considered in the EIA.
The Spatial Planning and Land Use Management Act, 2013 (No. 6 of 2013) (SPLUMA)	SPLUMA aims to develop a new framework to govern planning permissions and approvals, sets parameters for new developments and provides for different lawful land uses in South Africa. SPLUMA is a framework law, which means that the law provides broad principles for a set of provincial laws that will regulate planning. SPLUMA also provides clarity on how

Applicable legislation and guidelines	Relevance or reference
	planning law interacts with other laws and policies. Such requirements are not considered in the EIA.
Subdivision of Agricultural Land Act, 1970 (No. 70 of 1970)	The Subdivision of Agricultural Land Act, 1970 critically defines the zoning of agricultural land and the restricts the subdivision of land parcels subject to approval.

2.4 GUIDELINES, POLICIES, PLANS AND FRAMEWORKS

The guidelines polices, plans and frameworks listed below (Table 2-3) have been or will be taken into account during the S&EIA process.

TABLE 2-3: GUIDELINE AND POLICY FRAMEWORK

Guideline	Governing body	Relevance
Public participation guideline in terms of NEMA (2017)	DFFE	The purpose of this guideline is to ensure that an adequate public participation process is undertaken during the Scoping and EIA Process.
Guideline on Need and Desirability (2017)	DFFE	This guideline informs the consideration of the need and desirability aspects of the proposed project.
National Development Plan 2030	National Planning Commission	The National Development Plan 2030 (NDP) is the overarching development planning policy for the country, to which all other development planning, in particular spatial planning, must be aligned. The NDP outline South Africa's Vision and provides the Framework for eliminating poverty and reducing inequality by 2030.
Medium-Term Strategic Framework (MTSF) 2019-2024	National Planning Commission	Provides Government's Strategic Plan for the 2019-2024 electoral term.
Integrated Development Plans and Spatial Development Frameworks (various dates) for the District Municipalities.	District Municipalities	The IDP and SDFs of the relevant municipalities will be examined and relevant information will be included in the EIA report.

2.5 RHINO OIL AND GAS ESG AND OPERATIONAL STATEMENT

Hydraulic fracturing, also called fracking, hydrofracking, and hydrofracturing, is a technique typically used for the exploitation of shale oil and gas resources, involving the fracturing of formations by a pressurized liquid. The process involves the high-pressure injection of "fracking fluid" (primarily water, containing sand or other proppants suspended with the aid of thickening agents) into a wellbore to create new cracks in the deep-rock formations through which natural gas, petroleum, and brine can flow more freely.

While South Africa continues to explore the use of hydraulic fracturing through the development of policy and specific regulations, Rhino Oil and Gas has publicly confirmed that their corporate strategy will not be exploring for shale oil or gas and therefore will not use hydraulic fracturing as part of their planned exploration or potential future production.



FIGURE 2-1: COPY OF RHINO OIL AND GAS CORPORATE STATEMENT

3. SCOPING AND ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

This chapter outlines the assessment methodology and I&AP consultation process that has and will be followed in the S&EIA process.

3.1 DETAILS OF THE EIA PROJECT TEAM

SLR has been appointed as the independent EAP to undertake the S&EIA for the activities proposed by Rhino Oil and Gas. The details of the EAP project team that are undertaking this S&EIA are provided in Table 3-1.

SLR has no vested interest in the proposed project other than fair payment for consulting services rendered as part of the S&EIA process and has declared its independence as required by the EIA Regulations, 2014. An undertaking by the EAP is provided in Appendix 1.

TABLE 3-1: DETAILS OF THE EIA PROJECT TEAM

General				
Organisation	SLR Consulting (South Africa) (Pty) Ltd			
Postal address	PO Box 1596, Cramerview, 2060			
Tel No.	(011) 467 0945			
Matthew Hemming (SLR)	M.Sc. (Cons. Biol.), University of Cape Town	Pr.Sci.Nat., EAPASA (2019/1107), IWMSA, Member IAIAAsa	16	Principle Environmental Consultant Management of the EIA process, including public consultation, process review, specialist study review and report compilation.
Nicholas Arnott (SLR)	B.Sc Hons. (Earth & Geog. Sci.), University of Cape Town	Pr.Sci.Nat., EAPASA (2019/1001), Western Cape Branch Chair of IAIAAsa	16	Associate Environmental Consultant Management of the EIA process, including public consultation, process review, specialist study review and report compilation.
Gugu Dhlamini (SLR)	BSc (Hons) (Applied Sci. in Env. Technology). University of Pretoria	Member IAIAAsa	3.5	Environmental Consultant Assisting with the management of the EIA process, including public consultation, process review, specialist study review and report compilation.

3.1.1 Qualifications and Experience of the EAPs

Matthew Hemming holds a Master's Degree in Conservation Biology and has over 16 years of experience in a range of environmental disciplines, including EIAs, EMPs, Environmental Auditing and Monitoring in South Africa. He has expertise in a wide range of projects, including oil / gas, mining and infrastructure. Matthew is a Registered Professional Natural Scientist and a registered Environmental Assessment Practitioner and is also a member of the International Association of Impact Assessment, South Africa.

Nicholas Arnott holds a Honours Degree in Earth and Geographical Sciences and has more than 16 years over a range of environmental disciplines and has compiled numerous Basic Assessments, EIAs and Environmental Management Programmes. He has gained experience in a wide range of projects relating to oil and gas, mining and prospecting, infrastructure, housing and industrial developments. He is a registered Environmental Assessment Practitioner, a registered Professional Natural Scientist with SACNASP and the Chair of the Western Cape Branch of the International Association of Impact Assessment, South Africa.

Gugu Dhlamini holds an Honours Degree in Applied Sciences in Environmental Technology and has 3 and a half years' worth of experience within the environmental consulting field. Gugu has predominantly worked on various mining and renewable energy projects since joining SLR. She has also performed the role of an Environmental Auditor for a gas exploration project in Mpumalanga. Gugu is a member of the International Association of Impact Assessment, South Africa

Relevant curricula vitae (including proof of registrations) are attached in Appendix 2.

3.2 ASSUMPTIONS AND LIMITATIONS

The assumptions and limitations pertaining to this S&EIA are listed below:

- It is assumed that SLR has been provided with all relevant project information and that it was correct and valid at the time it was provided;
- While the Scoping process focuses on the extent of the various Target Areas, Rhino Oil and Gas is currently actively engaging with farm owners regarding access to high potential areas. The EIA phase and inputting specialist studies will then assess impacts based on these approximate locations. The exact locations of the drill site will not be disclosed as part of this EIA process.
- There will be no significant changes to the project description or surrounding environment between the completion of the S&EIA process and implementation of the proposed project that could substantially influence findings and recommendations with respect to mitigation and management, etc.
- The EIA considers the assessment of activities proposed as part of the additional exploration activities, but does not aim to identify or assess the impacts or benefits of possible future exploration or production activities or outcomes;
- The EIA Regulations, 2014 require the consideration of the "cumulative impact", which includes the 'reasonably foreseeable future impact of an activity'. Cumulative impacts of the proposed activities, in the context of other exploration activities, will be considered in the EIA, to the extent that this is feasible and 'reasonably foreseeable'. While it is foreseeable that further exploration and future production activities could arise from the proposed exploration activities (if granted), there is not currently sufficient information to make reasonable assertions as to nature of any future activities due to the current lack of relevant geological information; and
- No significant changes to the project description or surrounding environment will occur between the submission of the final EIA Report and implementation of the proposed project that could substantially influence findings and recommendations with respect to mitigation and management.

3.3 SCOPING PHASE

3.3.1 Objectives

In accordance with Appendix 2 to the EIA Regulations, 2014, the objectives of the Scoping process are to:

- identify the relevant policies and legislation relevant to the activity;
- present the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- identify and confirm the preferred activity, technology and sites related to the project proposal;
- identify the key issues to be addressed in the assessment phase;
- agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required, as well as the extent of further consultation to determine the risks and impacts the activity will impose on the preferred site through the life of the activity; and
- identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of residual risks that need to be managed and monitored.

The Scoping process consists of a series of steps to ensure compliance with these objectives and the EIA Regulations 2014. The process involves an open, participatory approach to ensure that impacts are identified and that decision-making takes place in an informed, transparent and accountable manner. A flowchart indicating the generic S&EIA process is presented in Figure 3-1.

3.3.2 Pre-application authority consultation and notification

SLR met with PASA on 19 May 2022. The purpose of this pre-application meeting was to provide notification of Rhino Oil and Gas' proposed application to PASA and to confirm the legislative requirements and the approach to the Environmental Authorisation processes.

Rhino Oil and Gas made applications to PASA for an extension of the period within which to submit the application for Environmental Authorisation.

3.3.3 Department of Forestry, Fisheries and the Environment Screening Report

In terms of Regulation 16 (1)(b)(v) of the EIA Regulations 2014 (as amended), a Screening Report was generated by the DFFE National Screening Tool on 17 March 2022 and submitted to PASA with the Application for Environmental Authorisation (see Section 3.3.5 below). A copy of the screening report is included in Appendix 5.

The Screening Tool essentially provides site specific information and identifies specific EIA requirements including specialist studies applicable to the proposed site and/or development, based on the national sector classification and the environmental sensitivity of the site.

The related specialist assessments identified by the DFFE Screening Tool and the rationale for why they will or will not be undertaken in the EIA phase is provided in the Site Sensitivity Verification Report in Box 3-1 overleaf.

BOX 3-1: SITE SENSITIVITY VERIFICATION REPORT**1. PURPOSE OF THIS REPORT**

In accordance with the Procedures for the Assessment and Minimum Criteria for Reporting on identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of NEMA, this Site Sensitivity Verification Report has been compiled to provide a rationale for the specialist studies, as identified by the DFFE Screening Tool, that will be undertaken as part of the environmental process.

2. SITE ENVIRONMENTAL SENSITIVITY

The proposed Exploration Right Areas intersect with several themes deemed to have *Very High* or *High* sensitivities:

Theme	Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
Agriculture Theme		X		
Animal Species Theme		X		
Aquatic Biodiversity Theme	X			
Archaeological and Cultural Heritage Theme	X			
Civil Aviation Theme			X	
Defence Theme				X
Palaeontology Theme	X			
Plant Species Theme				X
Terrestrial Biodiversity Theme	X			

3. RATIONALE FOR DFFE IDENTIFIED SPECIALIST STUDIES

The related specialist assessments identified by the DFFE Screening Tool and the rationale for why they will or will not be undertaken in the EIA phases is provided below.

The related specialist assessments identified by the DFFE Screening Tool and the rationale for why they will, or will not be, undertaken in the EIA phase is provided in the Site Sensitivity Verification Report below.

Specialist Assessment Identified by National Screening Tool	Rationale for inclusion/ exclusion
Agriculture Impact Assessment	Excluded Well positioning is based on the assumption that consent from the landowner (farmer) will be obtained and that the well will not be located within any agricultural lands/ crop fields.
Landscape/Visual Impact Assessment	Excluded The visual intrusion onto the landscape is short in duration (less than 3-4 months) and will be rehabilitated thereafter and will leave no remnants of the exploration activities.
Archaeological and Cultural Heritage Assessment	Included Despite the DFFE Screening Tool classifying the Target Areas as having a Low Archaeological and Cultural Heritage Sensitivity, SLR has opted to include an Archaeological and Cultural Heritage Impact Assessment which will be undertaken in accordance with the relevant protocol.
Palaeontology Impact Assessment	Included The DFFE Screening Tool classifies the Target Areas as containing <i>Features with a Very High paleontological sensitivity</i> . A Palaeontology Impact Assessment will be undertaken in accordance with the relevant protocol.
Aquatic Biodiversity Impact Assessment	Included Several water resource and animal species datasets within the Target Areas are classified as <i>Very High</i> or <i>High</i> . The initial sensitivity screening, undertaken during the Well Identification and Permitting phase, has aimed to exclude all such features from the Target Areas. Specialist assessments in terms of the relevant protocols will be undertaken for each well site, as part of the EIA
Terrestrial Biodiversity Impact Assessment	
Animal Species Assessment	
Plant Species Assessment	

Hydrology Assessment	<p>Water resource management is being considered both from a surface water and groundwater perspective:</p> <p>Hydrology - Excluded Surface water risks will be assessed as part of the EIA but a hydrological impact assessment <u>will not</u> be undertaken. The initial sensitivity screening, undertaken during the Well Identification and Permitting phase, excluded all areas within 100 m of mapped hydrological features. Thus, there would be limited risk from the well sites and a specialist assessment is not required.</p> <p>Geohydrology - Included The initial sensitivity screening, undertaken during the Well Identification and Permitting phase, excluded all areas within 100 m of mapped geohydrological resources. Thus, there would be limited risk from the well sites. However, it is anticipated that there will be concerns from land owners and water users, thus a specialist assessment will be undertaken during the EIA phase.</p>
Defence Assessment	<p>Excluded While the Target Areas extend across a military installation, the proposed exploration activities would not pose a risk to the South African National Defence Force (SANDF) infrastructure. The SANDF will be notified as part of the Public Participation Process as outlined below.</p>
Radio Frequency Interference (RFI) Assessment	<p>Excluded Despite the DFFE Screening tool highlighting the need to undertake a RFI assessment, the well drilling is not considered a risk to radio communications.</p>
Noise Impact Assessment	<p>Excluded Operation of the drilling rig will generate noise, however, given the rural/agricultural environment of well sites, it is unlikely that there will be any sensitive noise receptors.</p>
Geotechnical Assessment	<p>Excluded The exploration programme aims to investigate the underlying geological formations and forms part of a geotechnical assessment. No formal structures or infrastructure is to be constructed/developed necessitating an investigation into foundation designs.</p>
Health Impact Assessment	<p>Excluded The proposed drill sites will be located within a rural/agricultural landscape limiting the number of potential receptors of any emissions that may pose a risk to people's health.</p>

3.3.4 Landowner identification

The Applicant appointed a land surveyor to identify all properties (including farms and portions) that are included in the well drilling target areas (see list in Appendix 4). The land surveyor searched the properties against the records held by the Deeds Office to identify the landowner. This resulted in a database of properties and owners (where such information was available in the Deeds Office for the property). The landowner database included private persons, trusts, communal property associations, companies, organs of State and various government departments. The land surveyor subsequently searched the owner records held by the Deeds Office to obtain contact information for each landowner (where such information was available in the Deeds Office for the landowner). The applicant subsequently identified, and continues to do so, the owners of properties where they may potentially drill wells. Through this process further landowner contacts were obtained. SLR was provided with this database.

SLR subsequently identified, and continues to do so, properties adjacent to the properties where Rhino Oil and Gas may potentially drill wells. These properties were searched against the records held by the Deeds Office to identify the landowner and then for contact information for each landowner (where such information was available in the Deeds Office for the landowner).

Property information was not available for every land parcel, owner information was not available for every property and contact information was not available for every landowner. It is acknowledged that it has not been possible to source contact information for all landowners and occupiers within the Target Areas, and thus certain landowners and occupiers have not been directly notified.

The task of identifying and notifying landowners and occupiers will be on-going during the course of the EIA process. Refer to Box 3-1.

3.3.5 Application for Integrated Environmental Authorisation

An “Application Form for Environmental Authorisation” was submitted to PASA on 30 September 2022. PASA correspondence is presented in Appendix 3.1.

3.3.6 Pre-Application Public Participation Process

Although not a legislated requirement of the EIA Regulations 2014, a pre-application public participation process was undertaken. The purpose of which was to notify landowners and other key stakeholders of the proposed project and provided potentially interested and affected parties with an initial opportunity register and to raise any preliminary issues or concerns regarding the proposed project. Steps undertaken during the pre-application public participation process are summarised in Box 3-2 and all supporting information is presented in Appendix 3 to this report.

Comments and questions were received at the information meetings (Appendix 3.6). Approximately 11 written submissions were received from I&APs during the pre-application public participation process (Appendix 3.7). All written comments received have been collated, and responded to, in a Comments and Responses Report (see Appendix 3.8). The key issues identified by the project team, with I&AP input, are summarised in Section 7 of this report.

3.3.7 Compilation of Scoping Report

This Scoping Report has been prepared in compliance with Appendix 2 of the EIA Regulations 2014 (see Table 3-3) and has been informed by comments received during the pre-application Public Participation Process.

This report aims to present all information in a clear and understandable format suitable for easy interpretation by I&APs and authorities and provides an opportunity for I&APs to comment on the proposed project, findings of the public participation process and the scope of work for the next phase of the EIA (see Section 1.7 for details of the comment period).

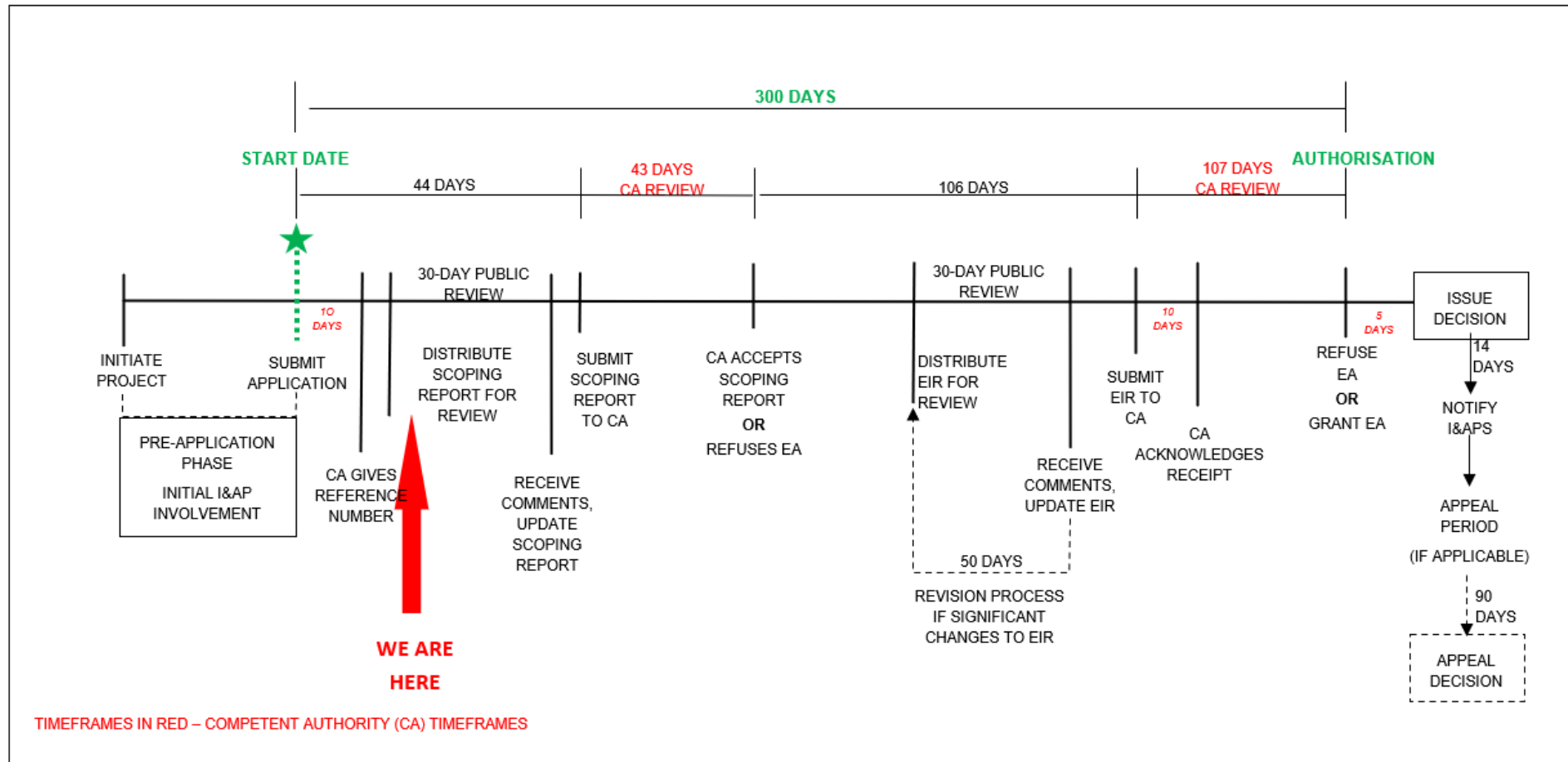


FIGURE 3-1: FLOW DIAGRAM SHOWING THE S&EIA PROCESS

BOX 3-2: TASKS UNDERTAKEN DURING THE PRE-APPLICATION PUBLIC PARTICIPATION PROCESS**• I&AP identification**

In addition to landowners (see below), a preliminary I&AP database of authorities (including State Departments with jurisdiction in the area, municipal offices and ward councillors), Organs of State, Non-Governmental Organisations, Community-based Organisations, adjacent landowners and other key stakeholders with a potential interest in the proposed project has been compiled. A letter and Background Information Document (BID) for the project were sent to all of these parties.

Additional I&APs were added to the database following responses to the advertisements and notification letter and attendees at Public Information Meetings. To date approximately 1 180 I&APs have been registered on the project database (see Appendix 3.2).

• Notification to Land owners

All landowners for whom contact details were obtained (see Section 3.3.4) were notified of the application and S&EIA process by means of a letter and BID which was circulated on 22 August 2022. This was sent via email, post or fax. An SMS was sent to those landowners for whom only a cell number was available. The list of landowners that have been notified of the project is provided in Appendix 3.2.

To date the percentage of landowners in the supplied database (with contacts) who have been sent a notification by SLR is ~ 60-70 % of all landowners in the well drilling target areas, but 100% of the well site property owners were notified.

• Background Information Document (BID)

All identified I&APs were notified of the application for a well drilling ER, the application for Environmental Authorisation and the S&EIA process by means of a BID (see Appendix 3.3 for a copy of the BID). The purpose of the BID was to convey information on the proposed project and environmental regulatory process, as well as to invite I&APs to register on the project database and provide initial comment. The BID was available, in English, SeSotho and Afrikaans at all of the public meetings. I&AP correspondence received during the BID comment period is presented in Appendix 3.7.

• Site notices and advertisements

Press advertisements providing notification of the proposal by Rhino Oil and Gas and the S&EIA process, SLRs contact information and details of the public meetings to be hosted were placed in the Vrystaat Vista on 25 August 2022 in English, Afrikaans and SeSotho (see Appendix 3.4). An additional notification was placed in the Free State Provincial Gazette (No. 57 of 30 September 2022).

A total of 29 site notices, with the same information as the adverts, were placed on 23 - 24 August 2022 in Wesselbron, Odendaalsrus, Allanridge, Kroonstad, and Steynsrus and along major arterial routes within the ER area (see Appendix 3.7):

• Public information sharing meetings

Two public information sharing meeting were held at Wesselbron and Odendaalsrus on 6 and 7 September 2022 respectively. Potential I&APs and the public were notified of the meetings via the advertisements, site notices and BIDs. At each meeting SLR introduced the Scoping and EIA process and Rhino Oil and Gas provided an overview of the well drilling ER application and the proposed programme. Opportunity was provided to stakeholders to raise any issues or concerns. Draft notes from the meetings (including presentation and attendance register) are presented in Appendix 3.8.

Box 3-2 cont.

- **Register of I&APs**

All landowners for whom SLR have contact details are considered as registered I&APs. All identified stakeholders as well as those parties whom attended the public meetings, registered with the project or returned the response sheet are registered as I&APs. The database of registered I&APs will be provided to PASA as Appendix 3.2. The database of registered I&APs will continue to be updated during the course of the Scoping and EIA phases. All registered I&APs will receive all further information regarding the project and the EIA process.

- **Summary of issues raised by I&APs**

The issues and concerns raised by I&APs and regulatory authorities during the Scoping phase to date have been compiled into a Comments and Responses Report (see Appendix 3.6). Also included in the report are responses to the question or issue raised. Table 3-2 provides a summary of the issues and concerns raised by I&APs during the scoping meetings, through completed response forms and direct submission. Also included in the Table are responses to the question or issue raised.

Copies of all written comments received from I&APs are included in Appendix 3.6. Comments continue to be received from I&APs and those received after this report was compiled will be included in the next report.

TABLE 3-2: SUMMARY OF THE ISSUES AND CONCERNS RAISED BY I&APs

Comment summary	Where addressed in the Scoping Report
Where are the proposed well drilling sites located?	<p>Details of the well drilling process are provided in Section 5.4 and Section 5.5 of this report.</p> <p>The location of the wells cannot be defined at this point in time. The location of well drilling sites is subject to a process of geological review, landowner consent and environmental considerations. Areas that are unsuitable are eliminated from further consideration. Rhino Oil and Gas is still currently busy with the well site identification process.</p>
How intrusive will the proposed well drilling be?	<p>The number of wells proposed is relatively small in relation to the overall extent of the proposed Target Areas. Thus, each well is likely to be widely distributed across the large extent of the ER area.</p> <p>For each well site, a typical drill rig and equipment requires an operating area of approximately 2 500 m², with approximately 100 m² forming the central working platform and the balance used for equipment storage, staging and parking. Thus, the overall footprint of each individual well site is also relatively limited in the context of the overall ER area.</p>
What will the effect be on our drinking water sources?	<p>The potential impact of the proposed well drilling activities on freshwater and groundwater resources will be assessed in the EIA Phase.</p> <p>During the drilling operation, the upper sections of the wells would be cased and cemented for stability and to close off the near surface aquifer. Therefore, there is very little opportunity for cross connection between aquifers and changes in water availability are not expected. Furthermore, as the exact location of a drill site is flexible and can be adjusted to accommodate environmental sensitivities,</p>

Comment summary	Where addressed in the Scoping Report
	impacts on the water resources can generally be avoided with the placement of activities outside of areas that are not considered suitable on the basis of the specific water resources on site.
Will there be any jobs for the local inhabitants of the area or will there only be foreign employment.	<p>Exploration work is reliant upon designated skilled contractors and, as a result, employment opportunities outside of these are limited.</p> <p>The proposed project is restricted to the exploration phase where Rhino Oil and Gas carry the financial risks. Apart from the generation of data to inform further exploratory work there is limited financial benefit from this phase. Potential indirect benefits to the local communities are beneficiation through the operation of the logistics base (See Section 5.4.7.3) and lease/rental agreements between Rhino Oil and Gas and the landowner responsible for the target drill sites.</p>

TABLE 3-3: REQUIREMENTS OF A SCOPING REPORT IN TERMS OF THE EIA REGULATIONS 2014

Appendix 2	Content of Scoping Report	Completed (Y/N or N/A)	Location in report
2(a)	<i>(i & ii) Details and expertise of the Environmental Assessment Practitioner (EAP) who prepared the report, including a CV.</i>	Y	Section 3.1, Table 3-1 and Appendix 2
(b)	<i>The location of the activity, including:</i>	Y	Appendix 4.2
	<i>(i) the 21 digit Surveyor General code of each cadastral land parcel; or</i>		
	<i>(ii) where available, the physical address and farm name</i>	N/A	N/A
(c)	<i>A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is:</i>	Y	Figure 1-2 and Appendix 4
	<i>(i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or</i>	N/A	N/A
	<i>(ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.</i>	N/A	N/A
(d)	<i>A description of the scope of the proposed activity, including:</i>	Y	Table 2-1 and Section 5.4
	<i>(i) all listed and specified activities triggered;</i>		
	<i>(ii) a description of the activities to be undertaken, including associated structures and infrastructure.</i>	Y	Table 2-1 and Section 5.4
(e)	<i>A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.</i>	Y	Section 2

Appendix 2	Content of Scoping Report	Completed (Y/N or N/A)	Location in report
(f)	<i>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.</i>	Y	Section 4
(h)	<i>A full description of the process followed to reach the proposed preferred activity, site and location within the site, including:</i>		
	<i>(i) details of all the alternatives considered;</i>	Y	Sections 5.4 & 8
	<i>(ii) details of the public participation process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs;</i>	Y	Section 3.4.3 and Appendix 3
	<i>(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;</i>	Y	Table 3-2
	<i>(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;</i>	Y	Section 6
	<i>(v) the impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated.</i>	Y	Section 7
	<i>(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;</i>	Y	Section 9.3.8
	<i>(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;</i>	Y	Sections 7
	<i>(viii) the possible mitigation measures that could be applied and level of residual risk;</i>	Y	Section 9.6
	<i>(ix) the outcome of the site selection matrix;</i>	Y	Sections 5.5 & 8
	<i>(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and</i>	N/A	Alternatives are considered in Section 5.5
<i>(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity.</i>	Y	Alternatives are considered in Section 5.5	
(i)	<i>A plan of study for undertaking the environmental impact assessment process to be undertaken, including:</i>	Y	Section 9

Appendix 2	Content of Scoping Report	Completed (Y/N or N/A)	Location in report
	(i) a description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity;		
	(ii) a description of the aspects to be assessed as part of the environmental impact assessment process;		
	(iii) aspects to be assessed by specialists;		
	(iv) a description of the proposed method of assessing the environmental aspects, including a description of the proposed method of assessing the environmental aspects including aspects to be assessed by specialists;		
	(v) a description of the proposed method of assessing duration and significance;		
	(vi) an indication of the stages at which the competent authority will be consulted;		
	(vii) particulars of the public participation process that will be conducted during the environmental impact assessment process; and		
	(viii) a description of the tasks that will be undertaken as part of the environmental impact assessment process;		
	(ix) identify suitable measures to avoid, reverse, mitigate or manage identified impacts and to determine the extent of the residual risks that need to be managed and monitored.		
(i)	An undertaking under oath or affirmation by the EAP in relation to:	Y	Appendix 1
	(i) the correctness of the information provided in the report;		
	(ii) the inclusion of comments and inputs from stakeholders and interested and affected parties; and		
	(iii) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;		
(k)	An undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment.	Y	Appendix 1
(l)	Where applicable, any specific information required by the competent authority.	N/A	-
(m)	Any other matter required in terms of Section 24(4)(a) and (b) of the Act.	N/A	-

3.3.8 Completion of the Scoping Phase

The following steps are envisaged for the remainder of the Scoping phase:

-
- After closure of the public comment period, the Scoping Report will be updated to incorporate the comments received. All comments received during the review of this Scoping Report will be assimilated and responded to in an updated Comments and Responses Report; and
 - The updated Scoping Report and all comments will be submitted to PASA/DMRE for their consideration.

If the Scoping Report is accepted, the project will proceed onto the EIA phase (see Section 3.4). A Plan of Study for EIA as required in terms of Section 2(i) of Appendix 2 of the EIA Regulations, 2014 is included in Section 9.

3.4 EIA PHASE

3.4.1 Objectives

In accordance with Appendix 3 of the EIA Regulations, 2014 the key activities of the EIA phase are to:

- Determine the policies and legislation relevant to the activity and document how the proposed activity complies with and responds to the policy and legislative context;
- Describe the need and desirability of the proposed activity in the context of the development footprint on the approved site as contemplated in the accepted Scoping Report;
- 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;
- Assess potential impacts of the proposed project alternatives during the different phases of project development;
- Identify the most ideal location of the activity within the development footprint of the approved site based on the lowest level of environmental sensitivity identified during the assessment;
- Present appropriate mitigation or optimisation measures to avoid, manage or mitigate potential impacts or enhance potential benefits, respectively;
- Identify residual risks that need to be managed and monitored; and
- Provide a reasonable opportunity for I&APs to be involved in the EIA process.

Through the above, ensure informed, transparent and accountable decision-making by the relevant authorities.

3.4.2 Specialist Studies

Four (4) specialist studies will be commissioned to address the key issues that require further investigation and detailed assessment (refer to Section 9), namely an Aquatic Ecology (including wetlands), Terrestrial Ecology, Geohydrology and Cultural Heritage. The specialist scopes will be focussed on proposed well site locations and outputs will be used to inform micro-siting of well sites (refer to Section 5.9.1).

The specialist studies will involve the gathering of data (desktop and site visit(s)) relevant to identifying and assessing environmental impacts that may occur as a result of the proposed project. These impacts will

then be assessed according to pre-defined rating scales (see Section 9.3.8). Specialists will also recommend appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively.

The terms of reference for the proposed specialist studies are presented in Section 9.3.

3.4.3 Landowner and Stakeholder notification

Rhino Oil and Gas and SLR will continue to source contact information for and notify landowners and potential I&APs of the well drilling ER application and the S&EIA process.

The methods that are employed to identify additional landowners and the percentage of land owners notified that is achieved will be reported on in the EIA Report.

3.4.4 Integration and Assessment

Relevant information will be integrated into the EIAR, which will include an Environmental Management Programme (EMPr). Refer to the Plan of Study in Section 9 for details on the impact assessment tasks and methodology.

The EIAR will be released for a 30-day comment period and all I&APs on the project database will be notified when the EIAR is available for comment.

3.4.5 Completion of the EIA Phase

After closure of the comment period, all comments received on the EIAR will be incorporated and responded to in a Comments and Responses Report. The EIAR will then be updated to a final report, which will include the Comments and Responses Report, and will be submitted to PASA for consideration and decision-making.

After the DMRE has reached a decision, and PASA has advised the EAP of the decision, all I&APs registered on the project database will be notified of the outcome of the application and the reasons for the decision.

A statutory appeal period in terms of the National Appeal Regulations, 2014 (GN No. R993) will follow the issuing of the decision. In terms of Regulation 4(1)(a), an appellant must submit an appeal to the appeal administrator, and a copy of the appeal to the applicant, any registered I&AP and any organ of state with interest in the matter within 20 days from the date that the notification of the decision for an application for an Integrated Environmental Authorisation was sent to the registered I&APs by the applicant.

4. NEED AND DESIRABILITY

This chapter provides an overview of the "need and desirability" of the proposed project, and essentially considers the strategic context of a project proposal within broader societal needs and the public interest.

The DFFE guideline on need and desirability (GN No. R891 of 20 October 2017) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. The guideline further notes that at a project level (as part of an EIA process), the need and desirability of the project should take into consideration the content of regional and local plans, frameworks and strategies.

4.1 SOUTH AFRICA'S NEED FOR GAS

South Africa's National Development Plan 2030 particularly recognises 'Constructing infrastructure to import liquefied natural gas and increasing exploration to find domestic gas feedstock' as one of eight key national 'infrastructure investments [which] should be prioritised'.

