Reconnaissance Energy Namibia (Pty) Ltd

Final Environmental Scoping Report Vol. 1 of 3 to Support the Notification for Application of Environmental Clearance Certificate (ECC) Project Registration for the Proposed Petroleum (Oil and Gas) Exploration Operations (Drilling of Stratigraphic Wells) in Petroleum Exploration License (PEL) 73 Covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821, KAVANGO BASIN, KAVANGO WEST AND EAST REGIONS, NORTHERN NAMIBIA

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May 2019

OPERATOR

Reconnaissance Energy Namibia (Pty) Ltd Subsidiary of
Reconnaissance Energy Africa Ltd (ReconAfrica)

LICENSE PEL 73

Blocks 1719, 1720, 1721, 1819, 1820 and 1821

WORKING INTERESTS

ReconAfrica owns 90%
National Petroleum Corporation of Namibia (Namcor)
(A State Owned Company) 10% with costs carried to the development stage

TYPE OF PETROLEUM EXPLORATION OPERATIONS

Drilling of Multiple Stratigraphic Wells Two (2) to Three (3)

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ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Dr. Sindila Mwiya (*PhD, PG Cert, MPhil, BEng (Hons), Pr Eng*)

CITATION: ***Risk-Based Solutions (RBS), 2019****. Environmental Impact Assessment (EIA) Report, Vol. 2 of 3 Report to Support the Application for Environmental Clearance Certificate (ECC) for the Proposed Petroleum Exploration Operations (Drilling of Stratigraphic Wells) in Petroleum Exploration License (PEL) 73 Covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821, Etosha Basin, Kavango West and East Regions, Northern Namibia.*

STATEMENT OF QUALIFICATIONS / SUMMARY CV /PROFILE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP) – DR. SINDILA MWIYA

Dr. Sindila Mwiya has more than eighteen (18) years of direct technical industry experience in Environmental Assessment (SEA, EIA, EMP, EMS), Energy (Renewable and Non-renewable energy sources), onshore and offshore resources (minerals, oil, gas and water) exploration / prospecting, extraction and utilisation, covering general and specialist technical exploration and production support, Health, Safety and Environment (HSE) permitting for Geophysical Surveys such as 2D and 3D Seismic and Gravity Surveys for mining and petroleum (oil and gas) operations support, through to engineering planning, layout, designing, logistical support, recovery, production / operations, compliance monitoring, rehabilitation, closure and aftercare projects lifecycles.

Through his companies, Risk-Based Solutions (RBS) and Foresight Group Namibia (FGN) (Pty) Ltd , which he founded, he has undertaken more than 200 projects for local, regional (SADC) and international clients. He continue to work for global reputable resources (petroleum and mining / minerals) and energy companies such as BW Offshore (Singapore), Shell Namibia B. V. Limited (Namibia/ the Netherlands), Tullow Oil (UK), Debmarine (DBMN) (Namibia), Reconnaissance Energy Africa Ltd (ReconAfrica) (UK/Canada), Osino Resource Corporation (Canada/Germany/ Namibia), Desert Lion Energy Corporation (Canada/ Australia), Petrobras Oil and Gas (Brazil) / BP (UK), REPSOL (Spain), ACREP (Namibia/Angola), Preview Energy Resources (UK), HRT Africa (Brazil / USA), Chariot Oil and Gas Exploration (UK), Serica Energy (UK), Eco (Atlantic) Oil and Gas (Canada / USA), ION GeoVentures (USA), PGS UK Exploration (UK), TGS-Nopec (UK), Maurel & Prom (France), GeoPartners (UK), PetroSA Equatorial Guinea (South Africa / Equatorial Guinea), Preview Energy Resources (Namibia / UK), Sintezneftegaz Namibia LTD (Russia), INA Namibia (INA INDUSTRIJA NAFTE d.d) (Croatia), Namibia Underwater Technologies (NUTAM) (Namibia), InnoSun Holding (Pty) Ltd (Namibia / France) and OLC Northern Sun Energy (Pty) Ltd (USA /Namibia). Dr. Sindila Mwiya is highly qualified with extensive experience in petroleum, mining, renewable energy (Solar, Wind, Biomass, Geothermal and Hydropower), Non Renewable energy (Coal, Petroleum, and Natural Gas), applied environmental assessment, management and monitoring (Scoping, EIA, EMP, EMP, EMS) and overall industry specific HSE, cleaner production programmes, geoenvironmental, geological and geotechnical engineering specialist fields.