This imperative is underpinned by multiple analyses¹ of South Africa's pathway of sustainable development, which recognise the extensive and important role of gas in delivering to the economic, social and environmental triple-bottom-line. It is worth briefly recalling some of the key potential contributions of gas in the South African context (though a thorough exposition is not the purpose of this document):

- **Reliable energy:** gas is an abundant resource with dependable availability, which can be managed and utilised at scale with relative ease and flexibility.
- **Enablement of renewable electricity:** gas-to-electricity can form the requisite foundation of robust reserve, reactive backup, and grid stabilisation needed by intermittent renewables.
- **Reduced emissions:** Gas and LNG would directly offset coal and diesel in power and industry sectors. Burning gas releases less CO² per unit energy and much fewer particulates.
- **Increased efficiency:** investment in modern efficient gas-fired plant would lead to much more efficient fuel usage, especially compared to legacy South African coal-fired plants

¹ See, *inter alia*:

Gas Master Plan 2022, Base Case Report, Stakeholder Consultation, September 2021, Dept of Mineral Resources & Energy

The Role of Gas in South Africa's Path to Net-Zero, Just Transition & Climate Pathways Study for South Africa, NBI

Decarbonising South Africa's Power System, Just Transition and Climate Pathways Study for South Africa, NBI, August 2021

Annual Report of the Industrial Gas users Association – Southern Africa 2021

National Development Plan: Vision for 2030, South African Government

Integrated Resource Plan, IRP 2019 Department: Energy, Republic of South Africa

Feasibility Study for the LNG Importation and Gas-to-Power Project, Delphos International Ltd, November 2019

LNG Importation: Evaluating the risks, Western Cape Department of Economic Development and Tourism, PWC, June 2016

South Africa Hydrogen Valley, Final Report, Science & Innovation Department, Republic of South Africa, October 2021

Hydrogen society roadmap for South Africa 2021, Science & Innovation Department, Republic of South Africa, February 2022

- **Broad based economic growth:** reliable energy and power would act as an economic multiplier and underpin greater efficiency, economic activity and job creation across all sectors²
- **Economic independence:** avoid dependency on imported energy supplies (e.g., methane or hydrogen / ammonia) that are likely to dominate the fuel mix in low-carbon power generation in the coming decades.

4.1.1 Domestic vs Imported Gas

Furthermore, there would be significant advantages for South Africa if such gas can be found and produced domestically rather than imported via pipelines or as LNG. Domestic gas production would yield tax and royalty receipts while also avoiding imports and therefore a debit on the balance of payments, providing economic insulation against foreign currency fluctuations. Substantial gas projects are likely to attract foreign investment and trigger follow-on investment in infrastructure, skills development and local support services. Improving energy independence for South Africa is a key strategic consideration, especially if gas-to-electricity enables and underpins the high-potential renewable electricity sector. Such independence would also cushion shocks to domestic gas prices as international LNG prices vary with global conditions. Hence, the NDP sets out in Action 16: ‘...If gas reserves are proven and environmental concerns alleviated, then development of these resources and gas-to-power projects should be fast-tracked.’

4.1.2 Project Proximity to Gas Need

Much of South Africa’s current gas demand is located within and around the Gauteng province, including Sasolburg, which is fed by the ROMPCO pipeline from Mozambican gas fields Pande and Temane. The production of these fields has reached decline with cessation of production expected within several years. Replacing this gas supply with imported LNG trucked from the coast, or building new gas trunk pipelines, or re-supplying ROMPCO would all come with enormous challenges. This project seeks to explore for gas in regional proximity to the demand, specifically in the Free State. Any discoveries would not only supply this critical latent demand but would be well placed to further supply other strategically important plants. 28 GW of South Africa’s 45 GW baseload power fleet is located in the region, as is Sasol’s CTL plant; offsetting old coal-driven plants with gas would have advantageous environmental benefits including significant reductions in CO₂ emissions³, acid mine drainage and surface water contamination, mining-related health hazards, and particulate pollution.

4.1.3 Local Economic Benefits

The geographical synergies extend beyond infrastructure, much of which has been developed to support mining activities, to the skills sets of the people and service providers who have historically been employed

² KPMG estimate each R1M of gas sales could add R1.3M to the South African economy, and directly or indirectly create 4 jobs [Onshore benefits report, KPMG, 2016, for Rhino Oil and Gas Exploration South Africa]

³ Bituminous coal releases 93 KgCO₂/mmbtu combusted, around twice as much as methane which releases 53 KgCO₂/mmbtu. The relative efficiency of new-build CCGT (55-60% HHV) versus old South African coal plants (~34%) means coal-to-gas switching could reduce related CO₂ emissions by two-thirds from 930-990 tCO₂/MWh to 300-330 tCO₂/MWh [https://www.eia.gov/environment/emissions/co2_vol_mass.php; <https://fffcarbon.co.za/conferences/2016/IPP/Falcon-Rosemary.pdf>]

in that sector. Gas developments in the Free State would re-invigorate local business and spur employment. It is envisioned that most of the work to be carried out in the proposed activity will be contracted to local suppliers, since they are likely to be the most locally experienced, flexible and efficient bidders, and therefore most cost-effective options. Whilst initially this is likely to have a relatively modest impact, the resource which could potentially be unlocked from this activity could have a very significant long-term impact on the economic prospects of the region and South Africa as a whole.

4.1.4 Project Environmental Context – Greenhouse Gases

The proposed activity is an investigation into the relatively new field of biogeochemistry – the study of the ongoing generation of biogenic methane in geological formations by archaea at geographical scale – not shale gas, coal seam gas, or any other gaseous fossil fuel. The biogenic gas is understood to be produced by archaea metabolising modern organic matter, with the gas leaking to the atmosphere from natural fissures and other geological features. The following image shows increased atmospheric concentrations of methane above the areas of geologic interest.

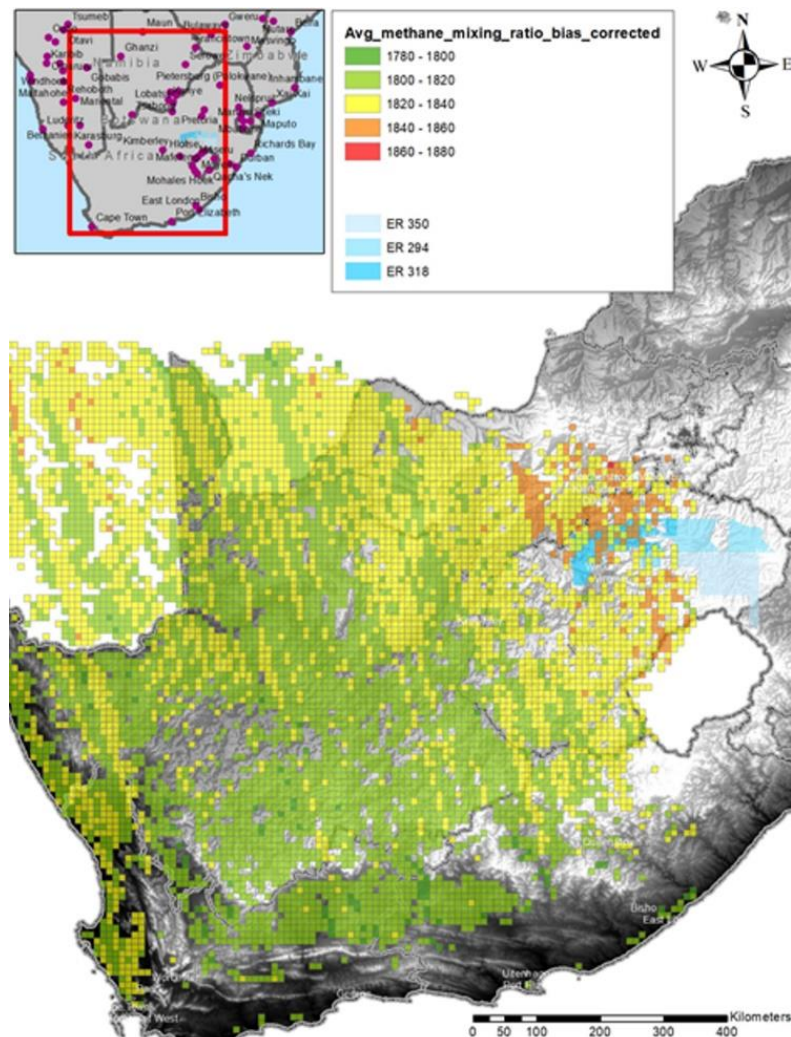


FIGURE 4-1: ATMOSPHERIC METHANE CONCENTRATIONS OVER SOUTH AFRICA

Source: ESA Sentinel 5P satellite, 17th January 2021

Methane is 25x more potent than CO₂ as a greenhouse gas over a 100-year period, and up to 80x over a 20-year period⁴, so simply capturing and combusting leaking biogenic gas would reduce the associated greenhouse gas liability by a factor of respectively nine-fold and thirty-fold⁵. If such combustion was instead utilised to displace fuels more commonly used in South Africa such as coal or diesel, the greenhouse gas liability could reduce another two- to three-fold. To put this in more tangible terms, each kilogram of methane captured and combusted for power generation, offsetting current coal-fired power generation, would release approx. 3 kilograms of CO₂e, whereas the status quo releases approx. 36 or 89 kilograms of CO₂e⁶. Instead, replacing the coal-fired generation with renewables and continuing to allow the methane to leak would release approx. 25 or 80 kilograms of CO₂e.

4.1.5 Project Environmental Context – Local

Hence, a key difference between the proposed project and domestic gas as considered in the NDP is the NDP considers potential reserves of shale and coal seam gas, and therefore caveats the benefit by the then-ongoing environmental impact investigations into shale gas production techniques – particularly hydraulic fracturing or “fracking”. Hydraulic fracturing of shales does not apply to the proposed project, which is centred on understanding the naturally fissured geology, and biogenic gas production, pooling and migration pathways.

The area of interest for the project is predominantly sparsely populated farmland, and our proposed drilling activity is limited to open farmland and away from water sources. We have engaged closely with the Free State Farming Union to represent farming interests as we have developed our proposals, and we appreciate their expressed support. The farmers would be generally familiar with the proposed activity as it analogous to the drilling of water wells, and we continue to engage with the communities to ensure continued informed consent. In fact, the improved understanding of local geology and especially water tables could be of material benefit to farmers and landowners.

The exploration of gas is a well-regulated activity, and with strict compliance, local engagement and due care and thought, much of the benefits and desirability of the activity can be realised and the risks and disruptions minimised.

In addition to gas, the exploration activity would also test for possible helium reserves. This high-value strategic resource is in high global demand, and discovery of material reserves could further add to the strategic and economic advantages of this project to South Africa.

4.2 GAS MASTER PLAN 2022

To highlight the alignment of the proposed Project with the overall objectives of the Government of South Africa, and to contextualise and emphasise the value of the proposed exploration activities, this section

⁴ <https://climate.mit.edu/ask-mit/why-do-we-compare-methane-carbon-dioxide-over-100-year-timeframe-are-we-underrating>

⁵ Combustion of 1kg of methane (CH₄) in air produces 2.75kg of CO₂

⁶ Depending on period used to determine CO₂e potency of methane (100 years or 20 years): 1 kilogram of methane to atmosphere = 25 or 80 kilograms of CO₂e; coal-fired power generator = approx. 9 kilograms of CO₂e for equivalent electricity production

considers certain extracts from the Gas Master Plan 2022 (Sept 2021, Department of Mineral Resources and Energy).

Background:

“The economy of South Africa can capture real benefit from developing natural gas resources, generating employment (directly and indirectly), increasing GDP (directly and indirectly), increasing foreign direct investments and with potential future exports, increase the inflow of foreign currency, stemming both from the extraction and utilization of natural gas.”

“The National Development Plan (NDP) envisions that by 2030 South Africa will have an energy sector that promotes economic growth and development through adequate investment in energy infrastructure. At just 2.6% of the country’s total energy mix, South Africa’s natural gas market is small, but with all its inherent benefits, it has the potential to completely change the economy by stimulating economic growth and development, stability, and job creation. The meaningful addition of natural gas to the country’s energy mix will rejuvenate an overburdened, out-dated energy infrastructure and reduce cyclical energy shortfalls. Perhaps even more importantly, it will stimulate the economy by allowing business and industry to lower their energy and operational spend while also creating significant numbers of new jobs and skills development opportunities. Considering that nearly 90% of South Africa’s existing natural gas demand is supplied by a single entity, namely Sasol Gas, the associated economic and employment risks of limited supply options, development and sourcing of alternative natural gas resources are high.”

“It is imperative to ensure economic and employment stability within the natural gas sector by introducing more suppliers. Southern Africa’s gas potential has been revealed by major discoveries that, when developed, widen options for greater regional energy trade. South Africa’s unconventional gas potential remains to be quantified but raises the prospect of possible domestic production in the longer term. Globally the natural gas industry has moved into a supply surplus, favouring a larger role for gas as a clean fossil fuel in many countries’ energy policies. A challenge in developing the gas sector is to bring gas demand and supply on stream at the same time and spread geographically to stimulate broader localized demand through South Africa. Without such localized gas demand, it is difficult to develop distributed gas supply and without such distributed gas supply it is difficult to develop localized gas demand. One way of breaking this impasse is to create significant “anchor” gas demand through the development of a gas-to-power programme. In pursuit of adding generating capacity, lowering carbon emissions, enhancing energy security and supporting industrial development, South Africa has taken the first steps in a gas-to-power programme to be executed under the Integrated Resource Plan 2019, aiming to increase the national energy mix natural gas contribution from 2.6% to 15.7% by 2030.”

The global gas supply/demand balance has changed significantly since the date of the publication of the Gas Master Plan as a result of the Russia/Ukraine conflict, with several implications on the global gas market. Such volatility in gas market dynamics highlights the importance of diversified supply options, whether from a large-scale offshore gas development, importation via pipeline, LNG regasification or onshore domestic gas production close to a major demand centre.

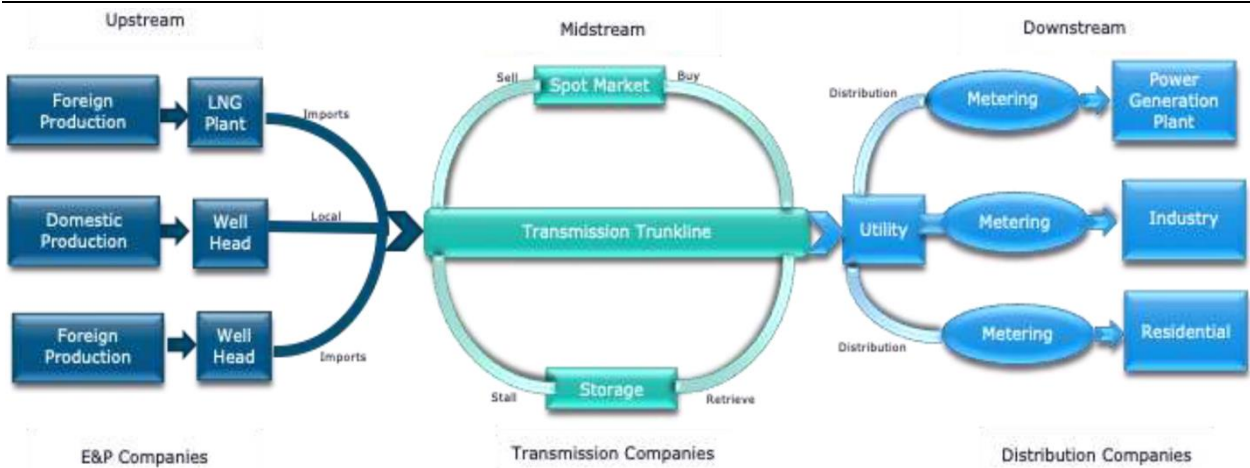


FIGURE 4-2: GAS VALUE CHAIN: NATURAL GAS BUSINESS

Source: Gas Master Plan 2022, Base Case Report, September 2021.

The current South African natural gas value chain structure, and associated dominant players, is depicted below. Tetra4 CNG production is noted as a domestic supply source and immediately neighbours the proposed Project.

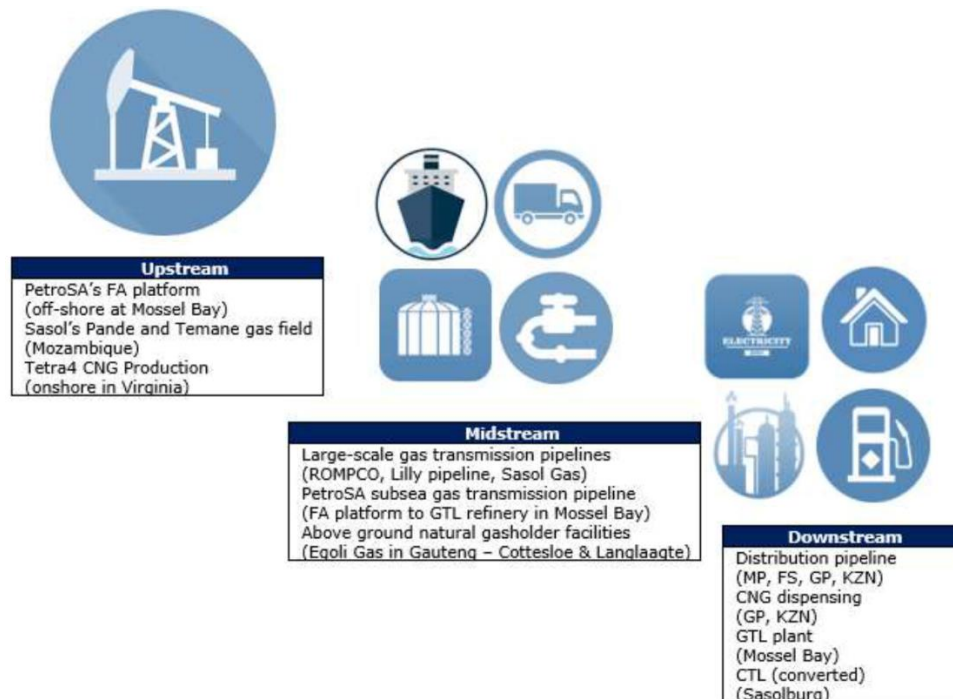


FIGURE 4-3: SOUTH AFRICAN NATURAL GAS VALUE CHAIN STRUCTURE

Source: Gas Master Plan 2022, Base Case Report, September 2021. Figure 3-2: South African Natural Gas Value Chain

4.2.1 Domestic Gas Reserves and Resources

“Ten countries hold more than two-thirds of the world’s total proven natural gas reserves according to the latest publications by US EIA, OPEC and BP. Although South Africa does not currently feature on any of the published proven natural gas reserve lists, the country has the potential to rank amongst the top 30 countries, provided the initial gas estimates, specifically unconventional natural gas reserves, hold true (BP Statistical Review of World Energy, 2020) (EIA, 2019) (OPEC, 2019). South Africa has several natural gas opportunities for local natural gas production, either from conventional (onshore/offshore) or unconventional (shale gas/coal bed methane) sources. Refer to Figure 4-4f or a simplified graphical representation of the domestic gas fields and their quantified reserve volumes.”

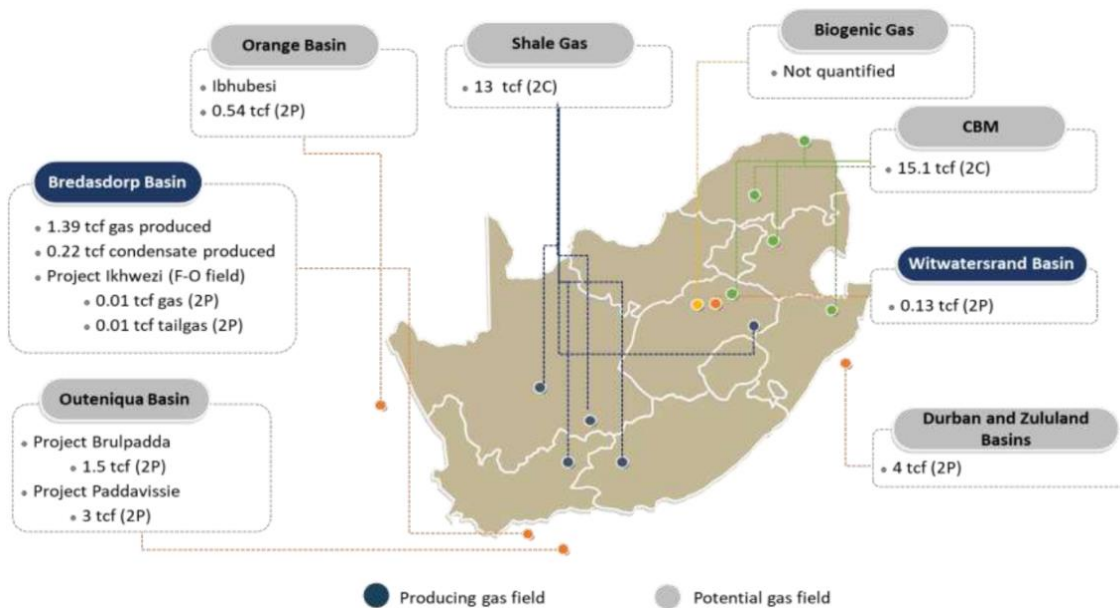


FIGURE 4-4: DOMESTIC GAS RESERVES

Source: Gas Master Plan 2022, Base Case Report, September 2021.

“Gas encountered within the coal-bearing Karoo strata in the region is believed to have migrated from the underlying Witwatersrand Basin, which is biogenic in origin and is thus constantly replenished. Given the unusual nature of this unconventional biogenic play, the volume of technically recoverable gas resource has not yet been quantified.”

The above extract from the Gas Master Plan 2022 recognises the potential scale of South African Biogenic Gas production has not yet been quantified, and the role this resource could play in alleviating the tight domestic gas supply balance it not yet well understood. The Project proposes to contribute to that understanding by conducting exploration activities over a significant geography to determine the Biogenic Gas volume in place, the replenishment and leakage rates, and hence how much is potentially recoverable.

4.2.2 Contribution to the Power Sector:

“More than 90% of South Africa’s electricity is generated from coal and it is anticipated to remain the main fuel source for power generation. Power generation has been clearly identified as the priority sector for gas utilisation in the draft IEP and approved IRP2019, aiming to increase the national energy mix’s natural gas contribution from 2.6% to 15.7% by 2030 (Department of Energy, 2019). The existing Open Cycle Gas Turbine (OCGT) peaking plants present an ideal opportunity for conversion to natural gas, with the potential to realize substantial cost savings of more than 30% from fuel source perspective. Nationally, there are six OCGT plants currently utilising diesel as fuel source. These OCGT plants, with a combined installed capacity of nearly 4 GW, could be powered by natural gas and potentially be converted to closed cycle operations, presenting both a cheaper and cleaner source of energy with potentially higher energy output. Further opportunities exist in converting mothballed coal fired power plants to run on natural gas. This opportunity will save substantial time and capital expenditure when compared with building new generation facilities and present the opportunity of recovering previously lost jobs when facilities were closed. The power sector presents an immediate source of secure and growing natural gas demand, with attractive margins at low-risk as existing OCGT plants are ready to convert to Combined Cycle Gas Turbine (CCGT) plants, in addition to new gas-based thermal plants at various stages of development.”

“The National Development Plan (NDP) identifies natural gas as a viable alternative to coal. The NDP further provides as one of the infrastructure priorities the construction of infrastructure to import LNG and increasing exploration to find domestic gas feedstock. Conventional and unconventional natural gas should play a more prominent role in South Africa’s future energy mix, both in the electricity sector and in the liquid fuel sector (National Planning Commission, 2012). In support of the vision for the South Africa gas programme, the Department of Mineral Resources and Energy has started developing, through its Independent Power Producer Office (IPPO), a gas-to-power IPP procurement programme. This programme will serve as an anchor for the gas market infrastructure development in South Africa. Furthermore, the RMIPPPP could serve as a catalyst for early LNG development. The introduction of large-scale gas in the South African economy will lower the country’s carbon emissions, not just from electricity generation but also from other energy sectors, including the transport sector.”

4.2.3 USE OF NATURAL GAS

Petroleum (oil and gas) products have a wide range of uses (e.g. energy, road building, chemical, plastic and synthetic material manufacture) and remain a key source of energy across the globe. They are produced from the refining of oil and gas extracted from beneath the earth’s surface.

In this exploration project the primary target is natural gas, although other petroleum products cannot be discounted. Natural gas is a fossil fuel which comprises mostly methane. It is used globally as a source of energy for heating, cooking, electricity generation and vehicles. It is also used in the manufacturing of plastics and other commercially important chemicals. Once extracted, gas can be contained, transported and safely used in many applications. The type of downstream use is entirely dependent on the commercial scale of the resource.

The fastest growing sector for the use of natural gas is for the generation of electric power (Union of Concerned Scientists). Natural gas power plants usually generate electricity in gas turbines, directly using the hot exhaust gases from the combustion of the gas. 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. When burnt, natural gas emits 30% and 45% less carbon dioxide than burning oil and coal, respectively. Burning natural gas also releases lower amounts of nitrogen oxides, sulphur dioxide, particulates and mercury when compared to coal and oil. However, some research shows that over an extended time period, comparing the greenhouse gas (GHG) emission of methane from gas, to carbon dioxide emissions, that both shale gas and conventional natural gas have a larger GHG footprint, than do coal or oil for any possible use of natural gas (Howarth 2014). This is because of losses of methane (with a high global warming potential) to atmosphere along the production chain).

As economic growth is dependent on the availability of energy, ensuring a sustainable and reliable supply of electricity with sufficient capacity is a key aspect to growing the economy of South Africa in the future. The electricity shortages experienced in South Africa over the past decade were a contributing factor to the significant slowdown in economic growth rate. To enable economic growth within the target rate of between 6% and 8% (Accelerated and Shared Growth Initiative, 2004) to be achieved, it will be necessary for Government to continue increasing electricity generating capacity in the country.

The use of natural gas for electricity generation is identified in national policy, together with renewable energy technologies, as an alternative in diversifying the domestic energy supply away from its current reliance on coal. 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, Carter-Brown, Wright & Zinaman, 2016). Gas is identified in the Integrated Resources Plan (October 2019) as significant contributor to South Africa's energy mix in the period up to 2030. According to the Plan, gas fired power generation should account for 8.1% of installed generation capacity, requiring 3 000 MW of new generation capacity. The feasibility of using natural gas for domestic power generation is considered to be dependent on the extent of available domestic reserves of natural gas, as well as the financial cost of importing natural gas should those reserves be insufficient.

Domestic resources are limited to gas fields close offshore of Mossel Bay (F-A field), which are in decline. Other proven offshore reserves include the Ibhuesi 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. Presently, gas is imported to South Africa through the Republic of Mozambique Pipeline Company (ROMPCO) pipeline from Mozambique. This gas is mostly used for chemical processes in Sasol's coal-to-liquid (CTL) process in Secunda (Bischof-Niemz, Carter-Brown, Wright, & Zinaman, 2016). In Johannesburg, Egoli Gas supplies industry and households in some suburbs with reticulated natural gas that is sourced from Sasol.

Identification and use of domestic natural gas reserves could enable South Africa to take steps to secure the country's 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 consistent with the Integrated Resource Plan (IRP) (2019).

4.3 NATIONAL POLICY AND PLANNING FRAMEWORK

This section aims to provide an overview of the national and regional policy and planning context relating to the promotion of development in general within South Africa, developing the energy sector (with specific reference to natural gas and renewable energy) and response to climate change. Further details on the need and desirability of the project, with consideration of relevant National policy documents, will be provided in the EIA Report.

4.3.1 White Paper on the Energy Policy of the Republic of South Africa (1998)

The White Paper on the Energy Policy (1998) is the overarching policy document which guides future policy and planning in the energy sector. The policy objectives include the stimulation of economic development, management of energy related environmental and health impacts and diversification of the country's energy supply to ensure energy security.

The paper 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. Before the development of the country's oil and gas resources can take place, there is a need to undertake exploration activities to determine their extent and the feasibility of utilising these resources for production.

4.3.2 White Paper on the Renewable Energy Policy (2003)

The White Paper on Renewable Energy supplements the White Paper on Energy Policy (described above) and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. The paper is based on the integrated resource planning criterion of "ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options". The White Paper affirms Government's commitment to develop a framework within which the renewable energy industry can operate, grow, and contribute positively to the South African economy and to the global environment.

The White Paper indicated that due to the limited availability of domestic gas reserves, gas was unlikely to form any major component of primary energy supply over any extended period when compared with coal, even though natural gas is considered to be a "cleaner fuel" in comparison with coal and oil. The IRP (2019) indicates a bigger contribution from gas, due presumably to the significant gas discoveries in Mozambique.

4.3.3 National Gas Infrastructure Plan (2005)

The National Gas Infrastructure Plan is Government's strategy for the development of the natural gas industry in South Africa so as to meet the energy policy objectives set out in the White Paper on Energy Policy (1998). The plan sets out the outlook for gas consumption and production globally and within South Africa and aims to articulate Government's broad policy and development aims. The plan outlines four main phases of gas infrastructure development (each with sub-phases) and following the completion of these projects, it is envisaged that there will be a fully integrated network linking the major economic centres to the upstream supplies of gas.

4.3.4 New Growth Path (2011)

The New Growth Path (NGP) reflects the commitment of Government to prioritise employment creation in all economic policies and sets out the key drivers and sectors for employment which will be the focus of Government. These focus sectors are infrastructure, agriculture, mining, manufacturing, tourism and the green economy.

The NGP targeted 300 000 additional direct jobs within the green economy sector by 2020, with 80 000 in manufacturing and the rest in construction, operations and maintenance of new environmentally friendly infrastructure. The potential for job creation rises to well over 400 000 by 2030. The additional jobs are envisaged to be created by expanding the existing public employment schemes to protect the environment and the production of biofuels. The NGP notes that renewable energy provides new opportunities for investment and employment in manufacturing new energy technologies as well as in construction.

The NGP further identifies the need to develop macroeconomic strategies and microeconomic measures to achieve sustainable expansion of work opportunities and output. The NGP states that one microeconomic measure is South Africa being the driving force behind the development of regional energy, transport and telecommunications infrastructure. Priorities in this regard include strengthening the regional integration of energy by undertaking urgent improvements in electricity interconnectors, and exploring other opportunities for enhancing clean energy across central and southern Africa, including natural gas.

4.3.5 National Development Plan 2030 (2013)

The National Development Plan (NDP) 2030 provides the context for all growth in South Africa, with the overarching aim of eradicating poverty and inequality between people in South Africa through the promotion of development. The NDP provides a broad strategic framework, setting out an overarching approach to confronting poverty and inequality based on the six focused and interlinked priorities. One of the key priorities is "faster and more inclusive economic growth". To transform the economy and create sustainable expansion for job creation, an average economic growth exceeding 5% per annum is required. The NDP supports transformation of the economy through changing patterns of ownership and control.

Meeting the development initiatives goals represent a challenge, as the NDP emphasises, at the same time, the need to:

-
- protect the natural environment;
 - enhance the resilience of people and the economy to climate change;
 - reduce carbon emissions in line with international commitments;
 - make significant strides toward becoming a zero-waste economy; and
 - reduce greenhouse gas emissions and improve energy efficiency.

The NDP makes numerous mentions of the need to act responsibly to mitigate the effects of climate change. Diversification of the energy mix away from fossil fuels will be key as energy generation makes up 48% of South Africa's GHG emissions. The NDP indicates that *"the country will explore the use of natural gas as a less carbon intensive transitional fuel"* and that there is a requirement for *"increasing exploration to find domestic gas feedstock... to diversify the energy mix and reduce carbon emissions"*. Thus, the ongoing exploration of local natural gas reserves is a key action required to ensure that natural gas is a viable transitional fuel for use in the national electricity generation mix.

4.3.6 National Climate Change Response White Paper (2014)

The National Climate Change Response Paper presents the South African Government's vision for an effective climate change response and the long-term, just transition to a climate-resilient and lower-carbon economy and society. South Africa's response to climate change has two objectives:

- Effectively manage inevitable climate change impacts through interventions that build and sustain South Africa's social, economic and environmental resilience and emergency response capacity.
- Make a fair contribution to the global effort to stabilise greenhouse gas (GHG) concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe that enables economic, social and environmental development to proceed in a sustainable manner.

The Paper acknowledges that South Africa has relatively high emissions for an emerging economy. The energy intensity of the South African economy, largely due to the significance of mining and minerals processing in the economy and the coal-intensive energy system, means that South Africa is a significant emitter of GHGs. The majority of South Africa's energy emissions arise from electricity generation.

The Paper sets out South Africa's overall response strategy through strategic priorities, leading to a series of adaptation, mitigation, response measures and priority flagship programmes. Policy decisions on new infrastructure investments must consider climate change impacts to avoid the lock-in of emissions intensive technologies into the future. In the medium-term, the Paper indicates that a mitigation option with the biggest potential includes a shift to lower-carbon electricity generation options. The Renewable Energy Flagship Programme is identified as possible driver for the deployment of renewable energy technologies. Renewable energy and not fossil fuel gas is ultimately recommended for climate change mitigation.

4.3.7 Paris Agreement - United Nations Framework Convention on Climate Change (2015)

The Paris Agreement is an international agreement / treaty, in terms of the UNFCCC, on climate change, which was adopted in 2015. It addresses mitigation, adaptation and finance and was adopted at the 2015

United Nations Climate Change Conference (CoP21), which was held in Le Bourget near Paris, France. The Paris Agreement was opened for signature on 22 April 2016. The agreement aims to improve upon and replace the Kyoto Protocol by committing countries to keeping the long-term rise of global temperatures below 2°C, above pre-industrial levels, and to pursue efforts to limit the increase to 1.5°C, thereby recognising that this would substantially reduce the risks and impacts of climate change.

South Africa signed the Paris Agreement and submitted its pledge in 2016. The pledge is also known as the 'Nationally Determined Contribution' or NDC. According to the pledge, South Africa adopted a 'peak, plateau and decline' approach, whereby it is anticipated the greenhouse gas emissions will peak by 2025, plateau for a decade and then start to decline. By signing the agreement, countries are required to adopt the conditions of the agreement into their own legal systems through ratification, acceptance, approval, or accession. The agreement will become enforceable when ratified / approved by at least 55 countries, which together account for at least 55 % of the global greenhouse gas emissions.

4.3.8 Integrated Energy Plan (2016)

The Integrated Energy Plan (IEP) (2016) considers how current and future energy needs can be addressed. The plan considers 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.

The IEP states that given South Africa is a net importer of oil, the liquid fuels industry and its economy is vulnerable to fluctuations in the global oil market. Current natural gas consumption exceeds production, with the majority of demand being met through imports from Mozambique.

The plan states that the use of natural gas as an alternative electricity generator must be considered in moderation due to limited proven reserves, but that it has significant potential both for power generation, as well as direct thermal uses. The use of natural gas for power generation is considered as an option to assist South Africa to move towards a low carbon future given that natural gas has a lower carbon content than coal.

The role of renewable energy to deliver the intended policy benefits of improved energy security and reduced greenhouse gas emissions is also acknowledged in the plan. The availability of untapped renewable energy resources within the country is highlighted. DoE has implemented the RE IPPs procurement process to increase the share of renewable energy technologies in the energy mix but, due to the intermittent nature of renewable energy systems and the variability in electricity load requirements, storage remains the most important challenge to the widespread use of renewable energy. Thus, the IEP notes the need to incorporate fossil fuels and nuclear power to ensure that there is both sufficient base-load electricity generating power to meet the minimum needs and peak-load power to meet the needs during peak periods.

4.3.9 Strategic Environmental Assessment for Shale Gas Development (2017)

The South African government commissioned a Strategic Environmental Assessment (SEA) for Shale Gas Development in the Central Karoo in order to provide an initial scientific assessment of the potential trade-offs between economic opportunity and environmental protection that the development of a medium to large shale gas resource might require. The key objective of the scientific assessment was to provide society with an evidence base, at a strategic level, which will assist South Africa in developing a better understanding of the risks and opportunities associated with Shale Gas Development. The SEA includes 18 chapters of scientific assessment that were drafted and peer reviewed by many authors and experts. The SEA considered three hypothetical development scenarios with the spatial context of the Karoo. The full report is publicly available at <http://seasgd.csir.co.za/scientific-assessment-chapters/>. The “Summary for Policy Makers” chapter provides an overview of the scientific report. The SEA also considers the risks of drilling within the development scenarios.

The SEA for Shale Gas Development in South Africa (CSIR) indicates that “Including more natural gas in South Africa’s energy mix would make the energy system more efficient, cheaper and more reliable. Natural gas, regardless of its source, has a desirable set of qualities that coal and oil do not possess. Gas can be used in almost all subsectors (e.g. power generation, heat, transport, manufacture of chemicals); is easily transported once gas infrastructure is in place; is supported by a growing international market; is a more consistent fuel than coal (thus more flexible and easier to handle); is less CO₂ intensive when burnt than coal (if leakage during production and transport is minimised); can be more efficiently used for power generation (more kWh per GJ); has high operational flexibility; and has an end-use cost structure that is capital- light and fuel-intensive, making it economically flexible” (Summary for Policy Makers, 2017).

4.3.10 Integrated Resources Plan (2019)

The Integrated Resource Plan, 2019 was gazetted in October 2019. The National Development Plan envisages that, by 2030, South Africa will have an energy sector that provides reliable and efficient energy service at competitive rates, is socially equitable through expanded access to energy at affordable tariffs and environmentally sustainable through reduced pollution. The IRP provides a path to meet electricity needs over a 20-year planning horizon to 2030 and will be used to roll out electricity infrastructure development in line with Ministerial Determinations. The plan aims to balance a number of objectives, namely to ensure security of supply, to minimise cost of electricity, to minimise negative environmental impact (emissions) and to minimise water usage.

Gas is documented in the Integrated Resources Plan (2019) as a low gas utilization scenario due to constraints on gas availability. According to the IRP, gas fired power generation should account for 8.1% of installed generation capacity in the period up to 2030, requiring 3 000 MW of new generation capacity and the conversion of diesel-fired plants to gas. The IRP notes that unconstrained gas would be a ‘no regret option’ as the power system calls for additional gas volumes if there were no constraints.

4.3.11 South African Economic Reconstruction and Recovery Plan (2020)

South African Economic Reconstruction and Recovery Plan's interventions are in pursuit of the National Development Plan goals of reducing unemployment, poverty and inequality. This document sets out a reconstruction and recovery plan for the South African economy that is aimed at stimulating equitable and inclusive growth. For the past decade, the South African economy has experienced stagnation which has put a strain in the effort to tackle the historical structural inequalities, unemployment and poverty. There is consensus that there needs to be substantial structural change in the economy that would unlock growth and allow for development. Government's conviction is that South Africa has to massively mobilise all its resources and efforts in economic activities to put the economy in a sustainable recovery trajectory. The Covid-19 pandemic deepened the economic crisis in South Africa with many people losing their jobs. As a result, inequality is expected to widen and poverty to deepen.

One of the priority intervention areas is Energy Security, which is critical for the maintenance of a stable economy and is also important in ensuring growth. Specific interventions in the energy sector include creating and securing additional supply, including gas, and finalising the Petroleum Resources Development Bill and related fiscal measures to enable Upstream Sector Investments.

The proposed project could support meeting this priority intervention in Energy Security, through the ongoing exploration to determine the nature and extent of potentially viable offshore resources, which could include gas finds.

4.3.12 South Africa's Low-Emission Development Strategy (SA-LEDS) 2050 (2020)

South Africa's Low-Emission Development Strategy (SA-LEDS) was prepared in response to Article 4 of the Paris Agreement and presents South Africa's first low-emissions development strategy. The Strategy sets out the path going forward to place the country on a low-carbon trajectory towards ultimately reaching a net zero carbon economy by 2050, while at the same time ensuring broader socio-economic development. The strategy acknowledges that as one of the top 20 global emitters, with a high dependency on fossil fuels, substantial emission cuts will be required. It also acknowledges that the rapid transition that will be required presents a potential risk to economic growth and sustainable development if not managed properly.

The strategy centres on measures currently being implemented to address mitigation across the four key sectors of the economy, namely energy; industry; Agriculture, Forestry and Land Use (AFOLU); and waste. With regards to energy supply, the decarbonisation will largely be driven through, *inter alia*:

- the Integrated Energy Plan, which analyses current energy supply and demand trends within the different sectors of the economy, and projects the country's future energy requirements under a variety of different scenarios,
- the Integrated Resource Plan (see Section 4.3.9), which guides the South African electricity supply sector, by identifying the preferred electricity generation technologies to meet projected electricity demand. It, thus, provides a mechanism for Government to drive the diversification of the country's

electricity generation mix and promote the use of renewable energy and other low-carbon technologies.

The Strategy recognises that many of the current measures address only the short-term and are not considered to be transformational. Thus, the Strategy also presents planned cross sectoral measures that will contribute to driving mitigation action. It acknowledges that a broad range of structural changes will be necessary, in order to ensure the global economy achieves carbon neutrality within the second half of the century. Changes will be required in terms of service demand, technology fleet, infrastructure, operating practice, and energy sources, for all sectors of activity.

4.3.13 South Africa's Draft Nationally Determined Contribution (2021)

On 31 March 2021 the Minister of Forestry, Fisheries and the Environment officially launched South Africa's updated draft Nationally Determined Contribution (NDC) for public consultation. The updated draft NDC is the cornerstone of South Africa's climate change response and expresses South Africa's commitment to the Paris Agreement and a statement as to how South Africa will address the climate challenge. South Africa remains committed to addressing climate change based on science, equity and sustainable development. Similarly, the present draft updated NDC seeks to balance the three structural components of mitigation, adaptation and means of implementation / support requirements.⁷

The Intergovernmental Panel on Climate Change (IPCC) indicates that more urgent and rapid reductions in emissions are required by all countries. The updated mitigation NDC proposes a significant reduction in GHG emissions target ranges up to 2030, with the 2025 target range allowing time to fully implement the national mitigation system, including those elements contained in the Climate Change Bill (see Section 4.3.17). It will also allow space for the implementation of IRP 2019 and other key policies and measures, as well as the national recovery from COVID-19. The 2030 target range (398 - 440 Mt CO_{2-eq}) is consistent with South Africa's fair share, and also an ambitious improvement on South Africa's current NDC target. The upper range of the proposed 2030 target range represents a 28% reduction in GHG emissions from the 2015 NDC targets. South Africa's updated NDC targets are aligned with planned policies and measures to provide opportunities for accessing large-scale international climate finance to fund low carbon infrastructure and also to fund the just transition.

The Presidential Climate Commission (PCC) was established in order to advise government and its social partners on the climate transition and viable pathways to a climate resilient net-zero economy and society. The PCC believe that the NDC should give expression to the need for a "just transition", to which Government and its social partners are committed. It is important to protect those most vulnerable to climate change, including women, children, people with disabilities, the poor and the unemployed, and protect workers' jobs and livelihoods as the economy shifts to cleaner, more sustainable production. In reviewing the draft NDC, the PCC recommends that (PCC 2021):

⁷ Source: https://www.environment.gov.za/mediarelease/creecy_indc2021draftlaunch_climatechangep26.

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- The upper and lower bounds of the emissions trajectory in the NDC should be compatible with South Africa's 'fair share' of emission reductions, taking into account common but differentiated responsibilities and respective capabilities.
 - The NDC should reaffirm South Africa's commitment to reaching 'net-zero' carbon emissions by 2050. A net-zero target will be consistent with the direction other countries are taking and will set the context for evaluating the 2025 – 2030 emission trajectory.
 - Since current policies will result in emissions below the draft updated NDC trajectory, the implementation of these current policies and programmes allows for increased ambition in the updated NDC.
 - Further ambition beyond existing policies is possible by adopting least-cost measures to accelerate emissions reductions, provided that the required investment is supported by scaled up climate finance.
 - South Africa should maximise the employment opportunities and other co-benefits associated with higher levels of and more rapid decarbonisation mitigation, at the same time as addressing negative local employment effects.
 - The NDC should note the sensitivity of tradable sectors of South Africa's economy to global carbon measures as trading partners embark on net-zero targets and seek to be competitive in low-carbon goods and services.
 - The NDC should lower South Africa's emissions target range to at least 350 – 420 Mt CO₂-eq by 2030. This will be consistent with South Africa's fair share contribution to a 2°C global target.

In addition, the NDC should indicate South Africa's long-term emissions target of achieving net-zero carbon emissions by 2050, as set out in SA-LEDS. In arguing for a proactive stance, it is important to be mindful of the enormous challenges South Africa faces in terms of unemployment, poverty and inequality. South Africa is committed to a just transition to a net-zero and climate resilient society. The process of transition to a decarbonised economy has to be carefully managed, and the social and economic cost of the transition for vulnerable groups must be factored into the planning process, while the economic opportunities of the transition should be fairly distributed.

4.3.14 South African Gas Masterplan Base Case Report (2021)

The NDP envisions that by 2030 South Africa will have an energy sector that promotes economic growth and development through adequate investment in energy infrastructure (See Section 4.3.5). At just 2.6% of the country's total energy mix, South Africa's natural gas market is small, but with all its inherent benefits, it has the potential to change the economy by stimulating economic growth and development, stability and job creation.

The meaningful addition of natural gas to the country's energy mix will rejuvenate an overburdened, outdated energy infrastructure and reduce cyclical energy shortfalls. It will also stimulate the economy by allowing business and industry to lower their energy and operational spend, while also creating significant numbers of new jobs and skills development opportunities.

A challenge in developing the gas sector is to bring gas demand and supply on stream at the same time and spread geographically to stimulate broader localised demand through South Africa. Without such localised gas demand, it is difficult to develop distributed gas supply and without such distributed gas supply it is difficult to develop localised gas demand. In pursuit of adding generating capacity, lowering carbon emissions, enhancing energy security and supporting industrial development, South Africa has taken the first steps in a gas-to-power programme to be executed under the IRP 2019, aiming to increase the national energy mix natural gas contribution from 2.6% to 15.7% by 2030.

The purpose of the Gas Masterplan Base Case Report is to establish baseline information for the natural gas sector in South Africa and to outline the Gas Master Plan roadmap. Such baseline information includes an overview of the gas value chain and regulatory framework. The report also sets the scene for the Gas Master Plan development process.

4.3.15 International Energy Agency: Net Zero by 2050 - A Roadmap for the Global Energy Sector (2021)

The International Energy Agency (IEA) is a Paris-based autonomous intergovernmental organisation established in the framework of the Organisation for Economic Co-operation and Development (OECD) in 1974. Today the IEA acts as a policy adviser to its member states, as well as major emerging economies, such as South Africa (which is an association country to the IEA), to support energy security and advance the clean energy transition worldwide. The IEA's mandate has broadened to focus on providing analysis, data, policy recommendations and solutions to help countries ensure secure, affordable and sustainable energy for all. In particular, it has focused on supporting global efforts to accelerate the clean energy transition and mitigate climate change. The IEA has a broad role in promoting rational energy policies and multinational energy technology co-operation with a view to reaching net zero emissions. In response to the growing number of pledges by countries and companies around the world to limit their emissions to net zero by 2050 or soon after, IEA announced in January 2021 that it would produce a roadmap for the global energy sector to reach 2050 net zero. The report maps out a pathway in line with preventing global temperatures from rising above 1.5°C⁸.

The global pathway to net-zero emissions by 2050 detailed in this report requires all governments to significantly strengthen and then successfully implement their energy and climate policies. The proposed pathway calls for scaling up solar and wind so that the energy sector is dominated by renewables with a significant decline in fossil fuels (reducing from four-fifths of total energy supply to slightly over one-fifth by 2050). Although the proposed pathway still recognises the need for fossil fuels in the energy mix, it does not provide for the approval of new oil and gas fields for development due to the projected drastic reduction in oil and gas demand (IEA, 2021).

The report, however, recognises that the route mapped out is a path, not necessarily the path, and so it examines some key uncertainties, including the speed with which demand and behaviours adapt, the real level of energy efficiency, the pace at which new decarbonisation technologies (such as hydrogen and

⁸ Source: <https://www.iea.org/reports/net-zero-by-2050>

carbon capture and storage) scale up, etc. The report thus concludes that the proposed pathway to net-zero emissions is just one possible pathway to achieve net-zero emissions by 2050.

4.3.16 Just Transition and Climate Pathways Study for South Africa (NBI, 2021⁹)

While gas is set to play a major role in South Africa's path to net-zero emissions, this report by the National Business Initiative, Business Unity South Africa and the Boston Consulting Group shows that a lack of supply threatens the country's decarbonisation strategy. This report unpacks the impact of including gas in the country's plans to reduce emissions from carbon-heavy sectors such as electricity, transport and industrial. It is envisioned that natural gas replaces coal and diesel fuel sources, which are more emissions-intensive. Eventually, gas would be phased out by 2050 and replaced by greener alternatives like green hydrogen once the latter is developed and becomes more affordable.

According to this report, the country's current gas consumption comes to 180 petajoules (180 trillion kilojoules) per annum. The majority of gas is used in the synfuels sector, followed by the industrial sector. Most of the country's gas is sourced from the Pande-Temane gas fields in Mozambique, which supplies approximately 160 petajoules to Gauteng, KwaZulu-Natal and Mpumalanga. Energy and chemicals company Sasol provides about 20 petajoules of gas to KwaZulu-Natal via the Lilly pipeline. However, the Pande-Temane reserves are declining and will be constrained from 2025, which "*poses a risk to the decarbonisation ambitions of key sectors in the South African economy, which will rely on gas as a transition fuel or low carbon feedstock*".

South Africa's potential future gas demand will be driven by four key sectors with proven use cases for gas as a transition fuel or lower emission feedstock:

1. **Power:** Use gas in gas-to-power (GTP) plants to enable a high penetration of renewable energy in the power system by providing the flexible capacity to manage the long-duration intermittency, which battery storage cannot currently address.
2. **Synfuels:** Introduce additional gas to enable the phase-out of significantly more carbon-intensive coal feedstock in the production of liquid fuels.
3. **Industry:** Phase out higher emitting coal, and to a lesser extent diesel, with additional gas as an energy source for industrial heat generation and other processes.
4. **Transport:** Use gas as an alternative to diesel, albeit at a small scale, for heavy-duty commercial road transport in the short- to mid-term, while alternative greener technologies mature and become economically viable.

The study warns that without additional gas, there would be more emissions in the long run because the synfuels, power and industrial sectors would rely on carbon-intensive fuels like coal and diesel for longer. The report, however, does highlight other potential sources of South Africa's gas supply over the short, medium and long term.

- In the short term (2021 to 2024), the country can supplement the Pande-Temane reserves by relying on LNG. LNG mainly would be supplied from floating storage regasification units or gas-carrying ships

⁹ Report summarised, in part by, by <https://www.news24.com/fin24/economy/shortage-of-gas-could-derail-sas-plans-to-decarbonise-20220221>

stationed at ports like Matola in Mozambique and South African ports such as Richards Bay, Coega and Saldanha.

- In the medium term (2024-2030), the supply from Pande-Temane could be maximised through "technical work" on the reserves. For example, this is possible through regional cooperation between South Africa and Mozambique to achieve a "win-win" for both parties. The report, however, notes that the additional gas available from Pande-Temane is not fixed and depends on contractual and other technical uncertainties.
- In the long term (beyond 2030), other supply options include LNG and piped gas from Rovuma and other gas fields from Mozambique. Gas can also be sourced from South Africa's exploration activities like TEEPSA's Brulpadda and Luiperd gas fields.

The study warned against unconstrained gas demand - as the goal is to ultimately move away from using the fuel in favour of green alternatives. The report encourages research into repurposing gas infrastructure for green synfuels and green hydrogen.

4.3.17 Climate Change Bill (2022)

On 18 February 2022, the Climate Change Bill was formally introduced to the National Assembly by the Minister of Forestry, Fisheries and the Environment. The aim of the Bill is to enable the development of an effective climate change response and a long-term, just transition to a low-carbon and climate-resilient economy and society for South Africa in the context of sustainable development.

The objects of this Act are to:

- "provide for a coordinated and integrated response by the economy and society to climate change and its impacts in accordance with the principles of cooperative governance;*
- provide for the effective management of inevitable climate change impacts by enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to building social, economic and environmental resilience and an adequate national adaptation response in the context of the global climate change response;*
- make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system;*
- to ensure a just transition towards a low carbon economy and society considering national circumstances;*
- give effect to the Republic's international commitments and obligations in relation to climate change; and*
- protect and preserve the planet for the benefit of present and future generations of humankind".*

When promulgated, the Bill will form the legislative foundation for the climate change adaptation and mitigation response. With respect to the mitigation response, the Bill provides for future review and determination of the national greenhouse gas emissions trajectory; determination of sectoral emissions targets for emitting sectors and subsectors; and allocation of carbon budgets (Source: SA-LEDs).

4.3.18 UN IPCC Report II (February 2022) and Report III (March 2022)

The IPCC released a new climate report in March 2022, building on the findings of a previous report released in February 2022. This provides the IPCC's guidance on what the world can do to avoid the consequences of climate change. The report outlines the most up-to-date science regarding current emissions levels and mitigation strategies in order to transition from fossil fuels. In order to ensure that the 1.5°C degree target can be fulfilled, the report notes that alternative fuels need urgent investment and scaling up to combat the rising global warming margins.

The latest IPCC report shows greenhouse gas emissions continue to rise and that current policies to address climate change are not ambitious enough to limit warming to 1.5°C above pre-industrial levels. The report notes that without a strengthening of policies beyond those that are implemented by the end of 2020, GHG emissions are projected to rise beyond 2025, leading to a median global warming of 3.2°C by 2100.

Although growth in emissions has slowed, global GHG emissions remain at their highest level ever. Global GHGs must peak around 2020 and before 2025 at latest in order to remain below 1.5°C with no or limited overshoot. To achieve the 1.5°C degree target, global GHGs must fall by 43% below 2019 by 2030 and 84% by 2050, while CO₂ emissions must fall by 48% by 2030 and to net-zero in early 2050s and methane must fall by 4% by 2030. If the world cuts emissions quicker, then there is slightly more time before CO₂ has to reach net-zero.

Current and historical GHG emissions are not evenly distributed, with the top 10% of households being responsible for 34-45% of emissions today. Least-developed countries have contributed to less than 0.4% of historical CO₂ emissions.

The report notes that cutting emissions requires a "substantial reduction in overall fossil fuel use", energy efficiency, low-emission energy sources, such as renewables and alternative energy carriers, such as hydrogen.

4.4 REGIONAL AND LOCAL POLICY AND PLANNING FRAMEWORK

This section aims to provide an overview of the regional and local policy and planning context relating to the proposed development.

4.4.1 Provincial

The relevant policies and development plans of the Free State Province will be examined and relevant information will be included in the EIA Report.

4.4.2 District Municipality Integrated Development Plans and Spatial Development Frameworks

The Local Government: Municipal Systems Act, (Act 32 of 2000) stipulates that all Municipalities are required to prepare an Integrated Development Plan (IDP) and that a Spatial Development Framework (SDF) be a component of the IDP. The Spatial Planning and Land Use Management Act (SPLUMA) provides a framework for spatial planning and land use management and Chapter 4 addresses the preparation requirements and content of an SDF.

The IDP and SDFs of the relevant municipalities will be examined and relevant information will be included in the EIA Report.

4.4.3 District Environmental Management Frameworks

An EMF is a document that aims to ensure that environmental limits to development are included in spatial planning documents. EMFs provide a compilation of information and maps, illustrating attributes of the environment for a specific geographical area that becomes useful in a diverse field of environmental applications, including EIA processes, but also other planning processes, such as the development of IDPs, SDFs and other open space planning applications.

While the development of IDPs and SDFs is a mandatory district and municipal requirement, the development of EMFs is not and as a result neither the Fezile Dabi Local Municipality, nor the Lejweleputswa Local Municipality have an adopted EMF at the time of writing this report.

4.5 CONSISTENCY WITH POLICY AND PLANNING CONTEXT

The previous sections have considered the policy and planning context at national, regional and local level, which are relevant to the proposed amended exploration work programme. There is a drive from national and provincial Government to stimulate development and grow the economy of South Africa with a strong focus on job creation in all sectors, whilst protecting the environment. In order to facilitate this economic growth, there is a need to ensure that there is sufficient capacity in the country's electricity supply by diversifying the primary energy sources within South Africa. Exploration for petroleum has been identified as a potential driver of economic growth, energy supply and job creation.

The proposed well drilling exploration activities would allow for the determination of whether or not petroleum resources are located within the proposed ER area. By gaining a better understanding of the extent, nature and economic feasibility of extracting these potential resources, the viability of developing indigenous gas resources would be better understood.

The promotion of the oil and gas sector could also be considered in contradiction with some of the other plans and policies, which identify the need to reduce the reliance on fossil fuels in order for South Africa to reduce GHG emissions and meet commitments in this regard. Nevertheless, the current limitations of

renewable energy technologies are such, that there is still a need to include fossil fuels (notably natural gas) within the energy mix of the country.

4.6 CONSISTENCY WITH NEMA PRINCIPLES

The national environmental management principles contained in NEMA serve as a guide for the interpretation, administration and implementation of NEMA and the EIA Regulations. In order to demonstrate consistency with the NEMA principles, a discussion of how these principles are taken into account during the EIA process is provided in Table 4-1 below.

TABLE 4-1: CONSIDERATION OF THE NEMA PRINCIPLES IN RELATION TO THE PROPOSED PROJECT

National Environmental Management Principles	Comment
<p>(2) <i>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.</i></p>	<p>The proposed project aims to determine the presence of petroleum resources within the ER area. Confirmation of the presence of such resources would enable the country to refine its long-term planning for the development of the oil and gas sector within the country. The gas sector is known to have economic benefits and environmental risk which need to be balanced.</p> <p>The S&EIA process will also serve to identify the needs and interests of potentially affected parties and to address issues and concerns raised through the course of the study.</p>
<p>(3) <i>Development must be socially, environmentally and economically sustainable.</i></p>	<p>Government has indicated that there is a need for the country to reduce its reliance on coal-based electricity. The use of natural gas is being considered to assist in reaching this goal. By determining the presence (and extent) of such resources, the sustainability of developing the petroleum sector within the country can be better considered.</p>
<p>(4)(a) <i>Sustainable development requires the consideration of all relevant factors including the following:</i></p> <ul style="list-style-type: none"> (i) <i>That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;</i> (ii) <i>that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;</i> (iii) <i>that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;</i> (iv) <i>that waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and</i> 	<p>The S&EIA process will consider potential social, economic, biophysical impacts that could result through the implementation of the proposed amended exploration work programme.</p> <p>Measures will also be identified to avoid, minimise and/or remedy potential pollution and/or degradation of the environment that may occur as a result of the proposed project.</p>

National Environmental Management Principles	Comment
<p><i>otherwise disposed of in a responsible manner;</i></p> <p>(v) <i>that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;</i></p> <p>(vi) <i>that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;</i></p>	
<p>(4)(a)(vii) <i>that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and</i></p>	<p>Assumptions, uncertainties and limitations associated with the compilation of the Scoping Report are discussed in Section 3.2. Compliance with the various legislative requirements is presented in Section 2.2.</p>
<p>(4)(a)(viii) <i>that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.</i></p>	<p>The S&EIA process will consider and assess the identified potential social, economic and biophysical impacts of the project (refer to Section 7). The EMPr will provide the recommended management measures to mitigate the significance of identified impacts.</p>
<p>(4)(b) <i>Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.</i></p>	<p>The S&EIA process that is being followed recognises that all elements of the environment are linked and interrelated. PASA/DMRE, as the decision-making authority, will be responsible for taking all aspects of the environment, including whether or not the potential impacts of the project would unfairly discriminate against any person, into consideration when making a decision regarding the proposed project.</p>
<p>(4)(c) <i>Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.</i></p>	
<p>(4)(d) <i>Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination.</i></p>	<p>The proposed plan of study includes undertaking a geohydrological assessment which is scoped to assess whether the proposed amended exploration work programme will present any risk to ground water quality or quantities (See Section 9.3).</p>
<p>(4)(e) <i>Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.</i></p>	<p>Rhino Oil and Gas is committed to comply with environmental health and safety consequences of the proposed well drilling exploration process.</p>

National Environmental Management Principles	Comment
(4)(f) <i>The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.</i>	The public participation process has been undertaken in accordance with the requirements of the EIA Regulations 2014 (see Section 3.3). In addition, a pre-application Public Participation Process was undertaken for the project, which included public information meetings and distribution of a BID for comment (see Box 3-2 and Sections 3.3.2 and 3.3.6).
(4)(g) <i>Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognizing all forms of knowledge, including traditional and ordinary knowledge.</i>	The S&EIA process will take into the account the interests, needs and values of I&APs, through the submission of comments on the proposed project, during the Scoping and EIA phases of the project. Thus, the decision-makers will have the necessary information before them on which to base an informed decision.
(4)(h) <i>Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.</i>	The Scoping Report and EIAR prepared for the proposed project will be made available to communities for review and comment (see Sections 1.7 and 0).
(4)(i) <i>The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.</i>	The S&EIA process will consider identified potential social, economic, biophysical impacts of the project in an integrated manner. The significance of these impacts will be assessed in the EIA phase according to pre-defined rating scales.
(4)(j) <i>The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.</i>	Rhino Oil and Gas (and its appointed contractors) would be required to comply with the requirements of the Mine Health and Safety Act. An Environmental Awareness Plan will also be prepared to inform staff about any aspects of their work that may pose a danger to the environment.
(4)(k) <i>Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law.</i>	The public consultation process is being undertaken in accordance with the requirements of the EIA Regulations 2014 (as amended) and will allow for the distribution of the Scoping Report and EIAR for public review and comment. This information will be provided in an open and transparent manner.
(4)(l) <i>There must be intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment.</i>	The public participation process for the proposed project provides an opportunity for the Organs of State to provide comment on the proposed project and address any potential conflicts between policies or other developmental proposals administered by them that may be in conflict with the proposed project before decision-making.
(4)(m) <i>Actual or potential conflicts of interest between organs of state should be resolved through conflict resolution procedures.</i>	It is not anticipated that the proposed project would result in any conflicts between organs of state.

National Environmental Management Principles	Comment
(4)(n) <i>Global and international responsibilities relating to the environment must be discharged in the national interest.</i>	PASA/DMRE, as the decision-making authority, will be responsible for taking cognisance of any international obligations that could have an influence on the project.
(4)(o) <i>The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.</i>	The S&EIA process will consider and assess the identified potential social, economic, biophysical impacts of the project (refer to Section 7).
(4)(p) <i>The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimizing further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.</i>	As the applicant, Rhino Oil and Gas will be responsible for the implementation of the measures included in the EMPr.
(4)(q) <i>The vital role of women and youth in environment management and development must be recognised and their full participation therein must be promoted.</i>	The public participation process for the proposed project has been and will continue to be inclusive of women and the youth.
(4)(r) <i>Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.</i>	The S&EIA process undertaken for the proposed project will identify relevant sensitive and/or vulnerable areas and assess potential impacts if applicable. Appropriate mitigation measures will be proposed if required.

4.7 SECURING ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

The biophysical impacts of the proposed project will be further investigated in the EIA phase. Measures to enhance the benefits and mitigate the impacts to these resources will be included in the EIAR.

4.8 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

The socio-economic impacts of the proposed project will be assessed in the EIA phase. Measures to enhance the benefits and mitigate the impacts to these resources will be included in the EIAR.

5. PROJECT DESCRIPTION

This chapter describes the sequence of the proposed project phases and activities, provides technical information, and describes the proposed exploration activities and alternatives.

5.1 DETAILS OF THE APPLICANT

Rhino Oil and Gas is a South African registered subsidiary of Rhino Resources Ltd. Rhino Resources Ltd is a technology driven, independent oil and gas exploration and development company focused on Africa. Company details for Rhino Oil and Gas are detailed in Table 5-1.

TABLE 5-1: DETAILS OF THE APPLICANT

Applicant details	
Company name	Rhino Oil and Gas Exploration South Africa (Pty) Ltd
Registration no:	2013/096757/07
Contact person	Travis Smithard
Postal address	3 rd Floor, Icon Building, 24 Hans Strijdom Avenue, Foreshore, Cape Town
E-mail	info@rhinoresourcesltd.com
Web address	http://www.rhinoresourcesltd.com/

5.2 PROJECT LOCATION

The extent of ER 318 includes ~ 3 000 properties (farms and portions) over an area of approximately 600 000 ha (see regional setting in Figure 1-2).

Rhino Oil and Gas has identified three (3) Target Areas within which the updated well drilling EWP intends to focus. The Target Areas include:

- **Target Area 1** is approximately 200 km² in extent and is located approximately 4 km west of Allanridge and 5 km north of Welkom. The Target Area includes ~ 680 properties;
- **Target Area 2** is approximately 450 km², approximately 4 km northeast of Allanridge and 20 km west of Kroonstad. The Target Area includes ~ 324 properties;
- **Target Area 3** is approximately 138 km² in extent in the eastern portion of ER 318, with Steynsrus located 38 km south and Kroonstad to 2 km west. The target Area includes ~ 228 properties.

The corner co-ordinates of the Target Area boundaries are provided in Appendix 4.3. A list of the properties included in the Target Areas is provided in Appendix 4.2. Given the large number of properties included, it is not feasible to include a cadastral description of every property in this document.

The location of well drilling sites is subject to a process of geological review, landowner consent and environmental considerations. Areas that are unsuitable are eliminated from further consideration. Rhino Oil and Gas is currently busy with the well site identification process.

5.3 EXPLORATION DRILLING PROGRAM AND PROJECT SCHEDULE

The Drilling Program and Time Schedule proposed by Rhino Oil and Gas is to start drilling at least ten exploration wells (i.e. three to four in each of the Target Areas) within the ER in 2023.

If any of the first ten exploration wells result in the identification of commercially viable commodities (hydrocarbons, helium, or hydrogen), Rhino Oil and Gas's Drilling Program and Project Schedule would be updated to include the drilling of additional exploration wells at different locations within the Target Areas.

Completed exploration wells will be tested to evaluate their commerciality, as described further in this chapter. The drilling of the exploration wells will likely be undertaken as one or two campaigns. At the end of operations, unsuccessful wells will be plugged and abandoned ("decommissioned"). Successful wells will have their ability to produce preserved but be capped and secured for possible future field development (subject to a receipt of the requisite approvals including, amongst others, Environmental Authorisation by means of a separate EIA process for Production Rights (PR)).

The drilling time to complete one well is estimated to take approximately 3 to 4 weeks. The results of the first few wells drilled within the Target Areas will influence the positioning and pace of the rest of the drilling campaign based on the interpretation of the geological, geophysical, fluid sampling data. The sequencing of the drilling campaign will be dynamic and influenced by the learnings of each new well.

The drilling rig will be mobilised from within South Africa. The likely drilling service provider already operates in the vicinity on Renegen's PR007 (Virginia field) located 15 km south of Rhino Oil and Gas's ER 294; as such the longest mobilisation will take only a couple of days.

5.4 MAIN PROJECT COMPONENTS

This section describes the main project components, including the following:

- Onshore Drill Rig;
- Exclusion Zone;
- Local logistics base;
- Supply trucks;
- Personnel;
- Crew transfer; and
- Infrastructure and services.

5.4.1 Onshore Drill Rig

Various types of drilling rigs are used worldwide in onshore drilling operations, with the type of unit typically dependent on the depths to which it needs to reach and the hardness of rocks it needs to penetrate. The alternative drilling rig types considered are discussed further in section 5.9.2.1. Based on the overall subsurface rock in each area of interest, it is anticipated that exploratory drilling will be conducted using a truck mounted drilling rig with air and mud drilling capabilities.

An example of truck mounted drilling rig specifications is presented in Table 5-2 below. The truck mounted drilling rig has minimal area of disturbance due to its compact footprint (See Figure 5-1 for an example of a typical drill rig). A significant benefit to using a truck mounted drilling rig is the ease of mobility as it is a self-propelled truck with the flexibility to move from location to location without the need of additional truck support.