Dr. Sindila Mwiya has undertaken and continue to undertake and manage high value projects on behalf of global and local clients with the single biggest project executed recently being valued at NAD4.9 Billion. Currently, (2019-2021) Dr. Sindila Mwiya is responsible for permitting planning through to completion compliance monitoring for four (4) major upstream petroleum operations valued at NAD4.2 Billion for three (3) of our global clients operating in Namibia and other parts of the World. He continue to worked as an Environmental Assessment Practitioner (EAP), Technical Consultant (RBS / FGN), Project Manager and has worked as a Lecturer (University of Namibia- UNAM), External Examiner/ Moderator (Namibia University of Science and Technology-NUST), National (Namibia) Technical Advisor (Directorate of Environmental Affairs, Ministry of Environment and Tourism / DANIDA – Cleaner Production Component) and Chief Geologist for Engineering and Environment Division, Geological Survey of Namibia, Ministry of Mines and Energy and a Field-Based Geotechnician (Specialised in Magnetics, Seismic, Gravity and Electromagnetics Exploration and Survey Methods) under the Federal Institute for Geoscience and Natural Resources (BGR) German Mineral Exploration Promotion Project to Namibia, Geophysics Division, Geological Survey of Namibia, Ministry of Mines and Energy.

He has supervised and continue to support a number of MScs and PhDs research programmes and has been a reviewer on international, national and regional researches, plans, programmes and projects with the objective to ensure substantial local skills development pivotal to the national socioeconomic development through the promotion of sustainable natural resources coexistence developmental approaches, utilisation, management and for development policies, plans, programmes and projects financed by governments, private investors and donor organisations. Since 2006, he has provided extensive technical support to the Department of Environmental Affairs (DEA), Ministry of Environment and Tourism (MET) through GIZ and continue to play a significant role in the amendments of the Namibian Environmental Management Act, 2007, (Act No. 7 of 2007), preparation of new Strategic Environmental Assessment (SEA) Regulations, preparation of the updated Environmental Impact Assessment (EIA) Regulations as well as the preparation of the new SEA and EIA Guidelines and Procedures all aimed at promoting effective environmental management practices.

Among his academic achievements, Dr Sindila Mwiya is a holder of a PhD (Geoenvironmental Engineering and Artificial Intelligence) – Research Thesis: Development of a Knowledge-Based System Methodology (KBSM) for the Design of Solid Waste Disposal Sites in Arid and Semiarid Environments (Namibia)), MPhil/PG Cert and BEng (Hons) (Engineering Geology and Geotechnics), qualifications from the University of Portsmouth, School of Earth and Environmental Sciences, United Kingdom. During the 2004 Namibia National Science Awards, organised by the Namibian Ministry of Education, and held in Windhoek, Dr. Sindila Mwiya was awarded the Geologist of the Year for 2004, in the professional category. Furthermore, as part of his professional career recognition, Dr. Sindila Mwiya is a life member of the Geological Society of Namibia, Consulting member of the Hydrogeological Society of Namibia and a Professional Engineer registered with the Engineering Council of Namibia.

WINDHOEK, MAY 2019

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Abbreviations and Acronyms

ALARP	As Low As Reasonably Practicable
Barrel or BBL	A stock tank barrel, a standard measure of volume for petroleum corresponding to 159 litters.
BHA	Bottom Hole Assembly
BOP	Blow-Out Preventer
Bpd	Barrels per day
Bcf	Billion cubic feet.
Bcfpd	Billion cubic feet per day.
BOE	Barrels of oil equivalent, with volumes of natural gas converted to barrels of oil using a conversion factor of 5,650 cf of natural gas to one bbl, in accordance with BP Statistical Review of World Energy of 2010.
Boepd	Barrels of oil equivalent per day.
Bcfg	Billion cubic feet of gas
Bopd	Barrels of oil per day
BWD	Basis of Well Design
DWA	Department of Water Affairs
EA	Environmental Assessment
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ERP	Emergency Response Plan
E&P	Exploration and production.
EOH	End of Hole
FGN	Foresight Group Namibia
HSE	Health, Safety and Environment
I &AP	Interested and Affected Parties (Stakeholders)
mamsl	metres above mean sea-level
Mbbl	Million barrels.
Mbpd	Million barrels per day.
Mboe	Million barrels of oil equivalent.
MME	Ministry of Mines and Energy
MET	Ministry of Environment and Tourism
MHSS	Ministry of Health and Social Services
MSS	Ministry of Safety and Security