TABLE 5-2: EXAMPLE OF ONSHORE DRILL RIG SPECIFICATIONS PARAMETERS,

Thor Drill Rig

MINE EXPLORATION RC RIG

RC 8000

TECHNICAL DESCRIPTIONS



DECK ENGINE	140 HP
FUEL TANK CAPACITY	1000 L
STANDARD COMPRESSOR	Different option available
DRILLING CAPACITY	@36,8 T 1177 meters with 4" rods & 981 meters with 4,5" rods
COOLING	Hydraulic cooler fitted
CONTROL SYSTEM	Easy accessible Control panel with clear view for operator
STEEL TRACK MOUNTING	45 tons trackOne under carriage, with manual hydraulic trammng system and wireless remote control option
TRUCK MOUNTING	6x4/6x6 or 8x4/8x8 truck
TOP HEAD DRIVE /ROTATION HEAD	Reduction gearbox type (grease filled) reduction 3,25:1 spindle hole 80 mm , RPM 0-80, MAX TORQUE 18000 Nm, spindle thread -102 ARD, Head can be used for RC/DTH/Air core
HYDRAULIC HEAD TILT	Hydraulic head tilt for safe and easy rod & casing handling
OUTRIGGERS	4 x steel boxed hydraulic outriggers bore size 100mm, stoke 1m, double fitted double pilot operated check valves in case of hose failure
FEED SYSTEM	Mast tubular construction working with 2 cylinders (no chains or cables)
PULL BACK	36,8 T @ 300 bar
PULL DOWN	21,7 T @ 300 bar
ROD LENGTH	6 M
MAST LENGTH	11 M
OVERALL DEPTH	400 mm
OVERALL WIDTH	600 mm
TOP HEAD TRAVEL /STROKE	7,4 M
DUMP MAST SLIDE TRAVEL	1,8M
BREAKOUT SYSTEM	Manual keeper spanner, Conventional hydraulic assisted breaker spanner, or hydraulic hands free option.
WINCHES	Worm Drive gearbox type hydraulically driven, max weight capacity 1000kg/1m/sec. Optional wire line winches available.
HYDRAULIC SYSTEM	Open loop hydraulic system, with Poclairn piston pump @ 300 bar, gear pumps for auxilliary functions and cooling.
HAMMER LUBRICATOR	In line venturi type with 15 L capacity
FOAM PUMP	Hydraulic driven piston pump 21 L/min @ 200bar
ELECTRIC SYSTEM	12 & 24 volts with options of working lights, emergency stops, and lock out depending on customer needs.
AIR LINES	All air lines are rated at 80 bar with whip safety socks on all ends with booster line as option
SHIPPING DIMENSIONS LxWxH (track mounted rigs)	10480 x 2500 x 4020 mm
GROSS WEIGHT (track mounted rigs)	27 T
DEPTH CALCULATION EXPLANATION	All depth calculations are theoretical based on different rod/m weight with 20% safety margin worked in. 4" RC rods 25KG/m, 4,5" RC rods 30KG/m. These capacities are based on the hydraulic capacities of the drilling rigs.



THOR DRILL RIG CC. MANUFACTURERS OF DRILLING EQUIPMENT
Plot 78 Vaalbank, R104 rd to Bronkhorstspuit,1055. PO Box 1881 Rayton, 1001
South Africa. Tel :+ 27 12 736 2345. marianna@thordrill.co.za len@thordrill.co.za



@thordrill



<https://www.thordrill.co.za/>

Source: thordrill.co.za



FIGURE 5-1: EXAMPLE OF A DRILL RIG,

Source: Torque Africa

5.4.2 Safety Zone

During the drilling operations, there will be a fenced safety zone of about 20 to 25 m around the drill site. No traffic will be allowed to enter the safety zone for the duration of drilling operations. The purpose of the safety zone is to prevent accident with the high-powered equipment used during operations. In addition, drilling may liberate flammable gases that require a standoff distance for safe handling.

5.4.3 Local Logistics Base

A local logistics base will be in close vicinity of Target Areas since it will be shared with other ongoing drilling activities undertaken by the drilling contractor for Renegen, who are developing and producing the Virginia field in the Free State.

That logistics base will be on an existing brownfield site (previously developed land) most likely used by farming communities to store and maintain heavy duty machinery. A final decision will be undertaken after a logistic survey in the identified areas. This base will include the following facilities:

- An open storage area partially equipped with pipe racks for drilling tubular material storage;

-
- A covered warehouse for drilling material and other minor equipment;
 - Temporary offices for logistic base personnel;
 - Area for storage (less than 90 days per well activity) for general waste and hazardous waste at any one time.

Wastes will be transported to a licensed waste disposal facility by an appropriately permitted waste management contractor and will not be stored within the base except for the time strictly necessary for unloading from the drill site and loading on the trucks for transport to the disposal site. The following maximum potential space requirements have been identified:

- Open area/pipe yard: up to 1000 m²; and
- Warehouse: up to 500 m².

Rhino Oil and Gas's drilling contractor plans to use existing infrastructure within the Free State to provide the transport, storage and bunkering facilities for the project. Based on regional experience, the drilling contractor anticipate that the drilling will be done by air drilling thus not requiring mud plant. However, for safe operations and well control backup options, a small temporary mud plant will be available at the well site.

5.4.4 Supply trucks

For the duration of the drilling operation, the drill site will be supported by supply trucks, which are general purpose trucks designed to carry a variety of equipment and cargo. These trucks will supply the drill site two to four times a week with cement, mud and equipment such as casing, drill pipe and tubing. They will also remove waste that must be appropriately disposed of on land. The number of supply trucks has not yet been defined but will be provided by the drilling contractor.

5.4.5 Personnel

The logistics base will be located within around 120 km reach and all based personnel will reside locally. The local staff employed by the South African drilling contractor is experienced local South Africans in drilling in the Free State region. Some external advisors might be internationally sourced if required by the project. Rhino Oil and Gas representatives will also be located in the Cape Town office and travel to well sites during the drilling campaign. The drilling will see around 5 to 10 personnel on site. The number of personnel on the supply trucks will vary based on the types of activities they support. The trucks will be local trucks and staff, where possible, for drilling operations service. All workers will be provided with health and safety training and Personal Protective Equipment (PPE) suitable for the types of activities by the drilling contractor.

5.4.6 Crew Transfers

Transportation of personnel to and from the drill site will most likely be provided by road. The drill site can operate during day and night shifts. However, if timeline permits, it is anticipated to mainly operate during day shifts only. Crews will generally work in 8 to 12 hour shifts in 2-to-4-week cycles. Crew changes will be

staggered, and in combination with ad hoc personnel requirements and will be managed by Rhino Oil and Gas's drilling contractor.

5.4.7 Infrastructure Support and Services

5.4.7.1 Freshwater

The project will require water for making water-based drilling muds to be used as backup for safe measure to maintain well control and for rig cleaning. This industrial water will be sourced by Rhino Oil and Gas's drilling contractor from authorized sources. The drinking (potable) water for the personnel on the drill site will be bottled water.

5.4.7.2 Fuel

The estimated total fuel consumption per well during the mobilisation, drilling phase (approximately 2 days mobilisation and 25 days drilling, 1000m drilled) by all the project equipment's and truck is on average 7 to 15 m³ of gasoil.

5.4.7.3 Food Supplies and Local Services

The bulk of food and local services will be purchased locally near the logistics base.

5.5 PROJECT ACTIVITIES PER PHASES

Project activities associated with drilling include the following phases, described further in the following sections:

- Mobilisation of the truck mounted rig and supply trucks from drilling contractor base located near Pretoria to the Rhino Oil and Gas Target Area in the Free State Province;
- Well drilling;
- Well execution (logging, completion) options;
- Well testing for successful well options;
- Well abandonment for unsuccessful well (Plug and Abandonment "decommissioning"); and
- Demobilisation of the drill rig, supply truck and local logistics base.

5.5.1 Mobilisation Phase

The drilling locations will be identified prior to mobilisation of the drill rig based on the results of the analysis of airborne geophysical data, regional geological analysis, historical data integration, land owner consultation and environmental sensitivities.

During mobilisation, the drill rig and supporting equipment will arrive directly on location from previous jobs (probably from Renegen drill sites) or from Rhino Oil and Gas's drilling contractor main yard near Pretoria.

Once on location, the well site will be prepared by drilling contractor. A typical drill site schematic is provided as Figure 5-2. Should any obstacles/sensitivities be identified at the drilling location, the well will be relocated to a nearby location where no obstacles/sensitivities are located.

These activities will be followed up with safety checks, drills, communication tests. This will take approximately 2 to 4 days to complete.

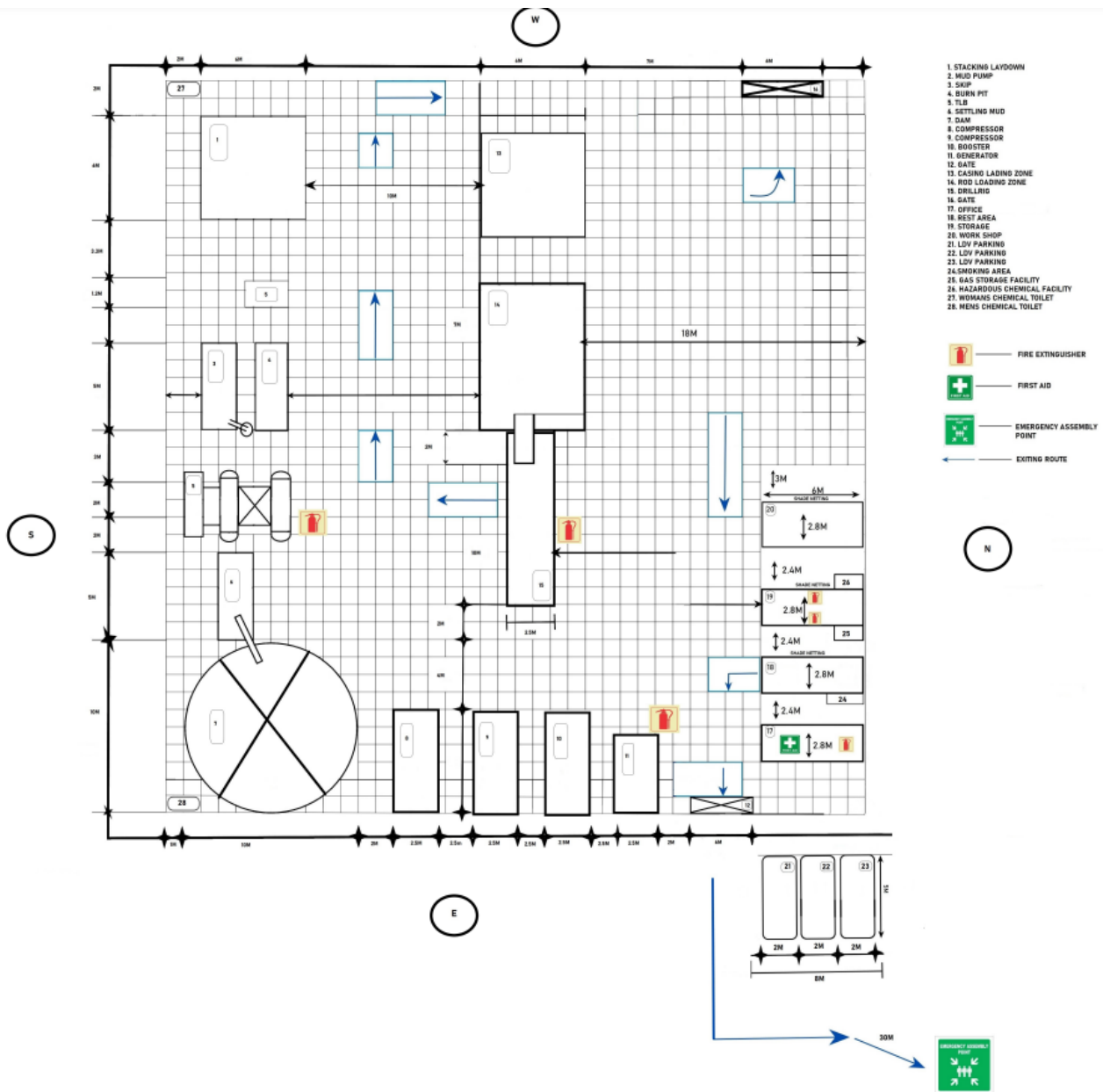


FIGURE 5-2: DRILL SITE LAYOUT

Source: Torque Africa

5.5.2 Drilling Phase

5.5.2.1 Well Drilling

After mobilisation, the next phase is the drilling phase.

The drilling sequence for the exploration drilling campaign is not yet defined as it will depend on the first exploration well results. However, it is currently planned that each Target Area will have at least 1 well drilled in the initial 10 exploration wells campaign.

To evaluate and confirm the commercial viability of the reservoir, a vertical or slanted well will be drilled to a total depth of approximately 1000 m below surface. The expected valuable fluid for these wells is biogenic gas, helium or geological hydrogen. A standard well design and programme for onshore wells is described below (see Section 5.5.3). This will be updated after the completion of seismic interpretation and stratigraphy evaluation by the geologists and petroleum engineers. The final well path will be defined according to the reservoir target and final location of the wellhead at surface. Rhino Oil and Gas's preference for drilling exploration wells is a slanted well profile allowing maximum chance to intersect naturally occurring faults in the basement rocks.

During the drilling phase, different drilling bit sizes are used to drill a series of telescoping holes, from the surface to the total depth of the planned well. The first hole, the outer diameter, is the biggest and called the top hole, while the next inner holes are progressively smaller and smaller as the well depth increases. This continues until the final hole, which is the smallest, reaches the reservoir level. Further details regarding the section diameters, depths and planned profile of the well are provided in Figure 5-3.

During the drilling process, drilling fluids such as compressed air or muds are pumped down the inside of the drill pipe and exit at the drill bit to optimise drilling operations. For the first section (top hole) of the well, a conductor pipe will be installed by hammering it down to around 50 m to isolate from any ground water. In the bottom sections of the well, air drilling (i.e., with compressed air injected) will be mainly carried out. The water-based mud programme will only be deployed if high rock formation pressure encountered. The main functions of drilling fluids (air or mud) include the following:

- Removal of drilled rock cuttings from the bottom of the well and from the well bore and transportation of these cuttings to the surface;
- Control of formation pressures and managing of formation fluids (i.e., 'primary well control');
- Transmission of power to the drill bit;
- Provision of hydrostatic pressure as well as chemical stability to the rock to maintain the integrity of the hole and prevent hole collapse;
- Lubrication and cooling of the drill bit.

The drill bit is connected to surface by a string of hollow tubulars referred to as the drill string. On the rig floor, drill pipes are attached, one by one, to the top of the string as the drill bit advances into the borehole. The action of drilling (creating a hole in the rocks stratigraphy) is obtained by applying weight and percussion to the bit. The top drive, installed in the truck mounted drill rig, advances the drill string into the well, and

provides the rotation/percussion and weight on bit required to drill. The drill string goes through a Rotating Control Device (RCD) to provide physical barrier with wellbore and allow flow back diversion to flare in case of hydrocarbon intersection. Once each hole section has been drilled, casing (steel tubulars) is run into the well and cemented in place to secure/seal the hole interval just drilled and to allow for the drilling of the next (smaller) hole section. The cement operation consists of pumping cement down the drill string to the bottom. The cement flows, out the bottom of the casing shoe and back up into the annular space around the casing, sealing the space between the cased tube and open hole.

Casing plus cement is a tested barrier that facilitates the drilling of the next section, allowing to reach the target final depth in the safest way. During the drilling stage, fluid (mainly air) and dust/cuttings are discharged directly on the surface in immediate proximity of the well after going through a cyclone separator. The physical and chemical properties of the drilling fluid are constantly monitored and adjusted to suit varying down-hole conditions. These conditions are, in part, due to the variation in formation pressure within the well bore at different depths. If water-based mud is in use, fluid density (or mud weight) is adjusted with mud additives. The 3 main mud additives likely to be used by the drilling contractor are AMC EzeeMix (classified non-hazardous), AMC Aerofoam and AMC Rotafoam (classified non to moderate hazardous). The mud additives details can be found on AMC website (www.amcmud.com).

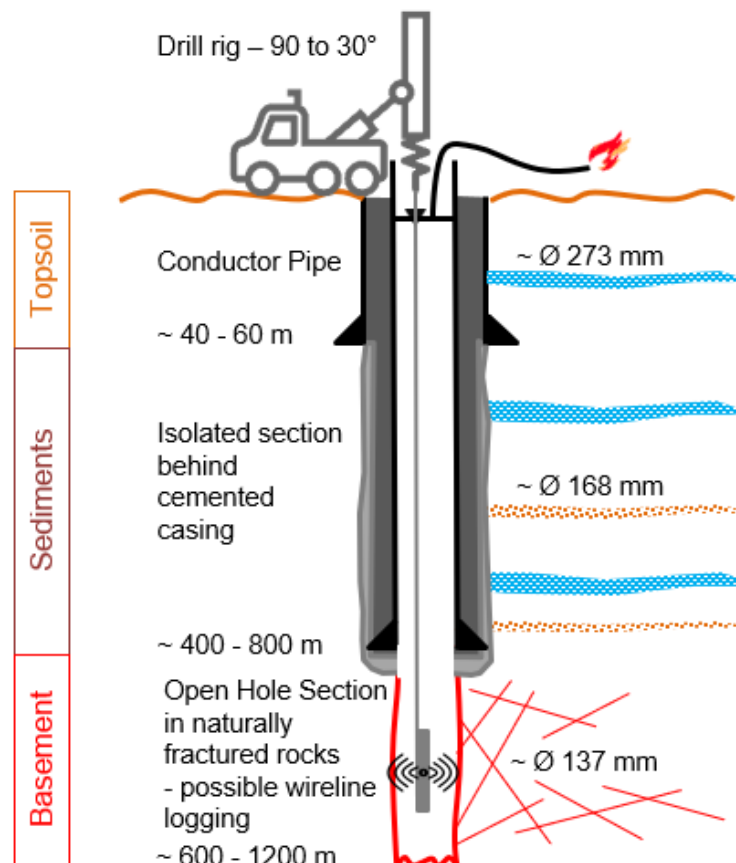


FIGURE 5-3: SUBSEA WELL SCHEMATIC AT THE END OF DRILLING PHASE

Source: ROGESA, 2022

Note: This drawing is not to scale, for dimension of rig vs equipment and tubulars or depths

5.5.3 Well Execution Options

5.5.3.1 Redrill

In case of any issues related to stratigraphy (e.g., permeable zones with different pressure gradient, hole instability, necessity to increase the inclination of the well to achieve the reservoir target) or problem during the drilling activities (e.g. bottom hole assembly stuck) it would be easier to redrill the well in a nearby location. The initial open hole will be cemented up and abandoned.

5.5.3.2 Well Logging

Different sensors are used throughout the drilling operation to measure several parameters such as quality of cement job, lithology, fluid types.

A dedicated run to measure/log the cement bond and consistency in the annuli is performed at the end of each cement job, prior to start drilling operations in the next phase.

Further detailed information is obtained on the physical properties of the rock formations and fluids (water, oil, gas) by means of an open and cased hole logging using sensors introduced down-hole with a wireline cable, or coiled tubing unit.

This operation is usually performed at the end of the drilling phase, after the bottom hole final clean up. The logging plan is developed in accordance with standard industry best practices. In the case of unsuccessful wells, once a full log of the reservoir section might have been undertaken, the well will be plugged and abandoned. The completion phase, if confirmed in case of discovery, will be performed.

5.5.3.3 Well Completion

Well completion and well testing operations will be conducted during drilling of successful exploration wells. The completion phase of a successful well takes place after the reservoir formation has been drilled and maintained open hole.

At the beginning of the completion operations, the wellbore is displaced with an industrial water, necessary to balance the downhole pressure and, at the same time, to complete the removal of dust/mud/solids from the well in order to minimise any potential damage to the rock formation.

The selection of salt and brine composition will be defined once the hydrocarbon has been discovered in the exploration well and reservoir lithology completely logged although simple industrial water is expected to be adequate considering low pressure encountered in regional analog exploration or production wells.

The successful well will be capped with well head valve connected to metering equipment with a flare stack at the end of it.

5.5.3.4 Well Testing Option for Successful Wells

As stated previously, well testing may be conducted on the successful wells if they present potential commercial quantities of hydrocarbon. A well test is a temporary completion of a well to acquire dynamic rate through time, pressure, and fluid property data. The well test often indicates how the well will perform when it is subjected to various flow conditions. An analysis is usually performed on the data to determine reservoir parameters and characteristics including pressure, volume, and temperature. Current testing practices are carried out using modern testing equipment and high-resolution pressure data acquisition system, getting the reservoir evaluation objectives depends on the behavior of the formation fluid properties, well completion, and flow assurance situations are only known when testing is carried out.

The well test objectives are to:

1. Determine key technical factors of the reservoir (e.g., size, permeability and fluid characteristics) and values for use in future drilling.
2. Obtain representative data including reservoir pressure, production rates and sample(s).

While testing, hydrocarbons are sent to a flare boom with a burner to ensure as complete combustion of fluids (including hydrocarbons) as possible. To ensure that burning can be done safely from the drill site, a flare pit can be installed in order to prevent fire propagation.

The flow periods and rates will be limited to the minimum necessary to obtain the required reservoir information during the well test. It is anticipated that a maximum well test time for this project will be approximately 30 days.

Downhole sampling, if required, normally consists of recovering reservoir fluids via wireline or through specific tools added directly to the temporary test string. Wireline testing involves running instruments into the borehole on a cable to measure formation pressures and obtain fluid samples. Formation fluids are brought to the surface where the composition can then be analysed.

The following key well testing preventative measures will be implemented during the well testing programme:

- Monitor flare performance to maximise efficiency of flaring operations;
- Flare equipment appropriately inspected, certified and function tested prior to operations;
- Flare equipment appropriately maintained and monitored throughout well testing operations;
- The appropriate emergency stop mechanisms (Emergency Shut Down devices) are in place to halt testing in case of emergency

5.5.3.5 Well Control and Blowout Prevention

Health, safety and environmental protection are prioritised throughout the drilling process. In particular, there is a specific focus and attention during preparation and operations to avoid any potential accidental events, with related hydrocarbon release or uncontrolled flow from downhole to surface.

Well control during well operations is a routine function, with each well designed and executed to minimise risk of developing a well control incident. Down-hole conditions, such as shallow gas and high-pressure zones can cause control measures as a sudden variation in well pressure. A well kick can occur if there is an influx of formation fluids with sufficient pressure to displace the well fluids.

The drilling will be done through a Rotative Control Device (RCD) that creates a pressure tight barrier against drilling hazards and allows safe diversion to the side flare stack (Figure 5-4). RCD must be pressure rated to the expected pressure to be encountered in the regional subsurface conditions.

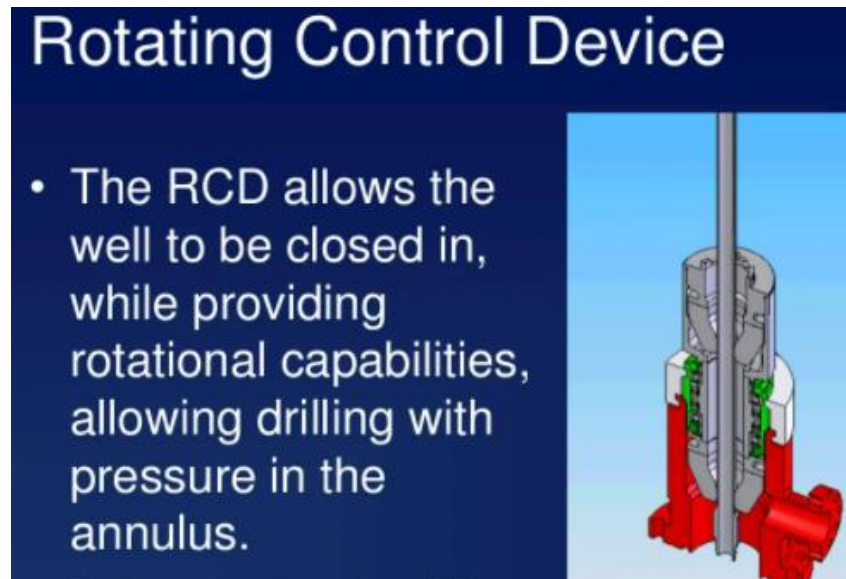


FIGURE 5-4: ROTATING CONTROL DEVICE

Source: Slideshare.net/SPE

5.5.4 Well Abandonment (Plug and Abandonment “decommissioning”)

Once drilling is completed, an unsuccessful well will be plugged and abandoned (P&A). The scope of well abandonment is to protect the environment by effectively sealing off all distinct permeable zones (i.e., the zones of potential hydrocarbons or water inflow penetrated by the well), to ensure that formation fluids are isolated, both within the wellbore and in annular spaces, and that their migration among different formations and/or up to the surface is prevented.

For unsuccessful wells, a cement plug setting job will be performed (Figure 5-5). The plugging and abandonment job will be final, in that no re-entry of the well is planned. The cement plugs are suitable to guarantee the effectiveness and integrity of the seal and are configured so that no future intervention and monitoring is required.

In the presence of a single permeable zone, the well will be isolated by means of at least one well barrier (plug). When the formation pore pressure from a permeable zone is expected to exceed the formation fracture pressure anywhere else in the open hole, two well barriers shall be present in order to prevent formation breakdown or underground blowout.

For each distinct permeable zone, two well barriers, referred to as “primary” and “secondary”, shall be present in order to prevent also cross flow to surface or vice versa. As per industry best practice, the primary well barrier envelope will have a well barrier element set across or above the highest point of potential influx (top permeable zone or top perforations) or as close as reasonably possible to it. The secondary well barrier shall have a well barrier element set in such a way to guarantee the sealing of the permeable zone in case of failure of the first well barrier.

The RCD will be then retrieved, and the wellbore will be flanged capped.

The final program for well plugging and abandonment will be finalized after the end of drilling phase and log evaluation, in order to maximize the number and composition of plugs sealing in the single or multiple permeable zones discovered.

At the end of the plug and abandonment operations, the well schematic and wellhead location (including casings dimension, length, cement plug dimension and composition, pressure and inflow test results etc.) will be included in a final report submitted to PASA.

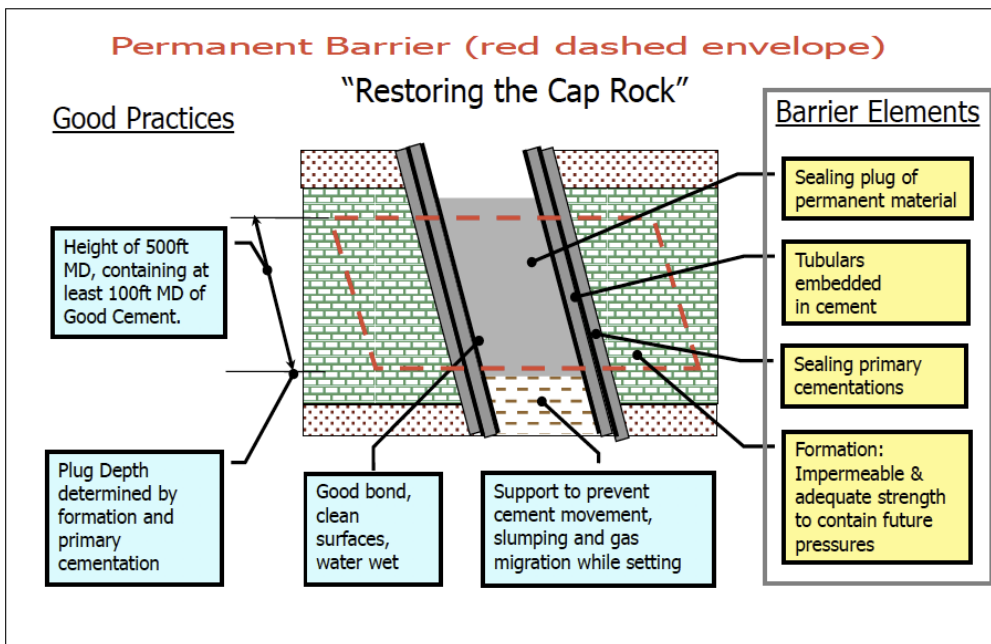


FIGURE 5-5: SCHEMATIC OF CEMENT PLUG AT BOTTOM HOLE

Source: Guidelines for the abandonment of Wells, p12 OGUK, 2015

5.5.5 Demobilisation

On completion of drilling, the drill rig and support trucks will leave the wellsite location. A final well site verification survey will be performed to check the condition of the wellsite.

5.6 HSE RISK MANAGEMENT DURING OPERATIONS

Rhino Oil & Gas's HSE (health, safety, environment) risk management will be implemented by the drilling contractor during operations. Rhino Oil & Gas is committed to protecting the health, safety and security of its employees and those of its contractors, to ensure that all activities are conducted in a manner that protects the environment and people who are potentially impacted by its operations.

5.7 PLANNED EMISSIONS, CUTTINGS HANDLING AND WASTE MANAGEMENT

This section presents the main sources of emissions to air, cuttings handling and waste that will result from the planned drilling activities and associated operations.

Waste management will follow South African regulations. Appropriately licenced waste disposal sites and waste management facilities will be identified prior to commencement of drilling.

5.7.1 Emissions to air

The principal sources of emissions to air from the proposed drilling campaigns could be from three (3) main sources:

- Exhaust emissions from diesel fuel used to generate power on the drill site. The power will be used for operating truck mounted drill rig, air compressors, miscellaneous equipment;
- Exhaust emissions from diesel fuel used by the supply trucks. The local logistics base will be in the vicinity and will minimise commute length and emissions;
- Flaring activities during well testing. Based on regional analysis and analog wells, mainly biogenic gas (CH₄) with traces of Helium (He) and geologic hydrogen (H₂) will be encountered. This gas will burn clean emitting mainly carbon dioxide (CO₂) and water (H₂O). No other polluting contaminants are expected such as Hydrogen sulfide (H₂S) or Mercury (Hg).

The emissions from diesel fuel will essentially be carbon dioxide (CO₂), sulphur oxides (SO_x), nitrogen oxides (NO_x) and carbon monoxide (CO). Relative to these pollutants, smaller quantities of non-methane volatile organic compounds (VOCs), methane (CH₄) and particulate matter (PM₁₀/PM_{2.5}) will also be released. These emissions are released during the normal operation of a diesel engine and have the potential to result in a minor short-term localised increase in pollutant concentrations. They also contribute to regional and global atmospheric pollution.

It is estimated that approximately 7 to 15 m³ of diesel fuel will be used during the operations of 1 well resulting in approximately 0.02 to 0.04 kt of GHG emissions being emitted to the atmosphere (<https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references#diesel>).

The emissions from the flaring activities will essentially be CO₂, He and water vapor. It is hard to predict a successful well flow performance ahead of a discovery. Based on regional analogues, flaring of 0.2 mmscfd of biogenic gas during 3 weeks of testing should generate approximately 0.23 kt of CO₂ GHG emitted to the

atmosphere per well test. It is worth noting, that the biogenic gas (CH₄) explored in the ER area is currently leaching into the atmosphere and is up to 80 times more potent than its combusted version (CO₂). Flaring gas reflect safe operations and should be considered GHG efficient (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator-revision-history>).

5.7.2 Cutting handling

For the first section (top hole) of the well, around 3 m² of topsoil will be picked up and dispersed in nearby field location. Once reaching deeper sections, the drilled rock formation will come back at surface in dust format while air drilling. Drilled rock formation if mud drilling will come back as cuttings. The overall volume is highly dependent on subsurface layering, overall depth to be drilled and the use or not of mud while drilling. In air drilling configuration, the volume of dust rock is estimated to be anywhere between 20 m³ for 600 m deep well and to 40 m³ to 1200 m deep well. Dust and Cuttings will be collected by Rhino Oil and Gas's drilling contractor and then transported in adequate containers to already identified specialized landfill for hazardous materials safe disposal or as directed by South Africa regulations.

5.7.3 Water management

To be prepared for water/liquid management, the wellsite will be provided with lined up sumps. The sumps will be used to temporarily dispose of subsurface water or drilling mud (if any). In the sumps, the water and mud will split/decant, and the solids will fall to the bottom. The volumes of liquid will largely be recovered with sub aqueous pumps for future drilling use, the small remainder naturally evaporating over a certain period of time with the hot ambient temperatures experienced in the Free State. This efficient dehydration process allows to handle smaller residual quantities. The remaining material will then be removed and handled by a hazardous waste company already identified by Rhino Oil and Gas's drilling contractor.

If water is intersected down hole, the hole will be reamed, casing installed, and a grouting job completed to seal off the water. The water in the hole will follow the same process as above.

5.7.4 Waste management

A number of other types of wastes generated during the drilling activities be transported for disposal.

These wastes will be recycled or re-used if possible or transported and disposed of at an appropriate licensed municipal landfill facility or at an alternative approved site.

5.7.5 Noise emissions

The main sources of noise from the proposed drilling programme include noise produced by the power generator and air compressor at the drill site. The noise characteristics and level will vary between 80 and 180 dB. The particular activity being conducted changes the noise characteristics, for example, if it is at idle, or providing full power to the truck mounted drill rig.

5.8 UNPLANNED EMISSIONS AND DISCHARGES

This section presents the main sources of emissions that will result from the unplanned/ accidental events during the drilling activities and associated operations.

5.8.1 Hydrocarbons and Chemical Spills

Two of the main types of unplanned/ accidental events that could occur while drilling wells that could result in a discharge of hydrocarbons or chemicals to the environment are loss of well containment and single event/batch spills.

Loss of well containment is a continuous release (in worst situation, with no control and massive release, it is called “well blowout”) which could last for a measurable period of time, while a single-event spill is an instantaneous or limited duration occurrence. Rhino Oil and Gas is not expecting to find any liquid hydrocarbon (oil) but only to find dry biogenic gas (already covered in the emissions section). The downhole pressures recorded in regional analog wells do not indicate any risk for potential long-term release.

Rhino Oil and Gas is committed to minimising the release of hazardous chemical discharge into the environment and avoiding unplanned spills.

In case of unplanned/ accidental events, Rhino Oil and Gas minimises any adverse effects to the environment and plans to accomplish this goal by:

- i) Incorporating chemical spill prevention into the drilling plans, and
- ii) Ensuring that the necessary contingency planning has taken place to respond effectively in the event of an incident.

In addition, precautions are taken to ensure that all chemicals and petroleum products handled in a manner to minimise the potential for a spill and environmental damage in the event of an unplanned/ accidental release.

5.9 PROJECT ALTERNATIVES

One of the objectives of an EIA is to investigate alternatives to the project.

In relation to a proposed activity “alternatives” means different ways of meeting the general purposes and requirements of the proposed activity. Appendix 2 Section 2 (h)(i) of the EIA Regulations, 2014 (as amended), requires that all S&EIR processes must identify and describe alternatives to the proposed activity that are feasible and reasonable. Different types or categories of alternatives can be identified, e.g., location alternatives, type of activity, design or layout alternatives, technology alternatives and operational alternatives. The ‘No-Go’ or ‘No project’ alternative must also be considered.