MURD	Ministry of Urban and Rural Development
MWAF	Ministry of Agriculture, Water and Forestry
Mmbo	Millions of barrels of oil
Mmcf	Millions of cubic feet
Mmcm	Millions of cubic meters
MPA	Model Petroleum Agreement
NRPA	National Radiation Protection Authority
OEC	Office of the Environmental Commissioner
OD	Overburden Drilling
OSCP	Oil Spill Contingency Plan
PEL	Petroleum Exploration License
PDDP	Pre-Drilling Data Pack
POOH	Pull Out of Hole
Q4	Quarter 4
RBS	Risk-Based Solutions
RDMO	Rig Down Move Out
RIH	Run In Hole
RMP	Radiation Management Plan
SADC	Southern African Development Community
SEP	Stakeholders Engagement Plan
TOC	Total Organic Carbon
Tcf	Trillion cubic feet
TD	Total Depth
WOC	Waiting on cement
ToR	Terms of Reference
WBM	Water-Based Mud
WMP	Waste Management Plan
wt%	Weight percent

NON TECHNICAL SUMMARY

1. Introduction

Reconnaissance Energy Namibia (Pty) Ltd (the Proponent and Operator) hold petroleum exploration rights under the Petroleum Exploration License (PEL) No. 73 covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821 falling within the Kavango Basin which is the eastern extension of the greater Etosha Basin in northern Namibia and the greater Kalahari Basin of Southern Africa. PEL 73 is situated in Kavango West and East Regions of northern Namibia. A total of eight (8) potential well drilling locations were initially identified and only two (2) well locations numbers 5-6 and 6-2) falling within Blocks 1819 and 1820 will be drilled. Depending on the results of the proposed two (2) wells, other localities may also be drilled in future.

2. Summary of the Proposed Activities

The company intend to drill two (2) stratigraphic Petroleum (oil and gas) wells scheduled to be drilled in last quarter (Q4) of 2019 between the months of October and December 2019. The proposed drilling operations will be undertaken using a land-based, drilling rig similar, but bigger than a standard water drilling rig platform. The various components of the rig will be transported to site by a truck and the rig will be built onsite. After drilling completion, the rig will be disassembled and the various components will be packed and transported to the next drilling location or final destination. The likely key sources of negative environmental (physical, biological and socioeconomic/cultural/ archaeological) impacts can be divided into two (2) main categories and these are:

(1) Routine and physical presence operational activities:

(i) Pre-construction and drilling requirements;

(ii) Construction;

(iii) Mobilisation;

(iv) Spudding and Conductor casing;

(v) Drilling surface / intermediate and setting casing and cementing process through up 900 m;

(vi) Drilling and continuous coring from 900 meters (2953') to 1900 meters (6234');

(vii) Drilling below 1900 meters to total depth, estimated at 2500 meters (+/-8202');

(viii) Plug and abandon hole;

(ix) Rehabilitate all surface disturbances and clear the site of any debris, and;

(x) Camp removal, site closure / abandonment.

(2) Unplanned accidental events:

(i) Major land accidental incidence such as diesel / oil spill / fire / explosion.

A standard single well site for conventional onshore oil or gas drilling will typically affect a surface area measuring 150 m by 150 m. The well site will typically hold the drilling rig and additional equipment along with supervisory accommodation and material storage. Once drilling is completed the affected area will be reclaimed to minimise surface disturbance. To prepare for initial drilling, the access road and well site/s may require vegetation clearing, levelling, if necessary, with a bulldozer and/or grader / labour-based option if manpower exists with the local area, with careful consideration given to sensitivities of the receiving environment including: not cutting down of larger trees and protected flora as well as being on a look out for possible unexploded ordinances that may be buried. The scale and duration of site preparation is site-specific and may last for few hours to a couple of days depending on the length of the access or size of the site to be prepared.

3. Regulatory Requirements

In accordance with the provisions of the Petroleum Agreement (PA) signed between the Ministry of Mines and Energy (MME) representing the Government of the Republic of Namibia (GRN) and Reconnaissance Energy Namibia (Pty) Ltd, Reconnaissance Energy Namibia (Pty) Ltd has committed to implementing an exploration programme which includes drilling of two (2) stratigraphic petroleum (oil and gas) exploratory wells, (vertical geological mapping test wells drilling operations).