Not all categories of alternatives are applicable to all projects. The consideration of alternatives is inherent in the detailed design and the identification of mitigation measures, and therefore, although not specifically

assessed, alternatives have been and will continue to be considered in the design and EIA processes. Despite many advances in geophysical data acquisition and analysis, currently no alternatives exist to definitively establish the presence of hydrocarbon reserves other than through exploration drilling. No activity alternatives have therefore been assessed.

A summary is provided below of the alternatives considered for this application.

5.9.1 Site Locality Alternative

5.9.1.1 Drilling Location

Rhino Oil and Gas is the operator and holds Exploration Rights for Block ER 318. Both aeromagnetic and gravimetric airborne surveys have been undertaken over Blocks within ER 318 and possible Target Areas were identified. Based on the interpretation of the geophysical information, Rhino Oil and Gas have identified three Target Areas covering a limited area of ER 318, in which they are considering undertaking exploration drilling activities in order to determine the presence and viability of the reserve.

The selection of each drill site location will follow an iterative process based on:

- Lawful entitlement in terms of the MPRDA, namely the full extent of Rhino Oil and Gas's ER;
- Prospective geology identified as part of previous geophysical surveys;
- Desktop GIS environmental sensitivity taking into consideration hydrological, geohydrological, ecological and cultural heritage constraints and opportunities;
- Consultation with landowners to agree access to the proposed sites; and
- Micro siting by petroleum geologist and environmental specialists considering the local situation and landowner preferences.

The micro siting will be concluded as part of this S&EIA process.

5.9.1.2 Logistics Base

A logistics base will be located near Welkom in vicinity to where the drilling contractor has enough momentum between its other local activities (shared facilities with Renegen). For drill sites that will be far away from that logistics base, an alternative base might be considered. This S&EIA will assess the impacts from a logistics base in Welkom.

There are no noticeable differences associated with the location of the logistic base in Welkom or more to the East towards Kroonstad.

5.9.2 Technology Alternative

5.9.2.1 Drilling Rig Alternatives

There is a range of drilling rigs available to conduct the drilling of a shallow onshore well. There are essentially 4 possible rigs to be considered:

- Coring drilling rig: usually used in mining type activities, not very efficient in handling hydrocarbons;
- Percussion air drilling rig: usually used in drilling water wells, can be used in very low-pressure hydrocarbons exploration but with limited ability to control well in un-expected kick situation;
- Rotating mud drilling rig: usually used in traditional hydrocarbon drilling activities, can handle high pressure reservoir but totally inefficient in low pressure naturally fractured reservoir (mud circulation losses and reservoir clogging); and
- Hybrid air/mud drilling rig: usually use for drilling water wells, can be used in very low pressure naturally fractured reservoir and ability to handle unexpected higher pressure with mud injection for well control.

Rhino Oil and Gas's preference is to use the hybrid air/mud drilling rig provided by the local South Africa experienced drilling contractor.

5.9.2.2 Design or Layout Alternatives

5.9.2.2.1 Number of Wells

Rhino Oil and Gas proposes to drill:

1. At least 1 well within each Target Area;
2. A campaign of 10 initial wells for ER 318;
3. With possible additional wells to supplement initial campaign in successful outcome.

The time sequence and the number of additional wells will be dependent on the success of the first exploration well.

Any additional wells will be drilled in a campaign with potentially up to 3 rig lines (parallel drilling).

5.9.2.2.2 Scheduling

The drilling of the first exploration well, is planned for 2023, dependent on drill rig availability, amongst a number of other planning requirements. The drilling of one well is estimated to take approximately 25 to 30 days to complete. The time sequence and the number of additional wells will be dependent on the results of the first exploration well and the interpretation of its results.

5.9.3 No-Go Option

The impact of the No-Go alternative is assessed in Section 8 of this report, in accordance with the requirements of the EIA Regulations, 2014 (as amended). The No-Go alternative entails no change to the status quo, in other words the proposed exploration drilling activities will not be conducted in ER 318.

The option not to proceed with exploration drilling will leave the areas of the potential drilling sites in their current environmental state, with the biogenic gas, helium and geological hydrogen potential remaining unknown.

This alternative is in contravention of South Africa's overall strategic objectives with a No-Go (assuming a viable hydrocarbon source would be discovered) resulting in:

- No improved security of gas/power supply for both businesses and households;
- Not being able to make competitively priced locally produced natural gas available;
- No in-country investments in a development project with associated job creation, increased government revenues and general contribution to economic growth;
- Not being able to help with the transition to a low carbon economy to meet South Africa's Paris Agreement obligations, and
- Increased dependence on imported Liquefied Natural Gas and coal for baseload power and industrial heat.

6. DESCRIPTION OF THE AFFECTED ENVIRONMENT

This chapter is aimed at providing the reader with general information on relevant environmental (geographical, physical, biological, social, economic, heritage and cultural) aspects associated with the Well Drilling ER application area. This assessment thus identifies environmental sensitivities within the Well Drilling ER application area, at a high-level and using currently available information.

Baseline information for this Scoping Report was sourced through a desktop study and draws extensively on information contained in studies that have been conducted by various government departments and non-government environmental organisations responsible for the area covered by the Well Drilling ER application. Several sources were used for this section, including:

- Provincial Biodiversity Conservation Plans;
- Data held by the South African National Biodiversity Institute (SANBI), World Wildlife Fund (WWF), BirdLife SA, Animal Demography Unit (ADU) and provincial conservation bodies etc;
- National Freshwater Priority Areas project;
- The International Union for the Conservation of Nature (IUCN) Red Data List of species;
- Available internet information on environmental issues related to exploration and production;
- Mining and Biodiversity Guideline;
- Available internet information on the baseline environment within the Well Drilling ER application area;
- Topocadastral and geological maps covering the Well Drilling ER application area at scales ranging from 1:50 000 to 1:250 000;
- Previous reports undertaken by SLR for the project area; and
- Municipality Integrated Development Plans and/or Municipality Spatial Development Frameworks

Where appropriate, more detailed information will be provided in the EIA Report once further investigations has been concluded.

6.1 CLIMATE

Rainfall across the Target Areas is limited to the summer months and is mostly in the form of thunderstorms.

Regional Mean Annual Precipitation (MAP) can vary between 544 mm to 668 mm per annum. Day temperatures reach a maximum of up to 28°C in the months of January and December (the hottest months of the year), whilst the lowest night temperatures can drop to a minimum of -5°C.

The wettest six months of the year are between October and March, with maximum precipitation occurring in December at an average of 112 mm and approximately 19.5 days of precipitation. On average 10 days of frost are experienced in the winter month of July, which is also the driest month of the year (Source: <https://www.meteoblue.com/>).

6.2 GEOLOGY

6.2.1 Regional Setting

The proposed Well Drilling ER application area lies in the north east of the Karoo Basin (see Figure 6-1). The main Karoo Basin in South Africa formed as a result of compression predominantly associated with flexural subsidence, characteristic of foreland basins, during the assembly of the Gondwana super-continent. Consensus on the tectonic setting of the basin, however, remains debated (Tankard et al., 2012; Schreiber-Enslin et al., 2014). The Karoo Basin represents a diverse and complex suite of rock units with an aerial extent of roughly 600 000 square kilometres that attains a maximum sedimentary thickness of 12 kilometres. The north east of the basin is host to several distinct facies of rocks that vary between shore face, fluvial and lacustrine sediments, deposited between the Permian and Triassic.

The deposition of Karoo Supergroup sediments ended in the early Jurassic during the emplacement of the igneous rocks that constitute the Drakensberg Group. The preserved basalts and dolerites attain a maximum thickness of approximately 1 400 m in the Lesotho area. The northern flank of the basin is defined by the erosional limits of the late Carboniferous-Permian Dwyka and Ecca Groups, where they unconformably overlay Archean-Cambrian age, Kaapvaal and Namaqua-Natal basement. The Ecca Supergroup consists mainly of sandstone and shale from the Permian period. The Dwyka Formation within the proposed Well Drilling ER application area consists mainly of tillite from the Carboniferous period.

6.2.2 Resource assessment

Resource assessments of the Karoo Basin have historically emphasised the world-class coal reserves that have dominated the energy history of South Africa. Some limited onshore exploration for hydrocarbon occurrences was undertaken in the 1960s, but no commercial hydrocarbon occurrences were discovered. However, it is expected that the north-east Karoo Basin has potential for a tremendous diversity of hydrocarbon resources including shale oil and shale gas, coalbed methane, helium and biogenic gas.

One of the complications recognised during the initial resource exploration effort undertaken in the 1960s was the widespread occurrence of dolerite dykes, especially in the north-east Karoo Basin. The thermal effects of these dykes led some early researchers to state that the dykes were required for distillation of hydrocarbons from adjacent coal and shale beds. The complexity of these dyke intrusions, well documented in the shallow north-east Karoo coal fields, makes it difficult to understand the geometry of any possible reservoir horizons in the adjacent sediments. As a result, there is poor understanding of the relationship between the observed non-commercial oil and gas occurrences and any structural control. Further compounding the perception of an absence of commercial hydrocarbons in the Karoo Basin was the documentation of low-permeability conditions in most drill holes. This led many researchers to conclude that the rocks possessed too low a permeability to produce hydrocarbons and porosities too low to trap them.

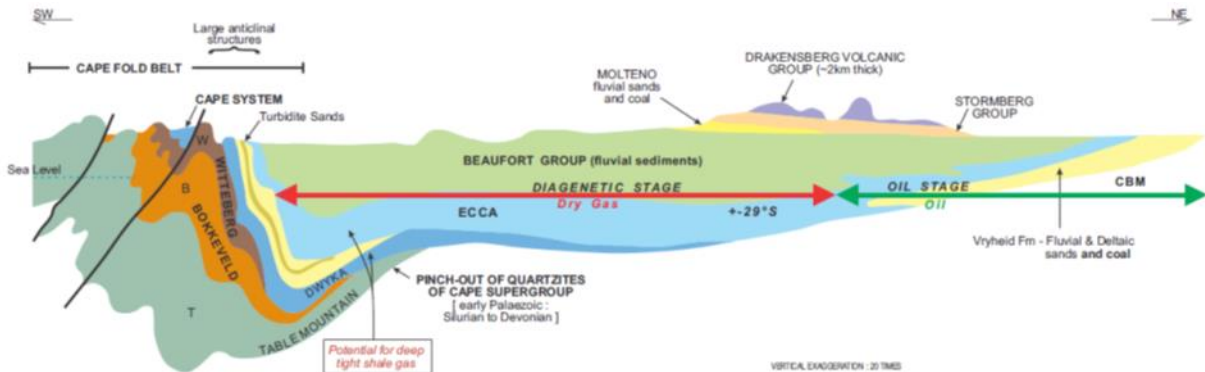
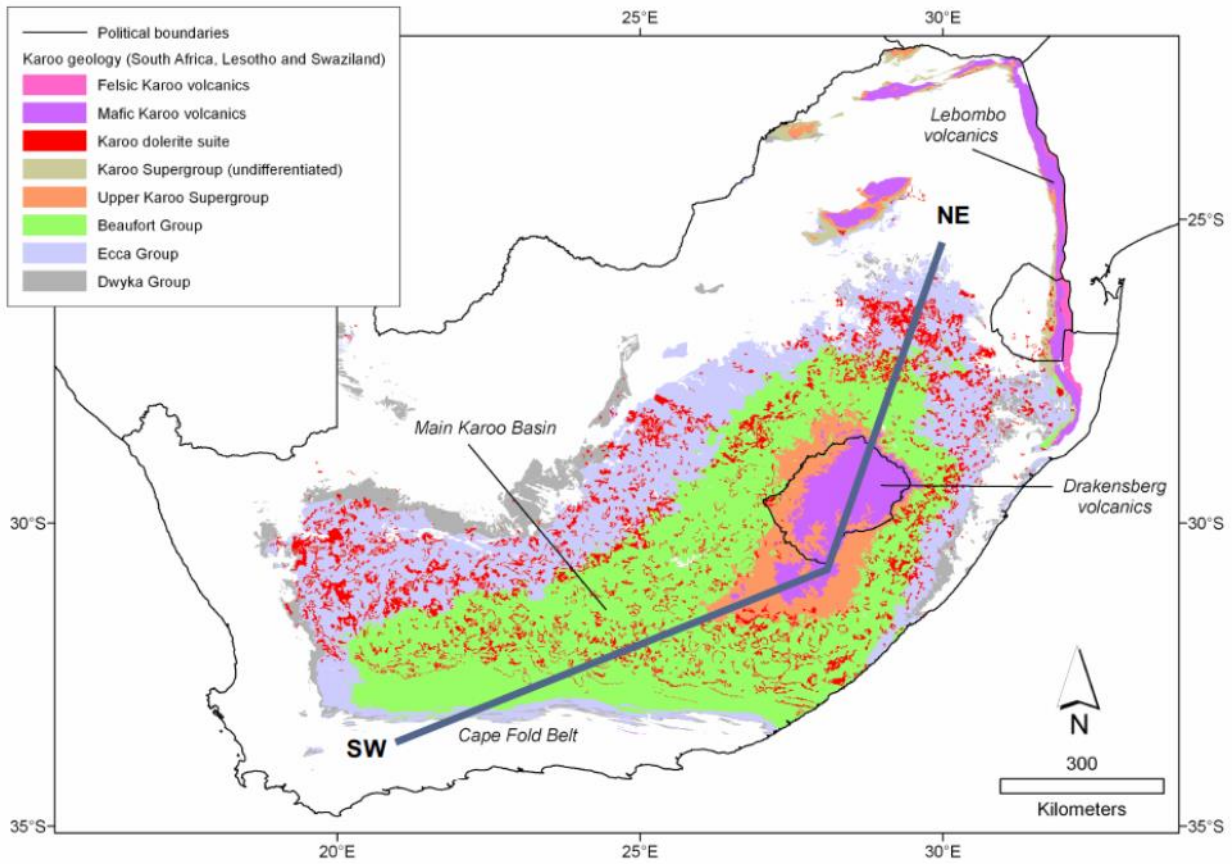


FIGURE 6-1: SIMPLIFIED GEOLOGY OF THE KAROO BASIN

Source: PRASA Brochure

6.2.3 Seismicity

The Southern African region is considered to be relatively stable from a seismic perspective. South Africa is located on the African tectonic plate, which includes the African continent and parts of the floor of the Atlantic and Indian Oceans. In general earth tremors and quakes are infrequent and generally of low magnitude. The largest ever recorded earthquake to occur in South Africa was the Ceres-Tulbagh Earthquake, which occurred in September 1969, and had a magnitude of 6.3 on the Richter Scale.

There are areas in South Africa with higher peak ground acceleration which indicates a greater likelihood of earthquakes. These are found in the Western Cape region and in parts of the northern and western Free State, as well as the Witwatersrand. In general, the Well Drilling ER application area is not located in a region with high levels of seismicity although minor earth tremors have been recorded in the recent past.

6.3 SOILS AND LAND CAPABILITY

Soils across the proposed exploration area are extremely diverse with soils ranging in structure and composition. The majority of soils within the study area are considered Lithic and Duplex and to lesser degree Oxidic. Lithic soils are young soils with orthic topsoil but weakly developed subsoil. Oxidic and Duplex soils both have orthic topsoils and are soils with a special subsoil relating to their pedogenic accumulation. Other less common or in lesser concentration soils include Cumulic and Gleyic soils.

Land capability of the region is largely tied to topography (slope), rainfall and altitude. Regions with steeper gradients and higher altitudes generally have lower agricultural potential.

6.4 LAND USE AND COVER

Land cover across large parts of the region comprises natural rangeland. The majority of the ER area consists of grassland (see Figure 6-2). Cultivated areas are evident across the region, except in the areas of high altitude and steep slope.

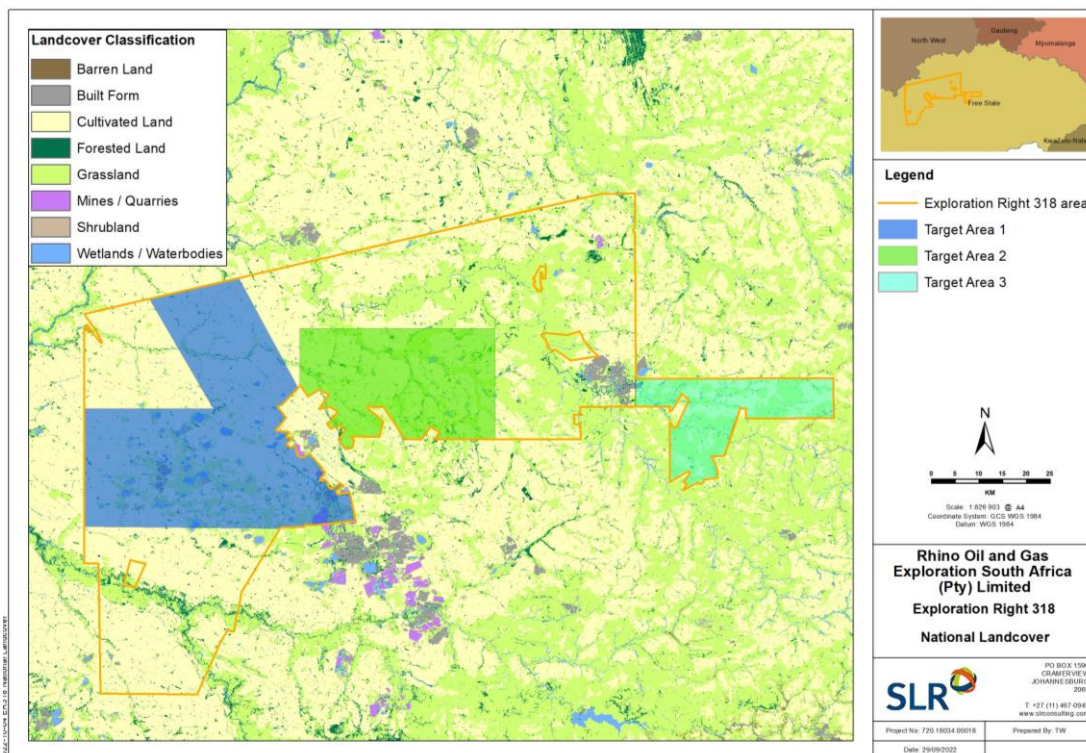


FIGURE 6-2: NATIONAL LANDCOVER DATABASE (2020)

6.4.1 Land Cover

6.4.1.1 Agricultural activities

The area is home to significant commercial agriculture. Agricultural activities associated with the area include a combination of crop production, animal production, horticulture, dairy farming, game farming, aquaculture, fruit production and agro-processing. Major crops are maize, soybeans, wheat, sorghum, sunflowers, potatoes, groundnuts and wool. Much is dryland but there are areas of irrigated crops. The main vegetable is asparagus, both of the green and white varieties. The large majority of the land is used for extensive livestock grazing (cattle and sheep). Subsistence farming is mostly associated with the towns where residents run livestock on the townlands

6.4.1.2 Main towns

The main towns located within the proposed Well Drilling exploration area include the following:

- Kroonstad;
- Wesselsbron; and
- Odendaalsrus.

These towns comprise numerous buildings such as schools, sports facilities, hospitals/clinics, shops, local farm co-operations and designated residential areas.

6.4.1.3 Local road network

Numerous tarred provincial roads are located within the proposed exploration area. These include the following:

- The R76 from Kroonstad to Viljoenskroon;
- The R30 from Bothaville to Odendaalsrus and Welkom; and
- The R719 between Bultfontein and Wesselsbron.

That national tarred road (N1) also traverses a portion of the proposed exploration area connecting Kroonstad to Johannesburg. Further to this, numerous gravel roads are located within the Target Areas predominately associated with access to farms.

Existing Mineral Rights

Rhino Oil and Gas will shortly submit a request to the Regional office of the DMRE for information on properties on which there are existing prospecting or mining rights (for non-petroleum minerals), and/or for which applications for prospecting or mining rights have been submitted. If there are overlapping rights Rhino Oil and Gas will engage with the holders prior to the undertaking of any well drilling.

Land Claims

Rhino Oil and Gas will shortly submit a request to the provincial office of the Commission on Restitution of Land Rights for information on properties with the Well Drilling ER area on which there are existing Land Claims.

Core Astronomy Areas

To date no Core or Central Astronomy Advantage Areas have been declared within the Well Drilling ER area.

6.5 HYDROLOGY

6.5.1 Catchments and River Systems

The well drilling ER area falls within the Middle Vaal Water Management Area (WMA). The Vaal River is the only main river in the Middle Vaal WMA. It flows in a westerly direction from the Upper Vaal water management area, to be joined by the Skoonspruit, Rhenoster, Vals and Vet Rivers as main tributaries from the Middle Vaal water management area, before flowing into the Lower Vaal water management area and then into the Orange River. The Middle Vaal WMA covers a catchment area of approximately 44 803 km². The total water requirements in the Middle Vaal WMA is 872 million m³/annum.

The Middle Vaal WMA consists of numerous quaternary catchments. The characteristics of the quaternary catchments located within the well drilling ER area are included in Table 6-1 below. Figure 6-3 illustrates the distribution of the quaternary catchments within the Well Drilling ER area.

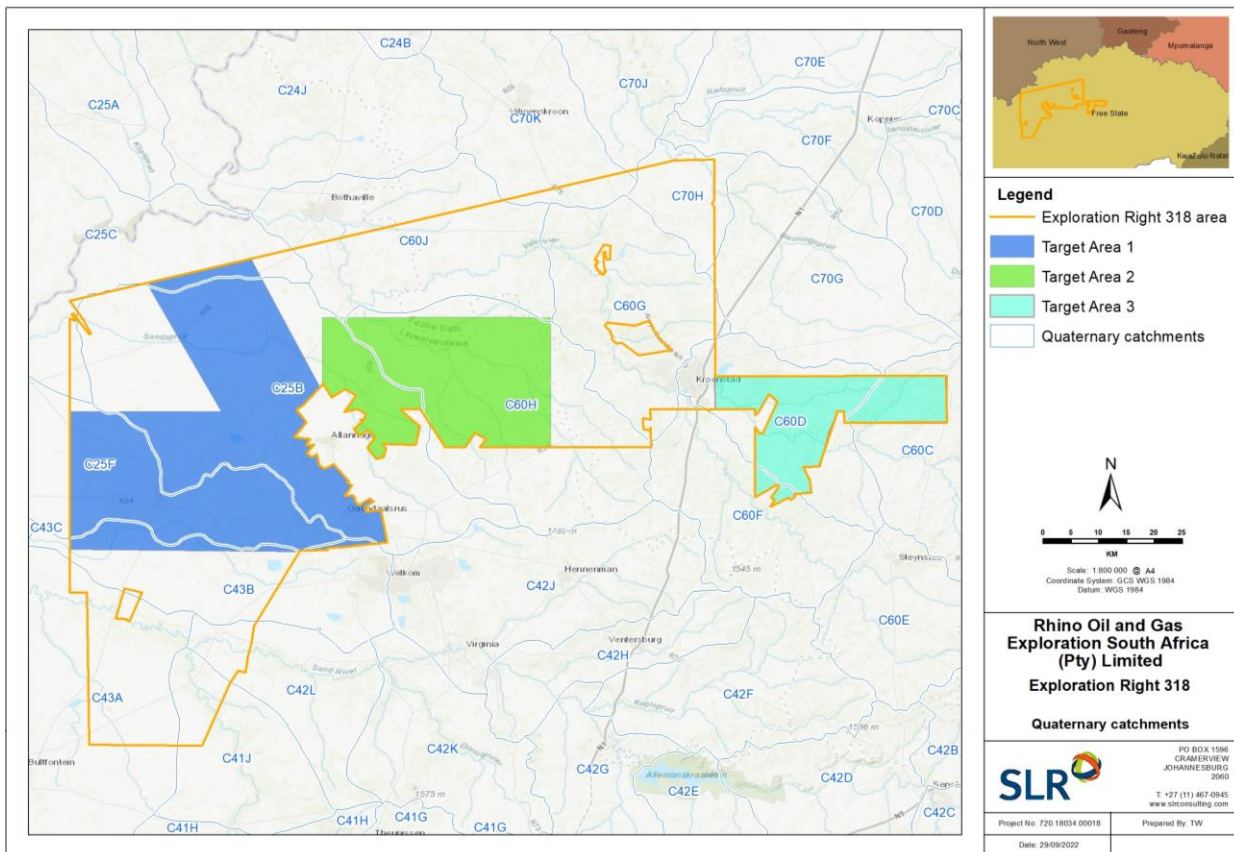


FIGURE 6-3: WATER MANAGEMENT AREAS AND CATCHMENTS

TABLE 6-1: QUATERNARY CATCHMENT CHARACTERISTICS (SLR, 2015)

Water management area	Quaternary catchment	Mean annual Runoff (mcm)	Catchment area (km ²)
Middle Vaal WMA	C25B	9.4	1888
	C25C	6.6	1210
	C25F	8.1	2219
	C43A	6	1491
	C43B	3.3	723
	C60F	17.87	659
	C60D	16.66	645
	C60C	28.63	1048
	C60G	16.4	782
	C60H	4.2	1232
	C70H	3.99	251
	C70K	10.9	891

6.5.2 Major Dams

The Vaal River is located within the ER and is one of South Africa's strongest-flowing rivers (see Figure 6-4). The Vaal dam itself falls outside of the ER. Several other small dams and numerous farm dams are located within the proposed Well Drilling ER area, which are largely used for livestock and domestic purposes.

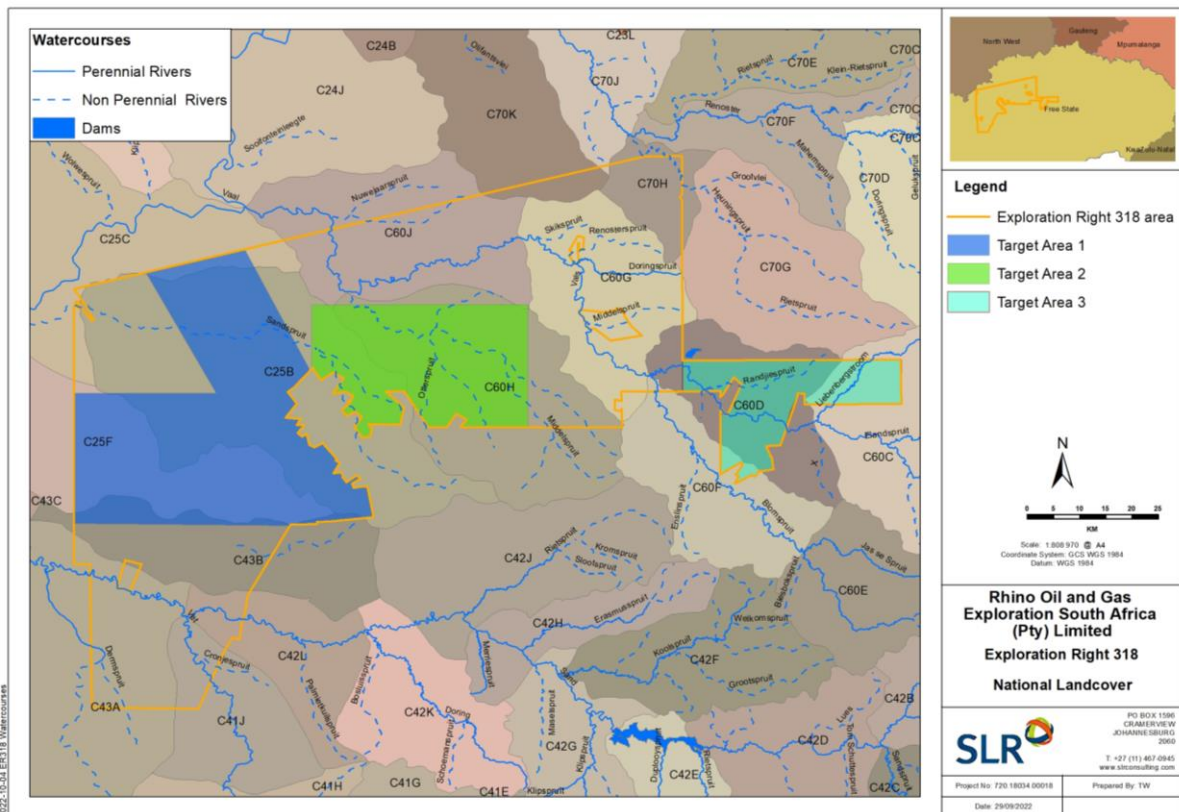


FIGURE 6-4: WATER RESOURCES

6.5.3 Wetlands

Based on the National Freshwater Ecosystem Priority (NFEPA) wetland database (2011) the Target Areas include a significant number of wetlands ranging in hydrogeomorphic classification, including:

- Channelled valley-bottom wetlands;
- Depressions;
- Flat;
- Floodplain wetlands;
- Seep;
- Unchannelled valley-bottom wetlands; and
- Valleyhead seeps.

For reference, the location of the NFEPA wetlands within the Target Areas are illustrated in Figure 6-5. More detailed information on wetland presence will be provided in the EIA report, following the following the relevant Biodiversity Studies.

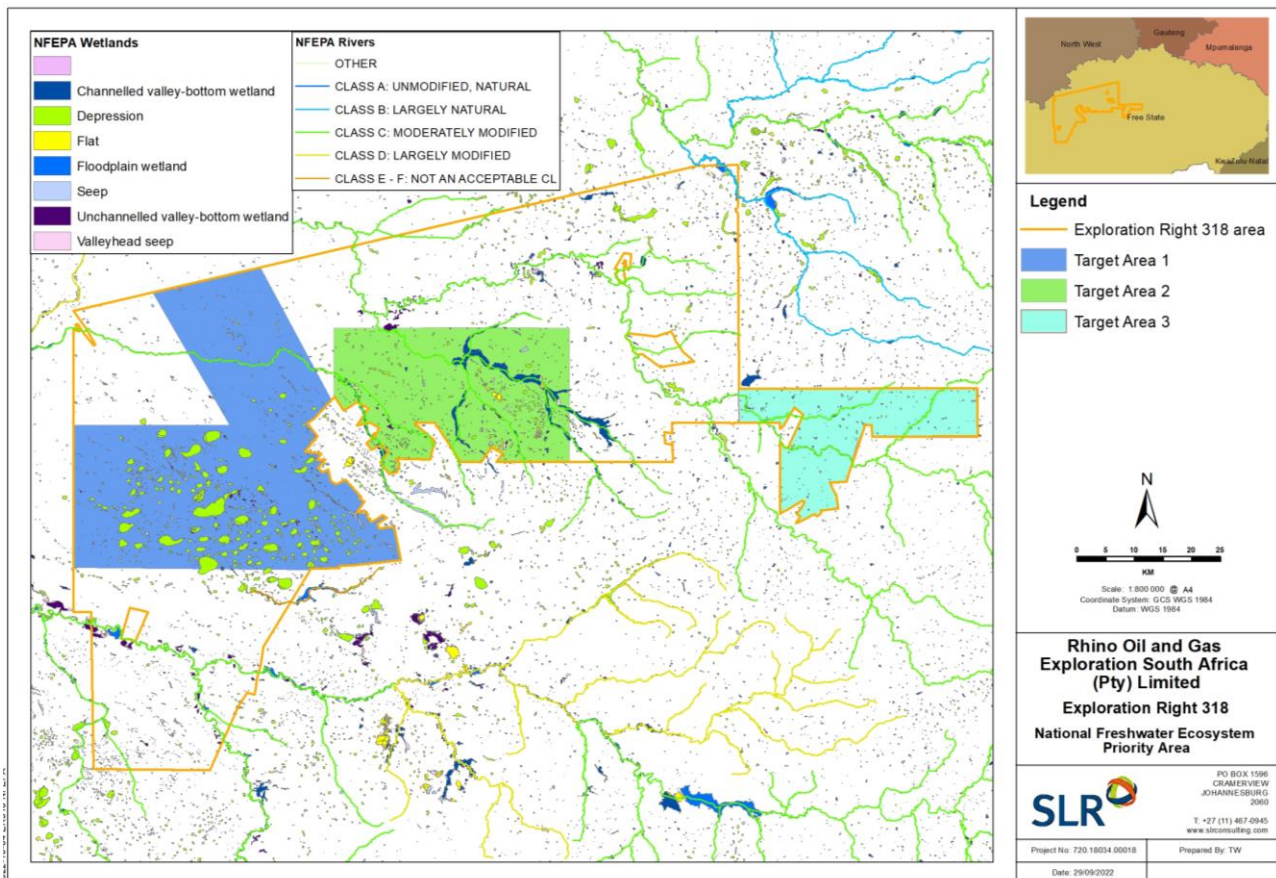


FIGURE 6-5: NFEPA WETLANDS WITHIN THE TARGET AREAS

6.5.4 Surface Water Use

Surface water use consists of a combination of domestic, livestock use and irrigation for crop production on farms. Rivers within the Target Areas are tributaries of the Vaal Dam which is utilised for domestic, industrial

and recreational purposes such as water sports and fishing. The Vaal Dam is a vital resource for water supply to Gauteng.

6.6 GROUNDWATER

6.6.1 Aquifer Classification

The Target Areas are located within an area classified as a minor aquifer region, which implies a moderately yielding aquifer system of variable water quality in terms of the Aquifer Classification Map of South Africa. Certain parts of the Well Drilling ER area are classified as poor aquifer regions, which implies a low to negligible yielding aquifer system with moderate to poor water quality. Although borehole yields in the deeper aquifer are generally, considered low, structural features such as faults and fractures can produce higher yielding boreholes.

Aquifer vulnerability indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. In terms of the Well Drilling ER area, the aquifer vulnerability in accordance with the Aquifer Vulnerability Map of South Africa (Conrad et al. 1999c), varies between 'least' and 'moderate' vulnerability. The areas of 'least' vulnerability are areas that are only vulnerable to conservative pollutants in the long term when continuously discharged or leached. The areas of 'moderate' vulnerability are areas which are vulnerable to some pollutants, but only when continuously discharged or leached.

Aquifer susceptibility indicates the qualitative measure of the relative ease with which a groundwater body can be potentially contaminated by anthropogenic activities and includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification. In terms of the Aquifer Susceptibility Map of South Africa (Conrad et al, 1999b), the Well Drilling ER area is associated with a 'low' to 'medium' susceptibility aquifer.

6.6.2 Groundwater Quality

The Groundwater Quality Map of South Africa (Conrad et al, 1999b) indicates that the groundwater quality that can be expected within the Well Drilling ER area has electrical conductivity concentrations from low (0 – 70 mS/m) to 150 – 370 mS/m where the water will have a noticeable salty taste. More detailed information will be provided in the EIA report, following the Geohydrology Study.

6.6.3 Groundwater Use

There is significant groundwater use at a local scale with many farmers dependent on the abstraction of groundwater for both potable water as well as for stock watering and in some cases irrigation. More detailed information will be provided in the EIA report, following the Geohydrology Study.

6.7 AIR QUALITY

The majority of the proposed Well Drilling ER area is rural in nature and is comprised mostly of small towns, isolated farmsteads, scattered communities and agricultural activities such as livestock grazing and crop cultivation. It follows that the air quality associated with majority of the area is expected to be good. The quality of air within and near to major towns is expected to be reduced due to various factors such as vehicle emissions and industrial operations. Existing emission sources within the proposed Well Drilling ER application area include fugitive dust from paved and unpaved roads, wind erosion from open areas, household fuel combustion (fuel and coal), vehicle exhaust emissions and smoke from veld fires in winter and stack emissions from industries.

6.8 BIODIVERSITY

Biodiversity refers to flora (plants) and fauna (animals). According to the International Union for Conservation of Nature (IUCN) (2011), biodiversity is crucial for the functioning of ecosystems which provide us with products and services which sustain human life. Healthy ecosystems provide us with oxygen, food, fresh water, fertile soil, medicines, shelter, protection from storms and floods, stable climate and recreation.

A brief description of fauna and flora located within the ER application area is provided below. More detailed information will be provided in the EIA report, following the relevant Biodiversity Studies.

6.8.1 Flora

The proposed Target Areas are located within the Grassland Biome and the Savannah Biome. The Grassland Biome comprises the Dry Highveld Grassland Bioregion and Sub-escarpment Savanna including an Inland Azonal Vegetation area. For detail pertaining to the various vegetation units located within the proposed Target Areas refer to Table 6-2. The distribution of the various vegetation units within the Target Areas is illustrated in Figure 6-6.

TABLE 6-2: BIOMES AND VEGETATION UNITS

Biome	Bioregion/Azonal Areas	Vegetation Unit	Conservation Status
Grassland Biome	Dry Highveld Grassland	Vaal-Vet Sandy Grassland	Endangered
		Eastern Free State Clay Grassland	
		Western Free State Clay Grassland	Least Concern
		Vredefort Dome Granite Grassland	Vulnerable
	Central Free State Grassland	Least Concern	
	Sub-Escarpment Grassland bioregion		Vulnerable
Savannah Biome	Sub-escarpment Savanna	Eastern Kalahari Bushveld Bioregion	Least Concern
Azonal Vegetation	Alluvial Vegetation	Highveld Alluvial Vegetation	Least Concern

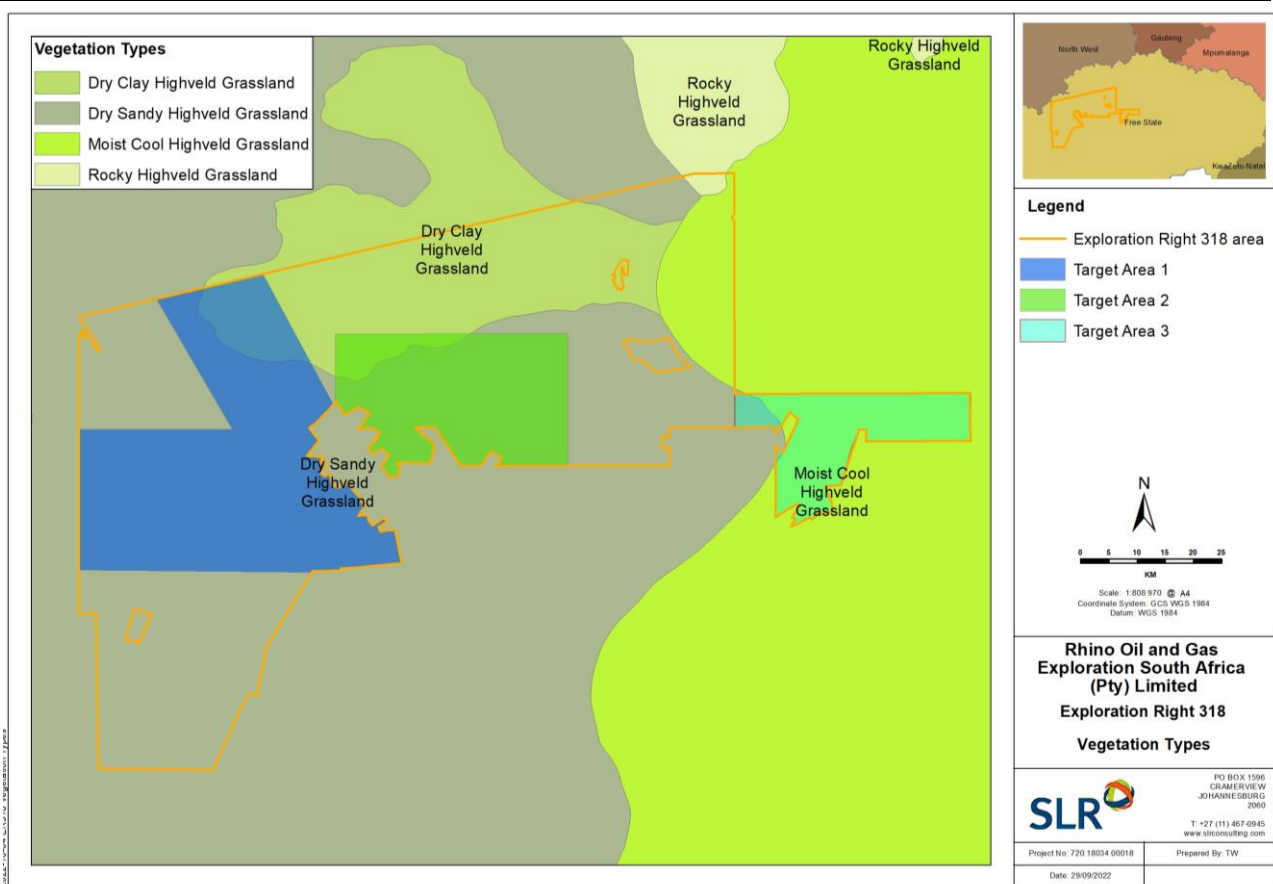


FIGURE 6-6: VEGETATION TYPES

Source: Mucina & Rutherford, 2006

6.8.2 Fauna

Numerous faunal species such as birds, amphibians, reptiles, mammals, fish and insects are associated with the various vegetation units located in the Well Drilling ER area. Species of concern that area likely to occur within the proposed exploration area are included in Table 6-3 below (SLR, 2015).

TABLE 6-3: MAMMAL SPECIES OF CONCERN LIKELY TO OCCUR WITHIN THE TARGET AREAS

Common name	Species	IUCN Status	Nature Conservation Bill
Aardvark	<i>Orycteropus afer</i>	LC	Protected
Aardwolf	<i>Proteles cristatus</i>	LC	Protected
African rock python	<i>Python sebae natalensis</i>	-	Protected
African wildcat	<i>Felis libyca</i>	-	Protected
All species of house snake	<i>Genus Lamprophis</i>	-	Protected
All species of otter	<i>Family Mustelidae</i>	-	Protected
All species of terrestrial tortoise	<i>Family Testudinidae</i>	-	Protected
All species of girdled lizard	<i>Family Cordylidae</i>	-	Protected
All species of chameleon	<i>Family Chamaeleonidae</i>	-	Protected
All species of monitor	<i>Family Varanidae</i>	-	Protected

Common name	Species	IUCN Status	Nature Conservation Bill
Bat-eared fox	<i>Otocyon megalotis</i>	LC	Protected
Black-footed cat	<i>Felis nigripes</i>	VU	Protected
Brown hyaena	<i>Hyaena brunnea</i>	NT	Protected
Civet	<i>Civettictis civetta</i>	LC	Protected
Hedgehog	<i>Erinaceus frontalis</i>	LC	Protected
Honey badger	<i>Mellivora capensis</i>	LC	Protected
Klipspringer	<i>Oreotragus oreotragus</i>	LC	Protected
Leopard	<i>Panthera pardus</i>	NT	Protected
Oribi	<i>Ourebia ourebi</i>	LC	Protected
Roan antelope	<i>Hippotragus equinus</i>	LC	Protected
Sable antelope	<i>Hippotragus niger</i>	LC	Protected
Scaly anteater	<i>Manis temminckii</i>	VU	Protected
Serval	<i>Leptailurus serval</i>	LC	Protected
Smith's red rock rabbit	<i>Pronolagus rupestris</i>	LC	Protected
Suricate	<i>Suricata suricata</i>	LC	Protected
Tsessebe	<i>Damaliscus lunatus</i>	LC	Protected
Vaal rhebok	<i>Pelea capreolus</i>	LC	Protected
Cape mole rat	<i>Georychus capensis yatesi</i>	NYBA	-
Sclater's golden mole	<i>Chlorotalpa sclateri montana</i>	NYBA	-
Highveld golden mole	<i>Amblysomus septentrionalis</i>	NT	-
Rough-haired golden mole	<i>Chrysospalax villosus rufopallidus</i>	NYBA	-
Rough-haired golden mole	<i>Chrysospalax villosus rufus</i>	NYBA	-
Juliana's golden mole	<i>Neamblysomus julianae</i>	VU	-
Robust golden mole	<i>Amblysomus robustus</i>	VU	-
Meester's golden mole	<i>Amblysomus hottentotus meesteri</i>	NYBA	-
Laminate vlei rat	<i>Otomys laminatus</i>	LC	-
Peak-saddle horseshoe bat	<i>Rhinolophus blasii empusa</i>	NYBA	-
Lesser long-fingered bat	<i>Miniopterus fraterculus</i>	LC	-
Welwitsch's hairy bat	<i>Myotis welwitschii</i>	LC	-
Short-eared trident bat	<i>Cloetis percivali australis</i>	NYBA	-
African striped weasel	<i>Poecilogale albinucha</i>	LC	-
Pangolin	<i>Manis temminckii</i>	LC	-
Aardwolf	<i>Proteles cristatus</i>	LC	-
Natal red rock rabbit	<i>Pronolagus crassicaudatus ruddi</i>	NYBA	-

LC = Least Concern, VU = Vulnerable, NT = Near Threatened, CR = Critical Endangered, EN = Endangered, NYBA=Not yet been assessed

TABLE 6-4: AVIFAUNA SPECIES OF CONCERN LIKELY TO OCCUR WITHIN THE PROPOSED TARGET AREAS

Common name	Species	IUCN Status
All bulbuls	<i>Family Pycnonotidae</i>	LC
All crows	<i>Family Corvidae</i>	LC
All mousebirds	<i>Family Colidae</i>	LC
Cape Turtle Dove	<i>Streptopelia capicola</i>	LC
Common Quail	<i>Coturnix coturnix</i>	LC
Egyptian Goose	<i>Alopochen aegyptiacus</i>	LC
Grey-winged Francolin	<i>Scleroptila africanus</i>	LC
Helmeted Guinea-fowl	<i>Numida meleagris</i>	LC
Laughing Dove	<i>Streptopelia senegalensis</i>	LC
Orange River Francolin	<i>Scleroptila levaillantoides</i>	LC
Red-knobbed Coot	<i>Fulica cristata</i>	LC
Red-billed Teal	<i>Anas erythrorhyncha</i>	LC
Red-eyed Dove	<i>Streptopelia semitorquata</i>	LC
Red-winged Francolin	<i>Francolinus levaillanti</i>	LC
Red-winged Starling	<i>Onychognathus morio</i>	LC
Reed Cormorant	<i>Phalacrocorax africanus</i>	LC
Rock Pigeon	<i>Columba guinea</i>	LC
South African Shelduck	<i>Tadorna cana</i>	LC
Spur-winged Goose	<i>Plectropterus gambensis</i>	LC
Swainson's Spurfowl	<i>Pternistis swainsonii</i>	LC
White-breasted Cormorant	<i>Phalacrocorax lucidus</i>	LC
White-faced Duck	<i>Dendrocygna viduata</i>	LC
Yellow-billed Duck	<i>Anas undulata</i>	LC
Whitewinged Flufftail	<i>Sarothrura ayresi</i>	CR
Rudd's Lark	<i>Heteromira fra ruddi</i>	VU
Yellowbreasted Pipit	<i>Hemimacronyx chloris</i>	NYBA
Bald Ibis	<i>Geronticus calvus</i>	VU
Botha's Lark	<i>Spizocorys fringillaris</i>	EN
Wattled Crane	<i>Bugeranus carunculatus</i>	VU
Blue Crane	<i>Anthropoides paradiseus</i>	VU
Grey Crowned Crane	<i>Balearica reguloru,</i>	NYBA
Blue Swallow	<i>Hirundo atrocaerulea</i>	VU
Pinkthroated Twin-spot	<i>Hypargos margaritatus</i>	LC
Chestnutbanded Plover	<i>Charadrius pallidus</i>	NT
Striped Flufftail	<i>Sarothrura affinis</i>	LC
Southern Ground Hornbill	<i>Bucorvus leadbeateri</i>	VU
Blackrumped Buttonquail	<i>Turnix hottentotta nana</i>	NYBA

Common name	Species	IUCN Status
Blue Korhaan	<i>Eupodotis caerulescens</i>	NT
Stanley's Bustard	<i>Neotis denhami</i>	NT
African Marsh Harrier	<i>Circus ranivorus</i>	LC
Grass Owl	<i>Tyto capensis</i>	LC
Whitebellied Korhaan	<i>Eupodotis cafra</i>	NYBA
Saddlebilled Stork	<i>Ephippiorhynchus senegalensis</i>	LC
Lappetfaced Vulture	<i>Torgos tracheliotos</i>	VU
Whiteheaded Vulture	<i>Trionocephs occipitalis</i>	VU
Bateleur	<i>Terathopius ecaudatus</i>	NT
Cape Vulture	<i>Gyps coprotheres</i>	VU
Martial Eagle	<i>Polemaetus bellicosus</i>	VU
Peregrine Falcon	<i>Falco peregrinus minor</i>	NYBA
Taita Falcon	<i>Falco fasciinucha</i>	NT

TABLE 6-5: ARACHNID SPECIES OF CONCERN LIKELY TO OCCUR WITHIN THE PROPOSED TARGET AREAS

Common name	Species	IUCN Status	Nature Conservation Bill
Baboon spider	<i>Family Theraphosidae</i>	-	Protected
Trapdoor spider	<i>Family Ctenizidae, Nemesiidae and Cyrtantheniidae</i>	-	Protected

TABLE 6-6: REPTILES SPECIES OF CONCERN LIKELY TO OCCUR WITHIN THE PROPOSED TARGET AREAS

Common	Species	Mpumalanga 2003 Status	IUCN Status	Nature Conservation Bill
Haacke's flat gecko	<i>Afroedura haackei</i>	EN	NYBA	-
Abel Erasmus Pass flat gecko	<i>Afroedura sp.</i>	EN	NYBA	-
Mariepскоп flat gecko	<i>Afroedura sp.</i>	EN	NYBA	-
Rondavels flat gecko	<i>Afroedura sp.</i>	EN	NYBA	-
Forest/Natal purpleglossed snake	<i>Amblyodipsas concolor</i>	VU	LC	-
Lowveld shieldnosed snake	<i>Aspidelaps scutatus intermedius</i>	VU	NYBA	-
Dwarf chameleon	<i>Bradypodion transvaalense complex</i>	VU	NYBA	-
Sungazer/ Giant girdled lizard	<i>Cordylus giganteus</i>	VU	VU	-
Barberton girdled lizard	<i>Cordylus warreni barbertonensis</i>	VU	NYBA	-
Lebombo girdled lizard	<i>Cordylus warreni warreni</i>	VU	NYBA	--
Swazi rock snake	<i>Lamprophis swazicus</i>	VU	NT	-

Common	Species	Mpumalanga 2003 Status	IUCN Status	Nature Conservation Bill
Transvaal flat lizard	<i>Platysaurus orientalis orientalis</i>	NT	NYBA	-
Wilhelm's flat lizard	<i>Platysaurus wilhelmi</i>	VU	NYBA	-
Montane burrowing skink	<i>Scelotes mirus</i>	LC	NYBA	-
Breyer's longtailed seps	<i>Tetradactylus breyeri</i>	VU	VU	-
Karoo flat gecko	<i>Genus Afroedura</i>	-	-	Protected
Mountain flat gecko	<i>Afroedura nivaria</i>	LC	-	Protected
Striped harlequin snake	<i>Homoroselaps dorsalis</i>	NT	-	Protected

TABLE 6-7: INVERTEBRATE SPECIES OF CONCERN LIKELY TO OCCUR WITHIN THE PROPOSED TARGET AREAS

Common name	Species	Mpumalanga 2003 Status	IUCN Status
Barbara's Copper	<i>Aloeides barbara</i>	EN	NYBA
Cloud Copper	<i>Aloeides nubilis</i>	VU	NYBA
Rossouw's Copper	<i>Aloeides rossouwi</i>	EN	VU
Stoffberg Widow	<i>Dingana fraterna</i>	EN	NYBA
Irving's Blue	<i>Lepidochrysops irvingi</i>	VU	NYBA
Swanepoel's Blue	<i>Lepidochrysops swanepoeli</i>	EN	VU
Jeffery's Blue	<i>Lepidochrysops jefferyi</i>	EN	VU
Rossouw's Blue	<i>Lepidochrysops rossouwi</i>	VU	NYBA
Marsh Sylph	<i>Metisella meninx</i>	VU	NYBA

TABLE 6-8: AMPHIBIAN SPECIES OF CONCERN LIKELY TO OCCUR WITHIN THE PROPOSED TARGET AREAS

Common name	Species	Mpumalanga 2003 Status	IUCN Status
Karoo Toad	<i>Bufo garipeensis nubicolus</i>	VU	LC
Natal Ghost Frog	<i>Heleophryne natalensis</i>	VU	LC
Spotted Shovel-Nosed Frog	<i>Hemisis guttatus</i>	VU	VU
Yellow Striped Reed Frog	<i>Hyperolius semidiscus</i>	VU	LC
Plain Stream Frog	<i>Strongylopus wageri</i>	VU	LC
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	VU	LC
Greater Leaf-Folding Frog	<i>Afrixalus fornasinii</i>	VU	NYBA
Whistling Rain Frog	<i>Breviceps sopranus</i>	VU	LC

6.9 CONSERVATION SITES

6.9.1 Protected Areas

While several formally protected areas are located within close proximity to the Target Areas, all areas with protected status under the National Environmental Management: Protected Areas Act, 2003 (No. 57 of 2003); 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) have been excluded from the extent of the ER area (see Figure 6-7). Thus, no exploration activities will occur within these Protected Areas.

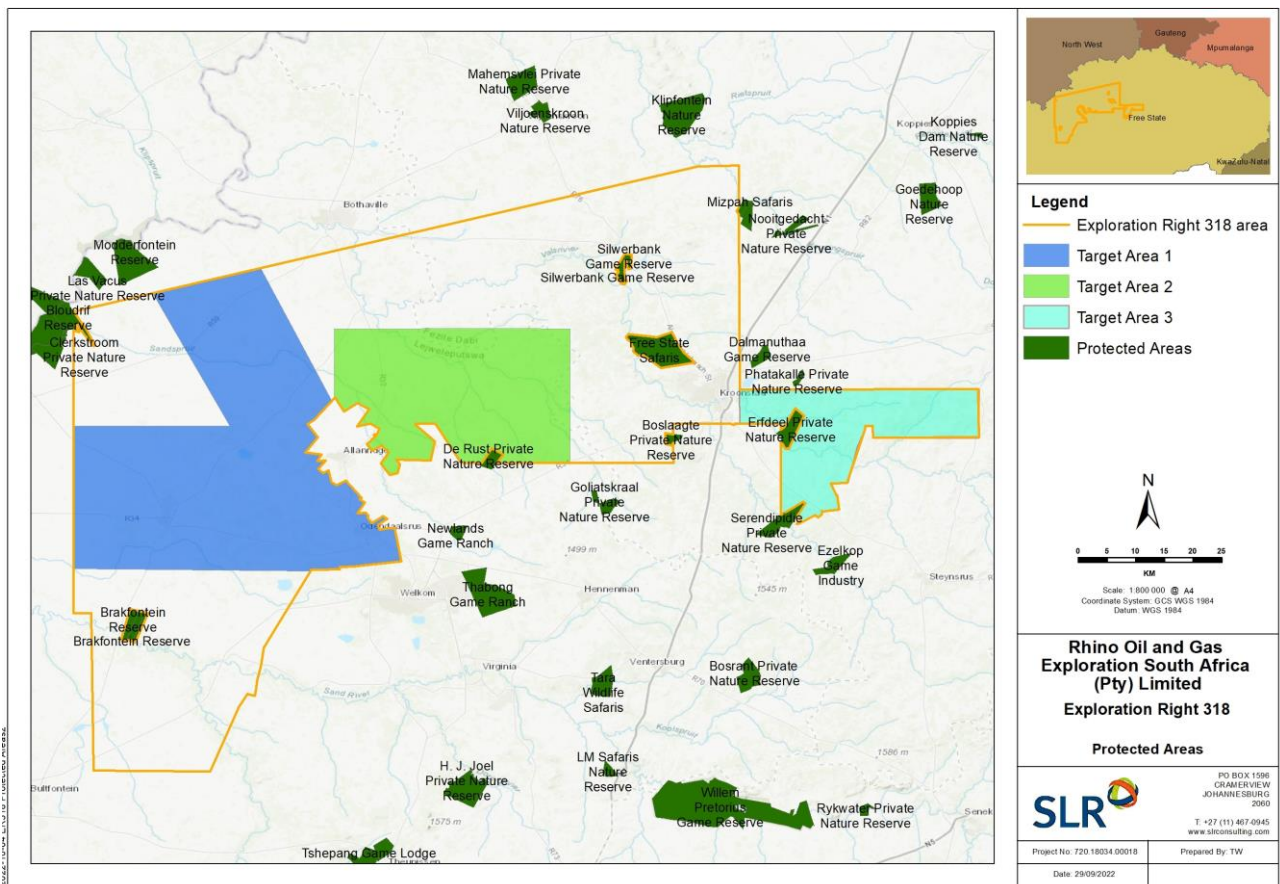


FIGURE 6-7: LOCATION OF PROTECTED AREAS OUTSIDE OF THE PROPOSED TARGET AREAS

6.9.2 National Protected Area Expansion Strategy

The aim of the National Protected Area Expansion Strategy (NPAES) is to achieve cost effective protected area expansion for ecological sustainability and adaptation to climate change. The NPAES sets targets for protected area expansion, provides maps of the most important areas for protected area expansion, and makes recommendations on mechanisms for protected area expansion. It deals with land-based and marine protected areas across all of South Africa’s territory (SANBI BGIS).

With reference to Figure 6-8, the ER area overlaps with the Free State Highveld Grasslands NPAES focus area. Focus areas are important for the land-based protected area expansion network as these areas are large,

intact and unfragmented areas which are suitable for creation or expansion of large, protected areas. However, it is noted that NPAES boundaries should never be literally interpreted as future protected area Boundaries (DEA, 2016).

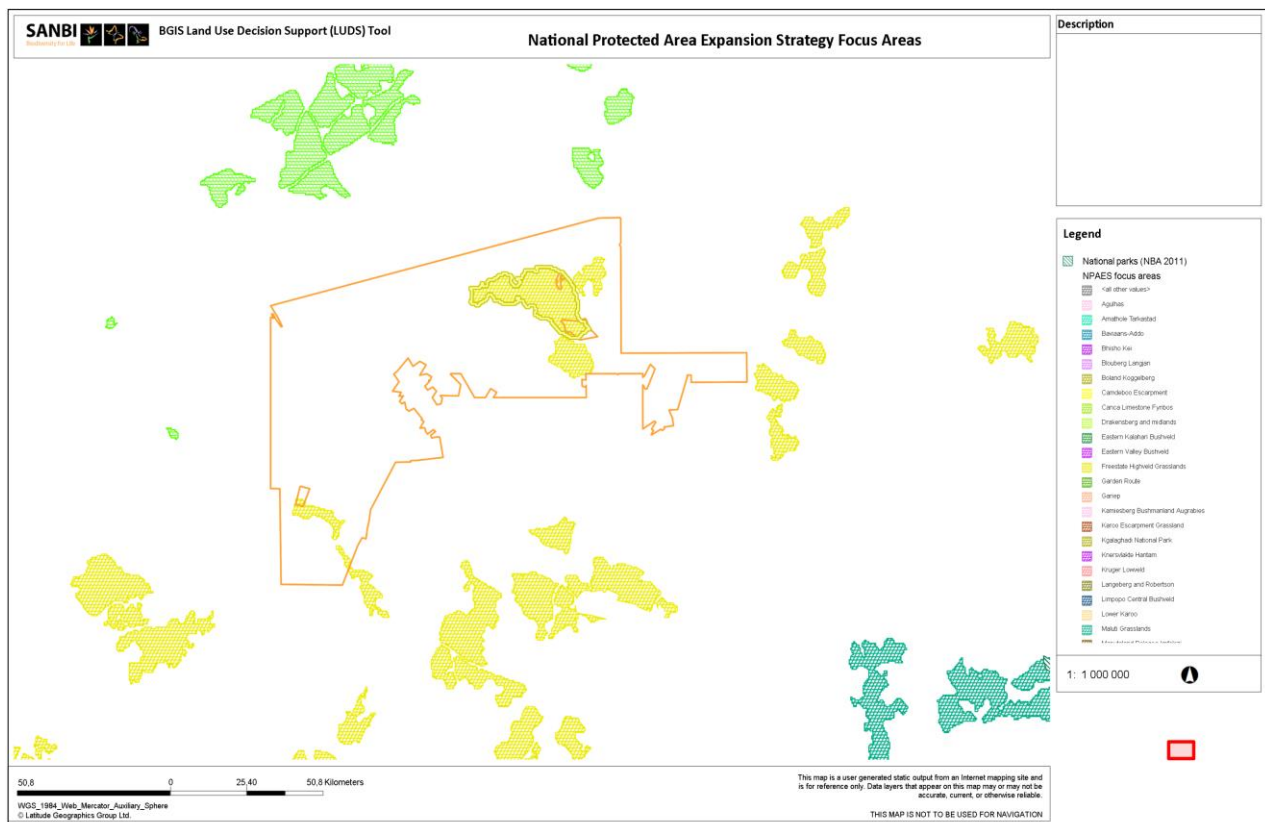


FIGURE 6-8: THE EXPLORATION RIGHT AREA IN RELATION TO THE NPAES FOCUS AREAS

Source: SANBI BGIS Map Viewer, 2022

6.9.3 National Threatened Ecosystems

Section 52 of the National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004) provides for the listing of threatened ecosystems at both national and provincial level. No critically endangered ecosystems are located within the proposed Target Areas (Mucina and Rutherford, 2006). The Vaal-Vet Sand Grassland is listed as endangered ecosystem and is found within the and Target Areas (see Figure 6-6).

6.9.4 Freshwater ecosystems

The Water Research Commission and partners undertook the National Freshwater Ecosystem Priority Areas project (NFEP). The NFEP project produced several outcomes including the Atlas of Freshwater Ecosystem Priority Areas in South Africa, which provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. The NFEP is supported by an implementation manual that provides guidance on the use of FEPA maps when planning and decision-making impacts on freshwater ecosystems. The manual provides ecosystem management guidelines for river FEPAs, wetland FEPAs, sub-quatery catchments associated with river FEPAs, and Upstream Management Areas. The purpose of freshwater ecosystem management is to conserve biodiversity patterns

and ecological processes and to maintain natural variability. Management should aim to prevent the occurrence of large-scale damaging events, as well as the repeated, chronic, persistent, subtle events.

There are numerous NFEPA Rivers and wetlands located within the proposed exploration area (refer to Figure 6-5 above). The present ecological state of the NFEPA Rivers located within the proposed exploration area are either classified as Class C (Moderately modified), Class D (Largely modified) and Class E (Seriously modified). It follows that all the NFEPA Rivers located within the proposed exploration area have been modified to some extent. No natural or unmodified NFEPA rivers are located within the proposed exploration area. The wetlands located within the proposed exploration area include a combination of Channelled valley-bottom wetlands, depressions, flat, floodplain wetlands, seeps, unchannelled valley-bottom wetlands and valley head seep.

According to the NFEPA implementation manual, mining in any form (including prospecting/exploration) should not be permitted in wetland FEPAs or within 1 km of a wetland FEPA buffer, or within 1 km of a riverine buffer (including all associated wetland systems and tributaries) within a FEPA catchment. It is noted that there is no legislation regarding buffers around rivers or wetlands in the NWA. The width of a buffer required around a river or wetland depends on many factors such as the risk the proposed development poses to the water resources, the sensitivity of receiving environment and the proposed mitigation measures.

6.9.5 Critical Biodiversity Areas

The Free State Biodiversity Sector Plan, 2016 was developed with cognisance of the requirements for the determination of bioregions and the preparation and publication of bioregional plans (DEAT, 2009). To this end, the two main products of this biodiversity sector planning process includes:

- A map indicating the different terrestrial categories (Protected, Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Other and Degraded)
- Land-use guidelines for the above-mentioned categories

The Free State Biodiversity Sector Plan represents the first attempt at collating all terrestrial biodiversity and ecological data for the province into a single system from which it can be interrogated and assessed. Biodiversity and ecological data included are:

- Land cover data;
- Inselbergs;
- Species distribution data (from records and expert mapping);
- Modelled species distribution;
- A range of national data sets (Vegetation types, NFEPA sub-catchments);
- The existing Ekgangala spatial biodiversity plan;
- Biodiversity plans of neighbouring provinces; and
- Existing provincial plans that guide development within the Free State Province, most notably the Provincial Spatial Development Framework (PSDF).

Interrogation and assessment of the data was done according to national accepted biodiversity planning principles, i.e. classification of the landscape was done according to a systematic and a quantitative

approach. Included in the assessment was the incorporation of edge matching principles to ensure that planning units across provincial boundaries have similar classifications (CBA, ESA, etc.) where appropriate.

Large portions of the Free State have been degraded and are not available for conservation. According to the 2009 land cover map of the Free State, portions of the province are degraded (18%) while 33.67% is transformed (urban development, agriculture). Only 1% of the Free State is covered by Formal Protected areas (Provincial Nature Reserves and SANParks).

The Target Areas proposed by Rhino Oil and Gas include several areas classified as Critical Biodiversity Areas and Ecological Support Areas, however the majority of the Target Areas are mapped as Degraded or Other (see Figure 6-9).

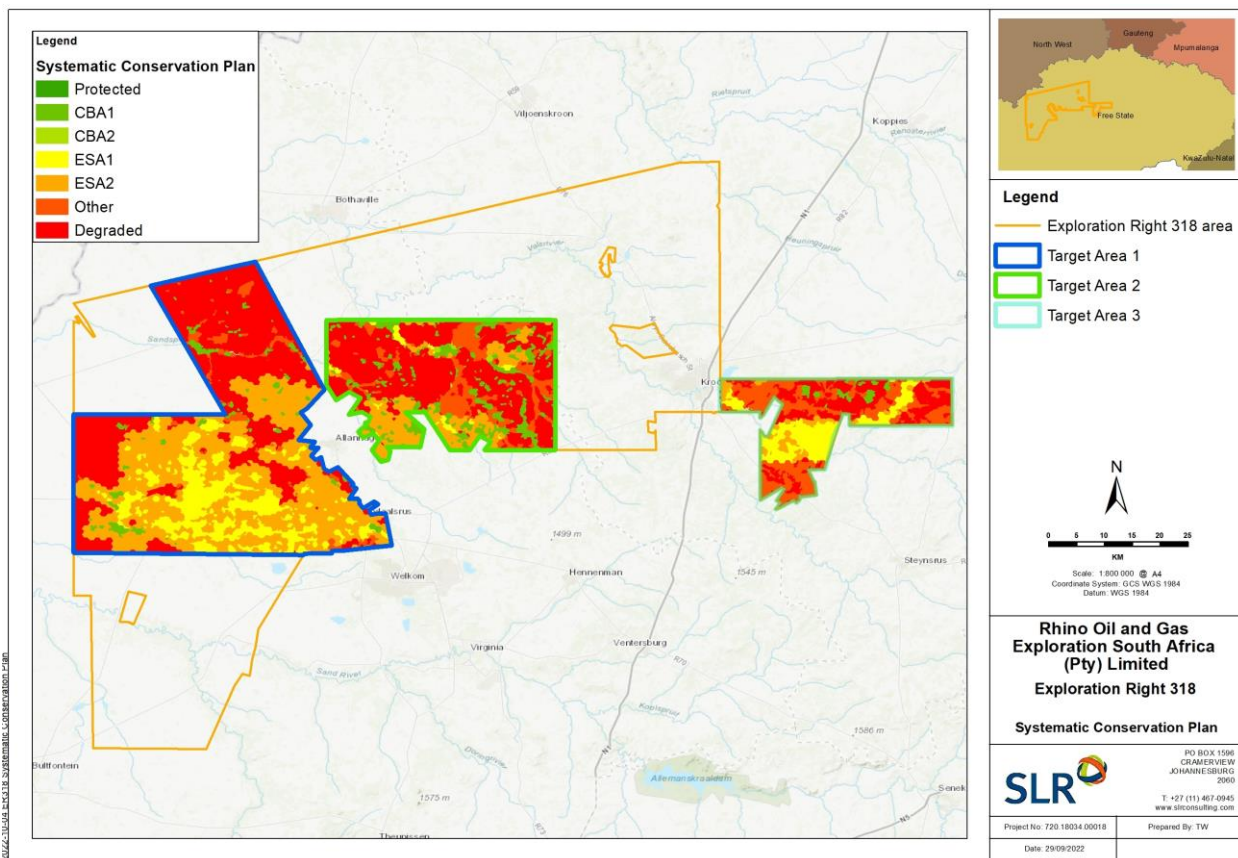


FIGURE 6-9: MAPPED TERRESTRIAL CATEGORIES OF THE FREE STATE BIODIVERSITY SECTOR PLAN WITHIN THE PROPOSED TARGET AREAS

6.9.6 Important Bird Areas

Important Bird Areas (IBAs) were initiated by BirdLife International to conserve a network of specific sites that are critical in the long-term survival avifaunal species. The following criteria was used in selecting the IBA's:

- Globally threatened species;
- Restricted range;
- Restricted to specific vegetation types or biomes; and
- Significant population numbers for a specific area.

No IBAs are located within the ER or proposed Target Areas (Figure 6-10).

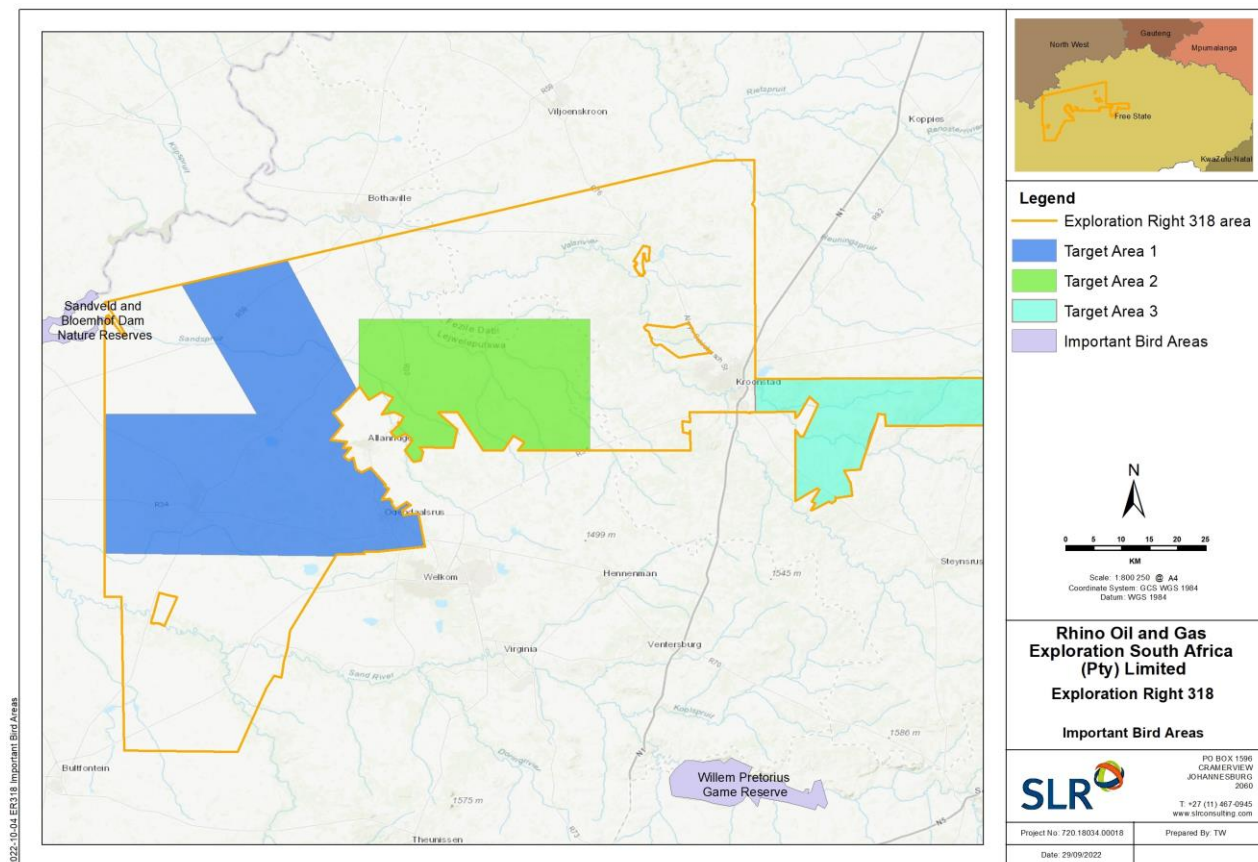


FIGURE 6-10: LOCATION OF THE PROPOSED TARGET AREAS IN RELATION TO IMPORTANT BIRD AREAS

6.10 HERITAGE/CULTURAL AND PALEONTOLOGICAL RESOURCES

Heritage (and cultural) resources include all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

The Target Areas are likely to include numerous heritage sites that are documented in the national and provincial heritage databases as well as many undiscovered sites. Each of the various towns associated with the Target Areas are likely to have buildings and graveyards of heritage significance. Many farms within the area will have graves and cemeteries while buildings of heritage significance are also likely on the older farms.

According to the SAHRIS database the Target Areas are located in an region that is generally regarded as having a very high to moderate palaeontological sensitivity. It follows that there is a high likelihood of fossil occurrence within most of the ER application area. More detailed information will be provided in the EIA report, following the Heritage Study.

6.11 SOCIO-ECONOMIC ENVIRONMENT

6.11.1 Districts

The ER area is largely located within three Local Municipalities in the Free State Province, namely:

- Nala Local Municipality;
- Moqhaka Local Municipality; and
- Matjhabeng Local Municipality.

Details (predominately based on Census 2011 data) pertaining to the three local municipalities area are provided in the section below. The ER area also has a small overlap with the Ngwathe (in the northeast corner) and Tswelopele (in the southwest corner) Local Municipalities. However, due to the limited overlap, these are not discussed in detail.

6.11.2 Population

The population of the Nala Local Municipality has decreased 3.3% from 81 220 in 2011 to 78 515 persons in 2016. The population of the Moqhaka Local Municipality has decreased by 4.4% from 167 892 in 2001 to 160 532 persons in 2011. The community survey conducted during 2016 indicated that the population once again decreased with 3.61% to 154 732.

The Matjhabeng Local Municipality experienced a 5.14% growth rate from 407 020 to 429 113 between 2011 to 2016.

6.11.3 Employment

In the Nala Local Municipality, there are 26 611 economically active (employed or unemployed but looking for work) people, and of these 35.9% are unemployed. Of the 12 357 economically active youth (15–35 years) in the area, 47.6% are unemployed.

Within the Moqhaka Local Municipality, there are 55 594 economically active (employed or unemployed but looking for work) people, and of these 35.2% are unemployed. Of the 27 349 economically active youth (15–34 years) in the area, 47.2% are unemployed.

In the Matjhabeng Local Municipality, A total of 99 650 people are employed while 13 290 are discouraged work-seekers. According to Census 2011, 58 524 people are unemployed, making the unemployment rate stand at 37%. Of the youth aged 15–34, 39 442 are employed and 38 975 are unemployed.

6.11.4 Households

In the Nala Local Municipality, there are 21 703 households in the municipality, with an average household size of 3.7 persons per household. 40.4% of households have access to piped water either in their dwelling or in the yard. Only 1.2% of households do not have access to piped water.

Within the Moqhaka Local Municipality, there are 45 661 households, with an average household size of 3.2 persons per household. 57.7% of households have access to piped water either in their dwelling or in the yard. Only 1% of households do not have access to piped water.

There are 123 195 households in the Matjhabeng Local Municipality, with an average household size of 3.1 persons per household. Of those households, 36% have access to piped water inside the yard whereas 54.8% have access to piped water inside their dwelling. Only 2% of the households do not have access to piped water.

6.11.5 Basic Services

The percentage of the total population located within each of the local municipalities within the ER area that have access to drinking water, sanitation and power is included in Table 6-9 below. Where access to sanitation is not available, alternative sources include pit toilets, bucket system, chemical toilets and other. Where access to power is not available, alternative sources such as wood, gas and paraffin are used.

TABLE 6-9: DEMOGRAPHICS – BASIC SERVICES

Local municipality	Access to drinking water	Access to sanitation	Access to power
Nala Local Municipality	87.6%	97.3%	Lighting: 90.4% Heating: 54.3% Cooking: 85.6%
Moqhaka Local Municipality	87.2%	98%	Lighting: 93.3% Heating: 65% Cooking:
Matjhabeng Local Municipality	95%	97.4%	Lighting: 91.1%

Source: StatsSA, Census 2011 data

6.11.6 Education

Education information for each of the local municipalities located within the ER area is included in Table 6-10 below.

TABLE 6-10: DEMOGRAPHICS – EDUCATION

Local municipality	No education	Completed grade 12	Higher education
Nala Local Municipality	7.9%	22.2%	5.6%
Moqhaka Local Municipality	5.3%	27.8%	8.6%
Matjhabeng Local Municipality	4.6%	28%	9%

Source: StatsSA, Census 2011 data

7. POTENTIAL PROJECT ISSUES AND IMPACTS

7.1 IMPACTS ON PHYSICAL ASPECTS

7.1.1 Geology

Issue: There is a remote risk that the proposed exploration work programme could destabilise certain geologies and pose risks to underground caverns or mine workings.

Response: The total number of exploration boreholes proposed for drilling (at least 10) is considered insignificant in relation to the overall extent of the exploration area. The drilling would not impact on the geological strata in any significant manner. The sterilisation or damage to any mineral reserves during this early phase of exploration activities is highly unlikely due to the short duration of the exploration activities. Exploration drilling would not take place in areas where active underground mining is taking place. The drill rig would only be in place for a short period of time and there would be no permanent effects preventing future mining of any reserves. The steel casing and cement plugged holes would not pose a significant risk to future underground mining. Information on the locations of the completed wells would be on record with regulatory authorities and thus available to any future mining stakeholders. This risk is not different to that from the numerous historical water and prospecting boreholes that occur across the exploration right application area.

7.1.2 Soils

7.1.2.1 Physical impact on soils (increased erosion / compaction)

Issue: The exposure of soils through vegetation clearance and/or physical disturbance of exposed soils may increase the risk of erosion (by wind and water), while the repetitive movement of vehicles and machinery over such surfaces could compact soils. These impacts may collectively affect the surface hydrology, damage soil structure, reduce aeration, soil permeability, infiltration rates and water retention capacity, and retard the regeneration of vegetation. Reduced infiltration could also result in an increase in surface runoff, potentially causing increased sheet, rill, and gully erosion.

Response: Impacts to soils caused by the proposed well drilling would be limited to the footprint area, which would for the most part be confined largely to existing roads, tracks and other previously disturbed areas (e.g. agricultural lands) already exposed to disturbance, compaction and at increased risk of erosion.

Vegetation cover and soil structure would only be disturbed on a small portion of each drill site. A typical drill rig and equipment requires an operating area of approximately 2 500 m², with approximately 100 m² forming the central working platform and the balance used for equipment storage, staging and parking. Thus the extent of soil exposed to these risks is relatively limited. In addition, the majority of proposed well drilling sites do not require the clearing of vegetation and thus there would be limited actual disturbance to soils and associated roots/seed.

Since the exact location of each well drilling site is flexible, the location of sites would be adjusted to avoid areas that are sensitive to compaction and erosion. Previously disturbed areas would be preferred for

selection. The specific requirements for detailed site assessments during selection of the drill sites will be documented in the EIA and EMPr.

Other mitigation to minimise the impact on soils that will be considered for inclusion in the EMPr include:

- Restricting the movement of vehicles and people to previously disturbed areas (e.g. existing roads) as much as possible,
- Limiting and controlling the movement of people and vehicles over natural areas (i.e. site demarcation and the establishment of no-go areas);
- Minimise the clearing of vegetation cover; and
- Rehabilitation of disturbed areas (including erosion control measures).

7.1.2.2 Potential contamination of soils

Issue: Leaks and spills from vehicles, machinery and handling of potential pollutants (e.g. fuel, lubricants and drill muds) during on-site activities may potentially contaminate the soil.

Response: The proposed exploration would require the use of vehicles and equipment that use fuel and lubricants. The drilling may make use of drilling muds and additives and will generate dust and cuttings, which may have hazardous elements. Cement will also be used. Certain hazardous materials, lubricants and chemicals may also be used and stored on site. Leaks and accidental spillages could occur from containers or during refuelling and handling, which could in turn contaminate the soil.

The overall volume of the high risk materials on-site during drilling would be relatively small with no bulk containers on-site (such materials are generally in 210 L drums or smaller). The volume of drilling muds, dust or cuttings per well is estimated to be in the region of 20 to 40 m³. The majority of this would be inert naturally occurring rock material and most of the drilling additives are non- to moderately hazardous. Certain geologies could generate materials with more hazardous properties. The drill muds and dust/cuttings will be contained in sumps and skips prior to disposal. Although it is not possible to predict the quantities of potential contaminants that may be accidentally released into the environment, periodic leaks and spills, should they occur, are likely to be of small volume. Adequate maintenance of vehicles and machinery, good housekeeping practices (including spill prevention and response) and the implementation of an adequate waste management plan would minimise any potential impact. An emergency response plan would also be recommended to guide appropriate containment and clean-up actions.

7.1.3 Impact to Groundwater

Most agricultural activities in the region use groundwater and may be partly or wholly dependent of groundwater. Many rural houses obtain potable water from groundwater. Some of the smaller towns operate municipal wellfields as a water source. In some catchments in the region the groundwater is fully allocated and there is no water available for new users, unless such water is reallocated from an existing user. Groundwater can, therefore, be viewed as a critical resource. Any changes to the quality or quantity of water in near surface aquifers may affect local, adjacent and even distant users who rely on groundwater for domestic and agricultural use.

7.1.3.1 Altered hydrogeological regime and groundwater availability

Issue: Activities during exploration might involve interaction with groundwater that could impact groundwater availability.

Response: Groundwater levels in the Target Areas are likely to vary significantly, but on average are likely to be generally shallow. The proposed wells would be drilled to depths of up to 1 000 m and would intercept groundwater if aquifers are present. The drilling of the well creates a direct conduit (of very small diameter) that connects the rock strata from higher up to the bottom of the hole. Groundwater in different stratigraphic aquifers could theoretically flow via this conduit from one aquifer to another, potentially affecting the availability and quality of water in these aquifers should the proposed casing and cementing is not adequate. If a well were completed incorrectly or abandoned without proper plugging this flow could continue.

In reality the wells would be relatively few in number, of small diameter, widely distributed across large areas and could not easily transfer significant volumes of water. There would also need to be a significant pressure differential between connected aquifers to cause movement, which is not indicated in regional examples. During drilling the upper sections of the wells would be cased and cemented for stability and to close off the near surface aquifer. During the proposed exploration would not be any active introduction of materials, no significant extraction of water, nor any stimulation of the formations via these wells. There is, therefore, very little opportunity for cross connection between aquifers and changes in water availability are not expected.

Since the exact location of a drill site is flexible and can be adjusted to accommodate environmental sensitivities, impacts on the groundwater can generally be avoided with the placement of activities outside of areas that are not considered suitable on the basis of the specific groundwater resources on site. Thus it is recommended that prior to final site selection of the drill sites a detailed site assessment is undertaken. The final site location should, if necessary, be adjusted to avoid identified sensitive groundwater resources. The proposed site locations and detailed site assessments will be documented in the EIA phase, and will include inputs from a specialist groundwater assessment (see Section 7.1.3).

Mitigation resulting from the specialist assessment will be included in the EMPr. Other mitigation to minimise the impact on groundwater resources that will be considered for inclusion in the EMPr include:

- Casing of wells through the aquifer layers to specific depths;
- Adequate sealing and plugging of wells after drilling; and
- Monitoring of groundwater (level and quality) in active water boreholes in close proximity to exploration wells must be considered.

7.1.3.2 Contamination of groundwater resources

Issue: Contamination of groundwater could occur as a result of the use of drilling fluids during well drilling, and accidental spillages and leaks.

Response: The proposed well drilling would make use of drilling fluids and lubricants in order to maintain cooling and lubrication of the bit and to return the fine drill cuttings to the surface. The drilling fluids could mix with groundwater encountered down the hole until such time as the hole is cased and cemented. The upper aquifers would be exposed to the drilling fluids for the shortest periods as the upper section of the hole is cased and cemented early in the drilling process. Drilling fluids unlikely to have a significant effect on groundwater quality for the following reasons:

- The drilling additives used are largely not hazardous and/or are bio-degradable;
- Drilling additives are relatively diluted in the drilling water (<3%);
- Fluids are designed to not move far from the drilling hole unless very poor formations or large cracks are encountered;
- A 'mudcake' of drill cuttings seals most of the drilled formations even during drilling;
- Drilling fluids are only used for a short period while the hole is being drilled;
- The total volume of drilling fluids is very small in comparison with any aquifer volume; and
- Return water and drilling fluid would be managed in above surface sumps.

Contaminants could also potentially enter the well from accidental situations, and would be introduced directly into the aquifer with limited opportunity for natural filtration by soils or geologic materials. Leaks and spills from vehicles, machinery and handling of potential pollutants (e.g. fuel and lubricants) during activities in the field could potentially contaminate groundwater resources through infiltration. If a contamination incident occurs it could put other boreholes in the same aquifer at risk, particularly those boreholes on the same property or those that are close to the well. Although it is not possible to predict the quantities of potential contaminants that may be accidentally released into the environment, periodic leaks and spills, should they occur, are likely to be very small. The placement of wells at suitable buffer distances away from existing boreholes would prevent impacts on those wells.

The location of drill sites can be adjusted to accommodate environmental sensitivities, and thus impacts on the groundwater can generally be avoided with the placement of activities outside of areas with specific groundwater resources or users. The proposed site locations and detailed site assessments will be documented in the EIA phase, and will include inputs from a specialist groundwater assessment (see Section 7.1.3). The final site location should, if necessary, be adjusted to avoid identified sensitive groundwater resources and users, with appropriate buffers.

Mitigation resulting from the specialist assessment will be included in the EMPr.

Mitigation to minimise the contamination of groundwater resources that will be considered for inclusion in the EMPr include:

- Declare all drilling additives and the quantities to be used prior to use;

-
- Choose the least hazardous and/or are bio-degradable additives and use the smallest volumes of these;
 - Appropriate management and disposal of drilling fluids on surface;
 - As a precautionary measure, implement a buffer (no-go area) between well sites and active water production boreholes. An appropriate buffer would need to be determined;
 - Adequate maintenance of vehicles and machinery;
 - Implementation of an adequate waste management plan;
 - Good housekeeping practices (including spill prevention and response);
 - Appropriate handling and storage of fuels and hazardous materials (e.g. explosives); and
 - Monitoring of groundwater in active water boreholes in close proximity to exploration wells must be considered.

7.1.3.3 Water consumption

Issue: Water would be required for the operation of the well drilling rig. In some catchments in the region the water resource is fully allocated and there is no surface or groundwater available for new users, unless such water is reallocated from an existing user. Exploration could therefore compete with farmers and other users.

Response: The total volume required for well drilling depends on the formations encountered, but is estimated to be less than 5 000 L per day. At a regional scale the overall water use is expected to be insignificant, however, at a local scale, in terms of existing allocations and in times of drought the water use could be significant. The water could lawfully be acquired from a supplier, abstracted from an existing borehole or a local surface water resource (e.g. river or dam). Given the expected water volumes, it is not anticipated that Rhino Oil and Gas would require authorisation in terms of the NWA.

Mitigation to ensure the lawful use of groundwater resources that will be considered for inclusion in the EMP include:

- Water must be sourced in a lawful manner and without comprising the rights of any existing user.
- Any abstraction from an existing borehole or surface resource must be undertaken with the landowners' consent;
- Water use must be minimised; and
- Water separation / recycling mud systems should be considered for use.

7.1.4 Impacts on surface water

Surface water is found in springs, seeps, wetlands, pans, dams and water courses. Surface water in the area is used locally for livestock watering and in ecological services. Baseline water quality in the area is generally good to very good. The region comprises the headwaters of a number of very important river systems which supply large quantities of water for human consumption, agricultural and industrial use. Any changes to the quality or quantity of water in surface resources may affect adjacent users who rely on water for domestic, agricultural and industrial use.

7.1.4.1 Altered surface water hydrological regime

Issue: Potential changes to the surface water hydrological regime (surface flow, drainage patterns, sediment load and availability) could have secondary impacts on water users and terrestrial and aquatic environment.

Response: The proposed well drilling activities are unlikely to have any real effect on the overall hydrological regime as the small footprint of the proposed activities would not alter natural surface drainage patterns. Since associated project activities would for the most part take place on existing roads and tracks, further surface disturbances that could affect surface drainage patterns (e.g. soil compaction or increased erosion) would be limited.

Since the exact location of a site is flexible, the location of sensitive areas (including wetlands, rivers and streams) would be taken into consideration during the final site selection process. The final site location should be adjusted to avoid identified sensitive surface resources. The proposed site locations and detailed site assessments will be documented in the EIA phase.

Where surface areas have been disturbed (by vehicle tracks, work platform, etc.) rehabilitation would be undertaken to re-establish the pre-exploration land use. The pre-exploration land-use would be determined during the detailed site assessments, which would be undertaken when finalising the location of each well site. The process of managing the impacts and rehabilitating the exploration sites will be detailed in the EMPr.

7.1.4.2 Contamination of surface water resources

Issue: As for soil and groundwater contamination, leaks and spills from vehicles, machinery and handling of potential pollutants (e.g. fuel, lubricants and drilling fluids) during activities in the field could potentially contaminate surface water resources. The drilling may make use of drilling muds and additives and will generate dust and cuttings, which may have hazardous elements. Cement will also be used. Inadequate management of drilling muds in surface sumps or skips could result in the contamination of surface water resources. Leaks and accidental spillages or release of contaminants into water resources could result in a deterioration of water quality, limiting use by water users, as well as damaging aquatic ecosystems.

Response: Exploration requires the use of vehicles and equipment driven by engines using hydrocarbons (diesel). Some of the equipment has hydraulic systems with lubricants. Certain hazardous lubricants and chemicals may also be used and stored on site. Thus leaks and accidental spillages could occur from containers or during refuelling, which could in turn contaminate surface water resources through stormwater discharge into wetland, rivers and streams.

The overall volume of the high risk materials on-site during drilling would be relatively small (such materials are generally in 210 L drums or smaller) with no bulk containers on-site. Although it is not possible to predict the quantities of potential contaminants that may be accidentally released into the environment, periodic leaks and spills, should they occur, are likely to be very small. Adequate maintenance of vehicles and

machinery, good housekeeping practices (including spill prevention and response) and the implementation of an adequate waste management plan would minimise any potential impact.

Return drill water dust and cuttings would be managed in above surface sumps or skips. These surface sumps would also contain sediments, drilling fluids and possibly hydrocarbons. Although the majority of the material is likely to be inert and naturally rock occurring, and most of the drilling additives are non- to moderately hazardous, there could be elements and chemicals at concentrations not suitable for release to the environment. The volumes of such material are estimated to be between 20 and 40 m³ per site. Inadequate management of sumps or skips could result in the contamination of surface water resources. Since the exact location of a drill site is flexible, and can be adjusted to accommodate environmental sensitivities, it is recommended that exploration sites be sited away from watercourses/bodies. By distancing the source from the receptor, the potential risks are reduced substantially. The proposed site locations and detailed site assessments will be documented in the EIA phase, and will include consideration of surface water resources.

Since the exact location of a site is flexible, it is recommended that exploration sites be sited away from watercourses/bodies. The specific requirements for detailed site assessments during finalising of the seismic lines or drill sites will be included in the EMPr.

Mitigation resulting from the assessment will be included in the EMPr. Other mitigation to minimise the contamination of surface water resources that will be considered for inclusion in the EMPr include:

- The location of the surface sumps should also avoid surface water resources and should take the topography, natural drainage and site run-off into account;
- As a precautionary measure, implement a buffer (no-go area) between wells and sump ponds and surface water resources. An appropriate buffer will need to be determined;
- Adequate maintenance of vehicles and machinery;
- Good housekeeping practices (including spill prevention and response);
- Appropriate handling and storage of fuels and hazardous materials; and
- Implementation of an adequate waste management plan.

7.1.4.3 Water consumption

Refer to Section 7.1.3.3.

7.1.5 Changes to ambient noise levels

Issue: Primary sources of noise associated with the proposed well drilling activities include vehicle traffic and drill rig operations. Increased noise levels may cause disturbances and nuisance to nearby receptors. The region generally has low ambient noise levels and exploration activities could change this, albeit for short durations.

Response: The noise generated by general operations (presence of vehicles and crew) would be similar in nature to a farming operation, and would be mobile and transient. Thus, the associated impacts are expected to be of low significance.

The proposed well drilling could introduce and increase noise levels for the drilling period, which could impact receptors. The noise arising from the drilling operations would not be dissimilar to agricultural activities that occur in the region (e.g. tractors and harvesters). The noise emissions would only occur during work periods, over a total duration of 3 to 4 weeks. Noise is known to attenuate with distance as well as due to other barriers and absorbing factors. Noise impacts would only occur where receptors were in close proximity to the source, with nuisance levels anticipated at distances of up to 250 m.

Any risks with regard to potential noise impacts of drilling can be avoided completely by maintaining a suitable buffer between the exploration site and the nearest receptor. This issue will be further investigated in the next phase of the EIA and an appropriate buffer will be determined.

7.1.6 Changes to ambient air quality

7.1.6.1 Dust and vehicle emissions

Issue: Dust fallout resulting from the movement of vehicles to and from exploration sites on unsurfaced roads may contribute to elevated particulate matter levels in the air on a local scale. Emissions would also be generated by vehicles and other combustion-driven equipment (e.g. generators) that release nitrogen oxides (NO_x), carbon dioxide (CO₂), carbon monoxide (CO) and volatile organic compounds (VOC).

Response: Dust is relatively inert, but high levels of fine particulate can be damaging to health and vegetation. In terms of dust generation and emissions, the proposed well drilling activities would be similar to any comparable operation involving similar vehicles and equipment and emissions would be very limited in both intensity and duration. Other than at site establishment and demobilisation, the majority of vehicle movement would comprise light motor vehicles. Thus the potential impact would be temporary in nature.

The impact on air quality as a result of the proposed exploration activities would be managed through good maintenance of vehicles and machinery to minimise emissions. Dust generation can be controlled by imposing and enforcing speed limits on all unsurfaced roads and tracks. Note that spraying affected areas with water to control dust may not be possible or allowed due to water scarcity. Risks with regard to potential health impacts can be avoided completely by maintaining a suitable buffer between the exploration site and the nearest receptor. An appropriate buffer will be determined in the next phase of the EIA.

7.1.6.2 Escape or release of gas from exploration wells

Issue: Wells drilled to the target strata could create the opportunity for gas to escape to the surface. The escape or release of gas from exploration wells is of concern as methane (one of the main constituents of

natural gas) is a relatively powerful green-house gas with a high global warming potential (27 to 30 times that of CO₂ over a 100-year period).

Response: If gas is present, the passive flow of gas up the core holes is expected to be unlikely/limited as the strata remain under pressure and much of the gas is adsorbed to the particle surfaces. However, the leak of gas could pose a safety risk and contribute to green-house gas emissions. Wells would only be open for a period long enough to complete the drilling and downhole geophysics. If free flowing gas was detected then the holes would be capped as a priority to ensure safety and limit emissions. Leaks around the casing and capping are highly unlikely due to the low pressures and integrity provided by the cementing. On completion, or if unsuccessful, the wells are sealed by the installation of one or multiple cement plugs, which would ensure that no gas would escape. Thus emissions are not anticipated to have a measurable impact on climate change.

Air quality issues will be further investigated in the next phase of the EIA and an appropriate management will be determined.

7.1.6.3 Health risks from gas release in exploration wells

Issue: Wells drilled to the target strata could create the opportunity for gas to escape to the surface. Gas that is released could be harmful to human health if exposure occurs.

Response: As indicated above, there are not anticipated to be significant releases of gas from the wells and thus health risks beyond the well site are not anticipated.

Air quality issues will be further investigated in the next phase of the EIA and if health risks are identified then these will be considered further.

7.2 IMPACTS ON BIOLOGICAL ASPECTS

7.2.1 Impact On Ecology

The region is host to a number of sites and habitats of ecological value or which are sensitive as a result of the presence of species of conservation concern. During exploration impacts to the ecology could include:

- Loss of or disturbance to vegetation, including species of conservation concern, from vehicles traversing areas or on-site activities;
- Disturbances to fauna, particularly species of conservation concern, as a result of on-site activities; and
- Enabling the establishment of alien and invasive species in disturbed areas.

7.2.1.1 Loss of or disturbance to vegetation and faunal habitats

Issue: Vegetation would need to be cleared and/or disturbed as a result of the proposed activities, including the possible creation of new access routes / tracks, establishment of work platforms for drilling, etc. The

clearing of vegetation and exploration activities may result in the loss or disturbance to habitats of faunal significance.

Response: Vegetation cover and soil structure would only be disturbed on a small portion of each drill site. A typical drill rig and equipment requires an operating area of approximately 2 500 m², with approximately 100 m² forming the central working platform and the balance used for equipment storage, staging and parking. Thus the extent of vegetation exposed to these risks is very limited. The balance of the disturbance is transient with vegetation trampling being the most prominent disturbance. Access would, for the most part, take place on existing roads and tracks. If appropriate mitigation measures are not put in place and there is inadequate on-site management such impacts could be residual and long lasting. Such impact would be of concern if drilling or seismic sites were located in areas where sensitive natural vegetation or plant species of conservation importance occur, or if exploration takes place in important faunal habitats.

Since the exact location of an exploration site is flexible and can be adjusted to accommodate environmental sensitivities, impacts on ecological resources (including vegetation, faunal habitat, etc.) can generally be avoided or reduced with the placement of activities on sites that do not have sensitive natural vegetation. Thus it is recommended that prior to final site selection of the drill sites a detailed site assessment is undertaken. The final site location should, if necessary, be adjusted to avoid identified sensitive vegetation types or faunal habitats. The proposed site locations and detailed site assessments will be documented in the EIA phase, and will include inputs from a specialist biodiversity assessment (see Section 9.3).

Any specific management or mitigation requirements will be included in the EMPr.

Additional mitigation measures to minimise the potential impact of loss of and damage to vegetation that will be considered for inclusion in the EMPr include:

- Implementation of buffers (no-go areas) around sensitive areas;
- Minimising the extent of any vegetation clearance by having clearly demarcated work areas;
 - Trees that are larger in diameter than 20 cm should not be felled; and
 - Leave in place smaller vegetation, topsoil, root stock, seeds and endangered or protected species and species used by local communities for commercial or subsistence use (identified in the detailed site assessment);
- Using existing access routes as far as is possible; and
- Rehabilitating disturbed areas. Where surface areas have been disturbed (by vehicle tracks, work platform, etc.) rehabilitation would be undertaken to re-establish the pre-exploration land use. The pre-exploration land-use would be determined during the detailed site assessments, which would be undertaken when finalising the location of each seismic line or drill site. Rehabilitation will be detailed in the EMPr.

7.2.1.2 Disturbance to and mortality of fauna

Issue: In addition to the indirect impact on fauna as a result of loss or damage to natural vegetation (faunal habitat), animals in the vicinity of exploration activities may be affected by increased human presence/activity. Some areas are host to species of conservation concern which are often more sensitive to disturbances.

Response: It is acknowledged that some of the natural habitats within the region host a wide variety of faunal species with a number of these species being protected or of conservation importance. Some may not be tolerant of disturbance, particularly during breeding, while others may be range/habitat restricted.

The proposed well drilling could affect sensitive species, forcing individuals to move away from the disturbance. Some may abandon their shelters. However, most animals would return to the area after the noise or disturbance has ceased, which would be within a few weeks for each well. Noise and other disturbances as a result of the proposed well drilling would be unlikely to alter feeding and breeding behaviour or displacement of animals from their preferred habitats, as it would not be of sufficient duration to cause species not to return in the short-term. Provision would need to be made prevent disturbances for specific instances (e.g. sun gazer lizards or breeding game and livestock species).

In addition to disturbance of faunal movement, direct mortality could result from the proposed activities. Those species that cannot effectively vacate the area by themselves may suffer direct mortality due to increase traffic or site clearing.

Mitigation that could prevent impacts would primarily be through a detailed site assessment undertaken to inform the final site selection of the drill sites. The final site location should, if necessary, be adjusted to avoid locations that host fauna of conservation concern. The proposed site locations and detailed site assessments will be documented in the EIA phase, and will include inputs from a specialist biodiversity assessment (see Section 9.3). Other mitigation to minimise the impact on terrestrial fauna that would be considered for inclusion in the EMP include:

- Restricting vehicle activity to existing roads, as far as possible;
- Implementation of buffers (no-go areas) around sensitive faunal habitats;
- Scheduling operations during least sensitive periods, avoiding migration, nesting and mating seasons; and
- Imposing and enforcing speed limits.

7.2.1.3 Enabling the establishment of alien and invasive species in disturbed areas

Issue: The establishment of alien and invasive plant species may be enabled by disturbances to the natural vegetation. Thus vegetation clearance and soil excavations during exploration could be the catalyst that enables alien and invasive plant species to colonise or proliferate in new areas. The introduction of alien invasive vegetation could occur as a result of vehicular traffic and the import of materials. Many of these activities happen regularly as part of daily activities in the region.

Response: Alien and invasive plant species occur widely in the region and are known to have impacts on natural vegetation, water resources and fauna. The disturbance footprint associated with the well drilling activities would be a minor percentage of the overall extent of the exploration right area. Thus, the extent of disturbed areas vulnerable to colonisation by alien and invasive plants is expected to be very limited. Indirect impacts on natural vegetation from the inadvertent introduction of alien vegetation (through imported material / seeds or vehicles brought in from other areas) can be adequately managed through implementation of an alien eradication / monitoring programme. The specific requirements for an alien eradication / monitoring programme will be identified in the next phase of the EIA as part of a specialist biodiversity assessment (see Section 9.3). These specific requirements will be included in the EMPr.

7.3 IMPACTS ON SOCIO ECONOMIC ASPECTS

7.3.1 Heritage

Issue: Loss of or damage to heritage resources as a result of exploration activities. Many farms and communities in rural areas have graveyards located near to the dwellings. There are also many buildings, infrastructure and sites of cultural or heritage importance across the Province.

Response: The heritage resources of the application area include archaeological and palaeontological material and the built environment comprising historic towns and farm buildings. Heritage resources, including archaeological or palaeontological sites over 100 years and buildings, graves and other structures older than 60 years are protected in terms of the NHRA and may not be disturbed without a permit from the relevant heritage resources authority.

The extent of surface and subsurface disturbance for each well site during the exploration phase is minimal. Cultural resources buried below the surface are unlikely to be affected, while material present on the surface could be disturbed by vehicular traffic, ground clearing and pedestrian activity.

No exploration drilling would be allowed to take place near to known heritage sites. Site selection would thus take cognisance of all buildings and other known structures, which will include built heritage resources, as well as other known heritage sites.

Since the exact location of a site is flexible and can be adjusted to accommodate environmental sensitivities, impacts on heritage resources can generally be avoided with the placement of activities on sites that do not have any heritage resources. The final site location should, if necessary, be adjusted to avoid locations that have heritage resources. The proposed site locations and detailed site assessments will be documented in the EIA phase, and will include inputs from a specialist heritage assessment (see Section 9.3).

Any specific management requirements from the heritage assessment will be included in the EMPr. Additional mitigation measures to minimise the potential impact on heritage resources that will be considered for inclusion in the EMPr include:

- Consultation with the landowner prior to commencement may help to identify heritage site;

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- Consultation with leaders and elders of rural communities may help to identify sites of cultural significance; and
 - Implementation of buffers (no-go areas) around known heritage sites.

7.3.2 Land tenure and access to private property

Issue: The issuance of an ER and approval of the well drilling EWPr would result in Rhino Oil and Gas holding a right that necessitates them to access private property in order to conduct the proposed exploration activities. Various queries were raised about how Rhino Oil and Gas would access the minerals on private land. Do land owners have any say with regards to access over their land for exploration? What would Rhino Oil and Gas do if the land owner denied access?

Potential impacts from the proposed exploration activities include:

Access by exploration personnel onto private property;

- Creation of access routes onto land where none existed; and
- Potential change in land use value.

Response: Despite the issuance of an ER, the land owner remains in control of the surface rights. A land owner has specific rights over land for which they hold title and is entitled to deny access to their land as this is private property. There would not be any change in land tenure.

The MPRDA provides that a mineral right is a limited real right and sets out that the holder may enter the land to which such right relates together with his or her employees, and bring onto that land any plant, machinery or equipment and build, construct or lay down any surface, underground or under sea infrastructure which may be required for the purpose of prospecting, mining, exploration or production, as the case may be. Rhino Oil and Gas's stated approach is to negotiate with willing participants.

At this stage the final location of the proposed well sites has not been determined and would be finalised once the relevant land owner agreements (as explained above) are in place. The exact location on the ground is flexible and can be adjusted to accommodate local features, landowner's needs and environmental sensitivities. Ultimately, Rhino Oil and Gas want to develop and maintain good working relationship with all landowners and would want to make sure that they understand and are comfortable with the planned activities before any work commences. Rhino Oil and Gas would not access any property without engaging with the land owner to agree terms and provide adequate notice of any activity. A written Access Agreement, defining all relevant conditions, would be concluded, giving the landowner opportunity to influence the location and terms of use. Thus each landowner will have direct input in whether and where exploration activity would take place on their land.

Access would largely be through existing routes and gates. New routes or gates would only be created in agreement with the landowner. Controlled access points would be locked at all times if that is what the landowner requires.

Activities for the early phase exploration are of short duration, limited extent and localised such that no real change to the land would occur. Unlike with mining there would not be disturbance or sterilisation of large areas of land. As such a change in land value is highly unlikely.

7.3.3 Land Use

Issue: Exploration activities would occupy land, which could have an impact on current associated land uses, e.g. farming, forestry plantation, mining, etc. The undertaking of the proposed exploration activities would preclude other land uses for the duration of the well drilling and testing period. Potential impacts include:

- Prevention or disruption of land user' activities;
- Impacts to crops, plantations, veld and livestock/game;
- Related loss of income; and
- Loss of productivity on disturbed land.

Response: Each individual well drilling sites would occupy an area of approximately 2 500 m². The drilling and testing period would only preclude other activities for a short period of a few weeks. Thereafter the extent of the well site is reduced to a few square metres for the well head, or completely removed in the event of abandonment. Thus any loss of land for farming activities would be highly localised and temporary.

The placement of the target sites/routes would be undertaken in consultation with the landowner/occupier to ensure that conflicting land uses are avoided where possible and disturbance to current land use activities are kept to a minimum. The primary target for any drilling site would thus be a previously disturbed area that is not currently being used for agricultural production. The use of any land for exploration activities would have to be through an Access Agreement negotiated between the exploration right holder and the landowner/occupier. Measures to ensure that any interference is avoided or minimised would be written into the agreement drawn up with each landowner and included in the final exploration plan. Thus the landowner would have direct input into where the exploration well drilling site is placed or not placed and the measures required to avoid or minimise interference. Refer to Section 7.3.2 above for further detail on access to land.

All disturbances occurring from exploration would be documented and the affected area returned to an agreed condition by the right holder and land owner. In most cases the effects of any disturbance would more than likely not be visible over a period of a few months.

Other mitigation to minimise the impact on landowners and current land uses that would be considered for inclusion in the EMP include:

- Possible exclusion periods to minimise the impact on current or planned land use activities (e.g. sowing, harvesting, etc.);
- Ensuring livestock is kept away from exploration sites (including temporary fencing and gates, established of buffers zones, etc.);
- Any loss of income would be determined between the landowner and the right holder and compensation agreed where necessary (see Section 5.4.20 for more detail on compensation); and

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- Adequate and ongoing consultation with landowners and other mineral right prior to and during on-site exploration activities.

7.3.4 Safety and Security

7.3.4.1 Public safety

Issue: Public safety within widespread exploration in the region has been raised as a concern by I&APs. Activities at exploration sites are potentially dangerous due to, *inter alia*, increased traffic volumes, operation of heavy machinery, use and storage of hazardous materials, possible release of gas, etc. Thus there is a risk of members of the public being injured if access to exploration sites is not controlled.

Response: Provision would need to be made to ensure public health and safety is maintained. Mitigation would largely involve excluding the public from sites where exploration is undertaken. Any risks relating to well drilling can be avoided completely by maintaining an appropriate buffer between the exploration site and the nearest receptor. It is recommended that no well drilling sites be located within 200 m of a residence or within 500 m of a residential area. This issue will be further investigated in the next phase of the EIA and an appropriate buffer will be confirmed.

Other mitigation to minimise the impact on public safety that will be considered for inclusion in the EMP include:

- Appropriate demarcation of sites (using temporary fencing or danger tape);
- Erecting signage (in appropriate languages); and
- Ensuring any excavations are backfilled.

7.3.4.2 Landowner security

Issue: Concerns have been raised relating to safety and security on farms with many farmers having experienced a wide range of crimes against their property, possessions and persons. There is a concern that the increased numbers of people in the area as a result of the proposed exploration activities could exacerbate the situation, either through direct theft by contractors and staff or through undeterred access onto private land through gates that are left open or fences that are removed / damaged.

Response: Concerns regarding site access, trespassing and farm security as a result of exploration teams would be alleviated by Rhino Oil and Gas and its contractors developing relationships with individual landowners. All access to land for exploration activities would have to be through an Access Agreement negotiated between the exploration right holder and the landowner/occupier (see Section 7.3.2). Thus any additional landowner requirements with regard to safety and security can be discussed during landowner negotiations prior to the start of exploration and written into the land use agreements with each landowner, as required.

Mitigation to minimise the risks to landowner security that will be considered for inclusion in the EMP include:

- Avoiding the creation of new access points to farms, as far as possible;

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- Ensuring the staff are under constant supervision and do not enter adjacent farms / residential areas under any circumstances except on official business; and
 - Ensuring all gates are closed/locked and any fences that are damaged or may need to be removed are repaired / replaced immediately.

7.3.5 Fires

Issue: The extensive natural vegetation of the region provides high fuel loads for veld fires. The dry winters combined with high wind speeds provide an environment susceptible to fire. Veld fires can have a devastating effect on landowners with risks to human life and livestock, damages to infrastructure and loss of winter grazing.

Response: During any exploration activities Rhino Oil and Gas and its contractors would be aware of the risk of fire. The contractor would be required to comply with the requirements of the Veld & Forest Fires Act, 1998 (No. 101 of 1998) in terms of establishing contact with the Fire Protection Association and /or surrounding landowners. Environmental awareness training would specifically need to address fire risks. Measures would be put in place to assess the fire risk of all activities and reasonable preventative actions would be implemented where necessary. An emergency procedure for the control of accidental fire would also be put in place. Suitable insurance would be maintained by Rhino Oil and Gas.

7.3.6 Contribution to local economy

Issue: Contribution to the local economy could occur through the creation of direct employment opportunities and generation of direct revenues as a result of using local businesses for support services and supplies. On the other hand if the exploration detracts from or compromises the main attractions of the region then it could result in a reduction in external inputs to the local economy.

Response: Since economic growth and employment opportunities are depressed in many of the small towns within the ER area, any potential stimulation of the local economy would result in a positive impact. However, since exploration is highly technical and requires specialised equipment and crews, job opportunities for local communities would be very limited. The small number people required and very short duration of each of the proposed exploration operations further limits opportunities. A staff of approximately five persons would operate a well drilling rig. These are mostly persons with specific technical skills.

The employment and training of local persons, particularly Historically Disadvantaged Individuals, even for short-term jobs, would be encouraged by Rhino Oil and Gas and all of their sub-contractors. Where ever possible the materials and equipment needed to operate the exploration equipment and sustain the personnel would be acquired locally, thus providing some limited input into the local economy. Training and skills transfer should be ensured whenever possible.

The above potential contribution to the economy would also need to take into consideration any potential negative impacts, e.g. impacts on existing land uses (e.g. agriculture, mining, tourism). Refer to Section 7.3.3 for a more detailed description of the impacts on existing land use.

7.3.7 Compensation

Issue: Various queries were raised relating to compensation for: (i) the minerals derived from the land; (ii) access to land; and (iii) the use of or impact to land.

Response: The MPRDA provides that all minerals vest with the State. Thus a landowner has no claim to the minerals that may occur on their land and is not due any compensation for those minerals. The nature of the proposed exploration programme is not expected to have a significant effect on any landowner or occupier, nor the income derived from such land. This would be ensured by negotiating access with landowners and siting activities at agreed locations that do not conflict with current land use. Where necessary, compensation would be agreed with landowners for access as well as any economic loss, damage to infrastructure, etc. This would form part of the Access Agreement that is negotiated between the exploration right holder and the landowner (see Section 7.3.2).

7.3.8 Rehabilitation and liability

Issue: Land owners were concerned about who would be responsible for rehabilitation of land and property after any exploration activity and questioned how the rehabilitation would be funded. Other concerns raised related to the enforcement of rehabilitation by authorities and who would be required to pay for the rehabilitation if Rhino Oil and Gas failed to complete the rehabilitation adequately. Land owners were also concerned in the case where exploration took place on an adjacent farm and resulted in impacts affecting their own neighbouring property.

Response: Rhino Oil and Gas would be responsible for the rehabilitation of all disturbances resulting from their exploration work, as set out in the NEMA. Where areas have been disturbed by exploration, rehabilitation would be undertaken to re-establish disturbed areas to the pre-exploration land use. The pre-exploration land-use would be determined during the detailed site assessments, which would be undertaken during the EIA when finalising the location of each well site. The process of managing the impacts and rehabilitating the exploration sites would be conducted in terms of an EMPr approved by the DMRE. The land owner's agreement is required before a drill site is considered rehabilitated.

As part of the EIA process it is necessary to determine the quantum of a financial provision that is required for rehabilitation, closure and on-going post decommissioning management of negative environmental impacts (Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, GN 1147). This quantum must be made available by Rhino Oil and Gas to PASA as security for the completion of rehabilitation should Rhino Oil and Gas fail to do so. PASA, in consultation with other relevant authorities, would determine the use and allocation of this money for rehabilitation. The financial provision that needs to be made is not limited to the land on which the exploration would be undertaken, but would provide for rehabilitation of damages from exploration.

The quantum of the required financial provision would be determined and disclosed through the EIA process.

8. PRELIMINARY ASSESSMENT OF PROJECT ALTERNATIVES

This chapter has been compiled in compliance with Section 2(h)(v) of Appendix 2 of the EIA Regulations, 2014 (as amended). The aim of this Section is to compare the environmental impacts and risks of the project alternatives for the purpose of selecting the preferred alternative(s). It does not, however, provide a conclusive assessment of all potential impacts. The assessment of potential impacts of the project (preferred alternative) will be presented in detail in the EIA Report.

It is reiterated that the scope of the EIA is aligned with and limited to the activities that have been proposed by Rhino Oil and Gas (i.e. well drilling). The applicant would have to obtain further authorisation, at least in terms of NEMA and the MPRDA, if they elected to pursue any activities beyond the scope of the updated EWP for which they have currently made application.

The potential impacts of the project activities and alternatives, in relation to the local environment, are presented in Table 8-1. These are based on the preliminary discussion of each of the issues / impacts discussed in Section 7 above. The preliminary assessment ratings provided in this table are for the unmitigated scenario only which assumes that limited consideration is given to the prevention or reduction of environmental and social impacts. A conservative approach has been applied to these ratings in the absence of specific studies.

The assessment and related ratings may change once the EIA phase has been completed. Moreover, once the mitigation / management measures have been incorporated into the assessment as part of the EIA, a determination of residual impact will be provided. The final impact assessment ratings will be included in the EIA Report.

TABLE 8-1: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS IDENTIFIED FOR THE PROPOSED ALTERNATIVES

ALTERNATIVE	POTENTIAL IMPACT	CONSEQUENCE			PROBABILITY	SIGNIFICANCE	DEGREE TO WHICH IMPACT:		
		INTENSITY	EXTENT	DURATION			Can be reversed	Causes irreplaceable loss	Can be avoided/ managed/ mitigated
No-Go Alternative									
No well drilling	No physical impacts would occur.					No Impact	Not Applicable (N/A)	None	N/A
	There would be no advancement in information on the potential petroleum resource within the ER and no potential socio-economic benefits would occur.	VL	L	H	D	L	N/A	N/A	N/A
Well Drilling Site Location and Drill Rig Technologies									
Well Drilling within identified Target Areas	Geology: Remote risk of destabilising certain geologies, underground caverns or mine workings.	M – H	VL	M	VL	Insig.	Mostly	Possible	Yes
	Soils: Project activities may result in contamination of soils. Vehicles and project activities on soils may damage soil structure and/or cause compaction or erosion.	M	VL	M	M	L	Almost always	Very unlikely	Yes
	Groundwater: Contamination of groundwater by drilling fluids, accidental spills and other sources.	M	VL	M	M	L	Mostly	Unlikely	Yes
	Freshwater: Contamination of freshwater by drilling fluids, accidental spills and other sources. Physical disturbances of the beds and banks of watercourses.	M	L	VL	L	L	Mostly	Very unlikely	Yes

ALTERNATIVE	POTENTIAL IMPACT	CONSEQUENCE			PROBABILITY	SIGNIFICANCE	DEGREE TO WHICH IMPACT:		
		INTENSITY	EXTENT	DURATION			Can be reversed	Causes irreplaceable loss	Can be avoided/ managed/ mitigated
Well Drilling within identified Target Areas	Noise: Project activities could result in changes to the ambient noise levels during operation around the proposed well drilling site.	L	VL	VL	VL	VL	Almost always	Very unlikely	Yes
	Air Quality: Project activities could result in changes to the ambient air quality during operation around the proposed well drilling site.	L	VL	VL	VL	VL	Almost always	Very unlikely	Yes
	Health Risks: Activities may pose a risk of injury to public.	M – H	VL	L	VL	Insig.	Mostly	Possible	Yes
	Ecology and Biodiversity: Damage or destruction of the vegetation, habitat and the disturbance or loss of species of conservation concern.	M	L	VL	L	L	Mostly	Very unlikely	Yes
	Heritage and Palaeontology: Disturbance of heritage resources by exploration.	M	VL	VL	L	L	Mostly	Very unlikely	Yes
	Land Use: Access to private land and the associated inconvenience, damage to infrastructure, interference with land use, safety and security risk.	L	VL	VL	L	L	Almost always	Very unlikely	Yes
	Contribution to Local Economy: Project activities would contribute to local economy through payment of local service providers.	L+	VL	VL	L	L+	N/A	N/A	N/A

9. PLAN OF STUDY FOR EIA

This chapter presents the Plan of Study for EIA as required in terms of Section 2(i) of Appendix 2 of the EIA Regulations, 2014 (as amended). It describes the nature and extent of the investigations to be conducted and sets out the proposed approach to the EIA phase.

9.1 ALTERNATIVES TO BE CONSIDERED

The project scope to be considered and assessed in the EIA is the 2-year EWP comprising the drilling of 10 wells, as proposed by the applicant and described in Section 5.5. Only the preferred alternative and the no-go alternative will be considered during the EIA.

9.2 DESCRIPTION OF THE ASPECTS TO BE ASSESSED

The environmental aspects relevant to the anticipated impacts as described in Chapter 7 will be considered and investigated in the EIA phase.

9.3 PROPOSED SPECIALIST STUDIES

Four specialist studies will be commissioned to address the key issues that require further investigation and detailed assessment, namely terrestrial biodiversity, aquatic biodiversity, heritage (including palaeontology), and a desktop hydrogeological investigation. The specialist Terms of Reference for these studies are presented in Section 9.3.2 to 9.3.5 below.

Each specialist will identify and describe the features in their field of expertise relevant to identifying and assessing environmental impacts that may occur as a result of the proposed exploration programme. These impacts will then be assessed according to pre-defined rating scales (see Section 9.3.6). Specialists will also recommend appropriate mitigation or optimisation measures to minimise potential impacts or enhance potential benefits, respectively.

9.3.1 General Terms of Reference for the Specialist Studies

The following general Terms of Reference will apply to the Specialist Studies:

- Describe the baseline conditions that exist within areas targeted for the proposed exploration programme and identify any sensitive areas that should be avoided or would need special consideration;
- Review the Comments and Responses Reports in the Final Scoping Report to ensure that all relevant issues or concerns relevant to the field of expertise are addressed;
- Identify and assess potential impacts of the operation, and decommissioning phases, as well as the No-Go Alternative;
- Identify and list all legislation and permit requirements that are relevant to the proposed exploration programme;

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- Identify areas where issues could combine or interact with issues likely to be covered by other specialists, resulting in aggravated or enhanced impacts;
 - Indicate the reliability of information utilised in the assessment of impacts as well as any constraints to which the assessment is subject (e.g., any areas of insufficient information or uncertainty);
 - Consider the precautionary principle in the assessment of all potential impacts;
 - Identify feasible ways in which impacts could be mitigated and benefits enhanced giving an indication of the likely effectiveness of such mitigation and how these could be implemented in the management of the proposed exploration programme;
 - To ensure that specialists use a common standard, the determination of the significance of the assessed impacts will be undertaken in accordance with a common Convention (see Section 9.3.6);
 - Comply with DFFE guidelines as well as any other relevant guidelines on specialist study requirements for EIAs;
 - Include specialist expertise and a signed statement of independence; and
 - Comply with the relevant specialist assessment and minimum report content requirements listed in the gazetted Specialist Protocols (GN R320 of 20 March 2020), or where no protocol has been prescribed, comply with the provisions of Appendix 6 of the EIA Regulations 2014 (as amended).

9.3.2 Terrestrial biodiversity

In accordance with the “Protocol for the Specialist Assessment and Minimum Report Content Requirements for Environmental Impacts on Terrestrial Biodiversity”, as the Screening Tool identified portions of the target areas as being of “very high” and “high” sensitivity for terrestrial biodiversity, a Terrestrial Biodiversity Specialist Assessment is required. The proposed terms of reference for the study is as follows:

- Identify, map (vegetation types, locations of species of conservation concern and conservation value / sensitivity map) and describe the flora present with sites targeted for the proposed well drilling, based on a field survey and available literature;
- Provide a broad description of the existing environment in terms of its fauna (focusing on vertebrates, but with cognition of invertebrates of conservation concern), based on a field survey and available literature;
- Identify and describe sensitive faunal habitats within sites targeted for the proposed well drilling;
- Comment on the conservation status and ecological importance of species on a local, regional, and national scale;
- Identify any species of special concern viz. species with conservation status, endemic to the area or threatened species that exist or may exist within the sites targeted for the proposed well drilling;
- Provide a conservation importance rating of the vegetation within sites targeted for the proposed well drilling (in local, regional, and national terms);
- Investigate ecological / biodiversity processes that could be affected (positively and/or negatively) by the proposed well drilling;
- Provide guidance for any requirements for a permit in terms of the National Environmental Management: Biodiversity Act, 2004 (No. 10 of 2004) to remove or destroy threatened or protected species;
- Assess the significance of the loss of vegetation, faunal species, and impact on ecological / biodiversity processes as a result of the implementation of the proposed well drilling; and

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- Identify practicable mitigation measures to reduce any negative impacts to the indigenous vegetation (including species and techniques that could potentially be used for rehabilitation purposes) and indicate how these could be implemented in the construction and management of the proposed project.

9.3.3 Aquatic biodiversity

As the Screening Tool identified portions of the target areas as being of “very high” and “high” sensitivity for aquatic biodiversity, a Freshwater Impact Assessment will be undertaken. The proposed terms of reference for the study is as follows:

- Identify, map, and describe the freshwater systems that could be affected by the proposed well drilling, based on a field survey and available literature;
- Describe the ecological condition, sensitivity, ecological important and conservation value of all identified freshwater systems;
- Identify and assess the significance of potential impacts associated with the proposed well drilling on the freshwater systems;
- Investigate ecological / biodiversity processes that could be affected (positively and/or negatively) by the proposed well drilling;
- Identify practicable mitigation measures to reduce impacts on the aquatic fauna and flora during well drilling; and
- Provide guidance for the requirement of any licences or permits from DWS that might be necessary.

9.3.4 Heritage (including palaeontology)

The specific terms of reference for the heritage assessment are as follows:

- Provide a description of the archaeology, palaeontology and cultural heritage of the areas targeted for the proposed exploration programme and identify and map any sites of archaeology, palaeontology or cultural significance that may be impacted by the proposed well drilling;
- Assess the sensitivity and conservation significance of any sites of archaeological, palaeontology or cultural heritage significance affected by the proposed well drilling;
- Identify and assess the significance of the potential impacts of the proposed well drilling on archaeological, palaeontology and cultural heritage;
- Make recommendations on the protection and maintenance of any significant cultural heritage and/or archaeological / palaeontology sites that may occur within the sites proposed for well drilling;
- Identify practicable mitigation measures to reduce negative impacts on the archaeological / palaeontology resources and indicate how these can be incorporated into the management of the proposed well drilling;
- Provide guidance for the requirement of any permits from the South African Heritage Resources Agency (SAHRA) that might become necessary.

9.3.5 Desktop hydrogeological investigation

A desktop analysis of the receiving groundwater environment which may be affected by the proposed well drilling will be undertaken by a geohydrologist in order to provide understanding of the key groundwater features. The aim will be to identify the groundwater resources in proximity to the well sites and to understand the extent, nature, status and use of these. Taking into consideration the extent of the study area, a desktop groundwater assessment study will be undertaken by a geohydrologist to establish:

- General distribution of groundwater levels in the target areas,
- Seasonal fluctuation of groundwater levels;
- Classification of groundwater potential for the area, aquifer types and depths;
- Presence of major catchment areas and possible interaction between surface and groundwater
- Current (baseline) regional conditions for groundwater; and
- Recommendations for later phase groundwater work that should be done if exploration proceeds.

The proposed methodology for achieving the objectives of the desktop study consists of:

- Interrogation of the National Groundwater Database (DWS) to determine presence of water supply and monitoring boreholes within the delineated target areas.
- Extraction of water level records and determination of the approximate groundwater levels.
- Extraction of groundwater quality records and delineation of possible zones of higher concentration for various groundwater constituents.
- Spatial processing of national groundwater maps
- Spatial geo-processing for groundwater resources in the target areas.

Aquifers and water use will be mapped to the greatest degree possible using available ground cover and other GIS data. The outcome will be to define the levels of compatibility of the proposed exploration programme with the groundwater resources and to determine exclusion criteria that should be applied when identifying and assessing sites for physical exploration.

The specific terms of reference for the groundwater assessment are as follows:

- Identify, map and describe groundwater resources / aquifers in areas targeted for the proposed exploration programme, based on available literature, existing databases and any fine scale plans for the region;
- Describe the ecological condition, sensitivity, ecological importance and conservation value of all identified groundwater resources / aquifers;
- Develop a sensitivity plan (low, medium and high significance) based on the findings of the desktop review and describe any potential constraints relating to identified sensitive areas;
- Determine exclusion criteria that should be applied when identifying and assessing sites for physical exploration during the detailed site assessment;
- Identify other practicable mitigation measures to reduce any potential negative impacts and indicate how these could be implemented and managed during exploration;
- Undertake a hydrocensus of (a defined number of) boreholes within 1 km of proposed wells to describe and map the local hydrogeological features and water uses. Sampling and analysis of active water production holes within 1 km of proposed wells will be undertaken;
- Develop a second order numerical groundwater flow and solute transport model of the hydrogeological systems around the proposed well sites; and

-
- Provide guidance for the requirement of any authorisation, permits or licences (e.g. General Authorisation or Water Use Licence).

9.3.6 Method of assessing impact significance

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 exploration programme. 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.

9.3.7 Identification and Description of Impacts

Identified impacts will be described in terms of the nature of the impact, compliance with legislation and accepted standards, receptor sensitivity and the significance of the predicted environmental change (before and after mitigation). Mitigation measures may be existing measures or additional measures that were identified through the impact assessment and associated specialist input. The impact rating system considers the confidence level that can be placed on the successful implementation of mitigation.

9.3.8 Evaluation of Impacts and Mitigation Measures

9.3.8.1 Introduction

Specialists are to use SLR's standard convention for assessing the significance of impacts, a summary of which is provided below. In assigning significance ratings to potential impacts before and after mitigation the approach presented below is to be followed.

1. **Determine the impact consequence rating:** This is a function of the "intensity", "duration" and "extent" of the impact (see Section 9.3.8.2). The consequence ratings for combinations of these three criteria are given in Section 9.3.8.3.
2. **Determine impact significance rating:** The significance of an impact is a function of the consequence of the impact occurring and the probability of occurrence (see Section 9.3.8.3). Significance is determined using the table in Section 9.3.8.4.
3. **Modify significance rating (if necessary):** Significance ratings are based on largely professional judgement and transparent defined criteria. In some instances, therefore, whilst the significance rating of potential impacts might be "low", the importance of these impacts to local communities or individuals might be extremely high. The importance/value which interested and affected parties attach to impacts will be highlighted, and recommendations should be made as to ways of avoiding or minimising these perceived negative impacts through project design, selection of appropriate alternatives and / or management.

9.3.8.2 Criteria for Impact Assessment

The criteria for impact assessment are provided below.

Criteria	Rating	Description
Criteria for ranking of the INTENSITY (SEVERITY) of environmental impacts	VERY HIGH	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	HIGH	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	MEDIUM	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	LOW	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VERY LOW	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VERY LOW +	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	LOW +	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	MEDIUM +	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	HIGH +	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VERY HIGH +	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	VERY LOW	Very short, always less than a year. Quickly reversible.
	LOW	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	MEDIUM	Medium-term, 5 to 10 years.
	HIGH	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VERY HIGH	Very long, permanent, +20 years (Irreversible. Beyond closure).
Criteria for ranking the EXTENT / SPATIAL SCALE of impacts	VERY LOW	A part of the site/property.
	LOW	Whole site.
	MEDIUM	Beyond the site boundary, affecting immediate neighbours.
	HIGH	Local area, extending far beyond site boundary
	VERY HIGH	Regional/National

9.3.8.3 Determining Consequence

Consequence attempts to evaluate the importance of a particular impact, and in doing so incorporates extent, duration and intensity. The ratings and description for determining consequence are provided below.

			EXTENT				
			A part of the site/ property	Whole site	Beyond site affecting neighbours	Local area, extending far beyond site.	Regional/ National
			VL	L	M	H	VH
INTENSITY = VL							
DURATION	Very Long term	VH	Low	Low	Medium	Medium	High
	Long term	H	Low	Low	Low	Medium	Medium
	Medium term	M	Very Low	Low	Low	Low	Medium
	Short term	L	Very Low	Very Low	Low	Low	Low
	Very short tern	VL	Very Low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very Long term	VH	Medium	Medium	Medium	High	High
	Long term	H	Low	Medium	Medium	Medium	High
	Medium term	M	Low	Low	Medium	Medium	Medium
	Short term	L	Low	Low	Low	Medium	Medium
	Very short tern	VL	Very Low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very Long term	VH	Medium	High	High	High	Very High
	Long term	H	Medium	Medium	Medium	High	High
	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short tern	VL	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very Long term	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short tern	VL	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very Long term	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short tern	VL	Low	Medium	Medium	High	High
			VL	L	M	H	VH
			A part of the site/ property	Whole site	Beyond site affecting neighbours	Local area, extending far beyond site.	Regional/ National
			EXTENT				

9.3.8.4 Determining Significance

The consequence rating is considered together with the probability of occurrence in order to determine the overall significance using the table below.

PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VH
			CONSEQUENCE				

9.4 CONSULTATION PROCESS DURING EIA PHASE

9.4.1 Consultation with the Competent Authority

Any conditions of the approval of the Scoping report from the competent authority will be implemented in the EIA process. If requested, a site visit and meeting with the competent authority shall be held.

The EIA Report (including EMPr) will be submitted to PASA in both draft and final formats. The opportunities for consultation and participation of the Competent Authority are shown in Table 9-1.

9.4.2 Public Participation Process during the EIA Phase

A description of the tasks that will be undertaken during the EIA, with specific reference to the opportunities for consultation and participation for I&APs, relevant State Departments Organs of State and commenting authorities is detailed below and shown in Table 9-1. A specific focus will be placed on informing and engaging land owners of properties where well sites could potentially be located, as well as the land owners of neighbouring properties.

9.4.2.1 Notification of interested and affected parties

I&APs registered on the project database will notified of relevant events in the EIA process via email, post and bulk SMS. This will include the authority decision on the Scoping Report, when the EIA Report is available for public review and notification of the authority decision on the EA.

9.4.2.2 Information to be provided to I&APs

The EIA Report will be subjected to public review for a period of 30 days. A summary of the findings of the EIA report will be provided in English and SeSotho.

Once PASA has issued a decision on the application, I&APs on the project database will be informed accordingly of the decision, the reasons therefor and the fact that an appeal may be lodged in terms of the National Appeals Regulations, 2014.

9.4.2.3 Details of the engagement process

The proposed tasks, including stakeholder engagement, to be undertaken for the rest of the Scoping and the EIA Phase is set out in Table 9-1 overleaf.

9.5 INTEGRATION AND ASSESSMENT

The specialist findings, recommendations and other relevant information will be integrated into an EIA Report. The full specialist studies will also be included as appendices to the EIA Report.

9.6 MEASURES TO AVOID, REVERSE, MITIGATE OR MANAGE IDENTIFIED IMPACTS

A draft EMPr will be compiled and included as an appendix to the EIA Report. The EMPr will be structured in terms of Appendix 4 to the EIA Regulations 2014 (as amended). The EMPr will provide recommendations on how to establish, operate, maintain and close the proposed project throughout all relevant phases of the project activities. The aim of the EMPr will be to ensure that the project activities are managed to avoid or reduce potential negative environmental impacts and enhance potential positive environmental impacts.

The EMPr will detail the impact management objectives, outcomes and actions as required, the responsibility for implementation and the schedule and timeframe. Requirements for monitoring of environmental aspects, as well as compliance monitoring and reporting, will also be detailed. The EMP will also include the required environmental awareness plan.

If approved by the relevant authorities, the provisions of the EMPr would be legally binding on the project applicant and all its contractors and suppliers.

9.7 DESCRIPTION OF TASKS AND INDICATIVE TIMING OF THE EIA PHASE

The EIA Phase has been developed to ensure that it complies with Section 23 of GN R326 and in particular Appendices 3 and 4 to the EIA Regulations 2014 (as amended). The various tasks / activities (including the indicative timing thereof) that will be undertaken during the EIA Phase are described in Table 9-1.

TABLE 9-1: EIA TASKS AND TIMING

Phase	EAP activity	Opportunities for Consultation and Participation		SCHEDULE
		Competent Authorities	I&APs, State Departments and Organs of State	
Scoping	Submit Final Scoping Report to authority by 14 November 2022.	Authority to Accept scoping report OR Refuse environmental authorisation (43 days of receipt)	Advise I&APs of authority decision on Scoping Report	Nov 2022 to January 2023
Specialist Assessments	EAP to manage specialist activities and receive inputs for EIA.		Ongoing consultation, particularly with key stakeholders and potentially affected land owners	January to March 2023
	Assess environmental impacts and identify management measures. Compile draft EIA Report (including EMPr)			January to March 2023
EIA Phase	Submit draft EIA report to I&APs & authorities.	Review of draft EIA report (30 days). Comments to EAP	Review of draft EIA report (30 days). Comments to EAP	March to April 2023
	Address public comment and finalise EIA and EMPr reports			April to May 2023
	Final EIA report to Authority (106 days from acceptance of scoping).	Authority Acknowledge Receipt of EIA report (10 days).		May 2023
Authority review and Authorisation Phase		Environmental Authorisation Granted / Refused (107 days).	Notifications to I&APs regarding environmental authorisation (granted or refused).	September 2023
Appeal Phase	EAP to provide guidance regarding the appeal process as and when required.	Consultation during processing of appeal if relevant.	Submit appeal in terms of National Appeal Regulations	20 days from date of notification of decision to grant/refuse EA

9.8 OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

9.8.1 Financial Provision

In terms of Section 24P of NEMA and associated regulations pertaining to the financial provision (GN. R1147), an applicant for Environmental Authorisation relating to exploration must, before the Minister of Mineral Resources issues the Environmental Authorisation, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts.

Rhino Oil and Gas would put in place the required financial provision for the proposed exploration activities. Rhino Oil and Gas will discuss the nature and quantum of the financial provision with PASA during the next phase of the EIA. The proposed nature and quantum of the financial provision will be presented in the EIA Report.

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

Exploration as proposed is not expected to have a significant effect on the socio-economic conditions of any landowner or occupier. This can be ensured by negotiating access with landowners and siting activities at agreed locations. Where necessary, compensation will be agreed with landowners for any economic loss.

9.8.3 Other matters required in terms of sections 24(4)(a) and (b) of the act

None.

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