The proposed Oil and Gas Stratigraphic well drilling activities are listed in the Environmental Management Act, 2007 (Act No. 7 of 2007) and Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and cannot be undertaken without an Environmental Clearance Certificate (ECC). The company is required to have undertaken Environmental Assessment (EA) and preparation of the Environmental Scoping, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) reports in order to support the application for ECC. Reconnaissance Energy Namibia (Pty) Ltd as the proponent and operator of the license area has appointed Risk-Based Solutions (RBS) CC as the environmental consultant to apply for the ECC for the proposed drilling operations in PEL 73.

This Environmental Scoping Report (Vol. 1 of 3) has been prepared by Risk-Based Solutions (RBS) CC on behalf of the proponent in order to fulfil the environmental requirements with respect to the proposed drilling operations in PEL 73. The purpose of this Scoping Report is to identify key environmental issues to be covered in the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP).

4. Summary of the Baseline Environment

The well locations falls in the Ncamangoro and Mashare Constituencies of the Kavango West and East Regions. Ncamangoro Mashare Constituencies falls within the boundaries of the Mbunza and Sambyu Traditional Authorities, respectively. Overall, the proposed well locations are situated in a remote and sparsely populated areas with limited skills base. The project area is accessible via the D3425 Gravel / Sandy Road from Rundu to Ncuncuni and Ncaute. The highest population density in the area is concentrated along the D3425 and Omatako Ephemeral River Channel with no major settlements expected around the general drilling localities.

The main economic activities are subsistence agriculture, mainly small-scale millet (mahangu) farming, timber harvesting including community forestry resources and tourism, particularly in Kavango East Region. Livelihoods are thus considerably diversified, with residents relying also

on wages and salaries, pensions and cash remittances. Source of water supply in the project area is mainly groundwater with recharge linked to the Omatako Ephemeral River Channel.

In terms of fauna and flora, the general project is estimated to have at least 67 species of reptile, 32 amphibian, 116 mammal, 210 bird species (breeding residents), at least 107 species of larger trees and shrubs (>1m in height) and up to 111 species of grasses are known to or expected to occur in the general PEL 73 area.

With well know pre-colonial farming settlements with links to historical and modern cultural heritages, both the Kavango East and West Regions and the surrounding project is likely to hold archaeological resources.

5. Receptors Likely to be Negative Impacted

Based on the results of the project screening process and the findings of the Environmental Scoping Report, it's likely that the proposed project activities may have significant impacts / influences on the receiving environment (physical, biological, socioeconomic, cultural and archaeological) covering the following components:

- **Physical environment** (Water quality, physical infrastructure and resources, air quality, noise and dust, landscape and topography, soil quality, and Climate change influences);
- **Biological environment** (Habitat, protected areas and resources, flora, fauna and ecosystem functions, services, use values and non-use or passive use), and;
- **Socioeconomic, cultural and archaeological environment** (Local, regional and national socioeconomic settings, subsistence agriculture, community forestry, tourism and recreation and cultural, biological and archaeological resources).

6. Public and Stakeholder Consultation

Public and stakeholder consultations process covering all the Interested and affected Parties (I&APs) were conducted during the months of March and May 2019. Copies of the Environmental Assessment Reports were distributed to the following key the institutional stakeholders including the Offices of the Governors of Kavango West and Kavango East Regions as well as the Ministry of Safety and Security (MSS) in both regions with respect to the assessment of unexploded ordnances around the proposed drilling localities. Well attended public /stakeholder meetings were held in Nkurenkuru, Kavango West Region and Rundu, Kavango East Regions on the 9th and 10th May 2019 respectively.

7. Conclusion and Recommendations

Based on the results of the project screening process and the findings of the Environmental Scoping Report, it's hereby concluded that the proposed project may have significant impacts on the receiving environment (physical, biological, socioeconomic, cultural and archaeological) and thus requires a full environmental assessment to be undertaken. The environmental assessment to be undertaken shall comprise this Environmental Scoping, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Reports. These reports have been prepared in order to support the application for ECC. It's hereby recommended that the following specialist studies have been undertaken as part of the Environmental Assessment

Process leading to the preparation of the EIA and EMP Reports for the proposed two (2) stratigraphic well drilling operations in PEL 73:

(i) Flora and fauna;

(ii) Socioeconomic;

(iii) Ground and surface water, and;

(iv) Archaeology.

The Environmental Assessment process inclusive of all the specialist studies have been undertaken in accordance with the provisions of the Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991) as amended, the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012, the Environmental Management Act, 2007, (Act No. 7 of 2007) and Reconnaissance Energy Namibia (Pty) Ltd requirements as well as all other relevant Namibian laws, regional and international environmental and petroleum exploration standards and practices applicable for onshore stratigraphic oil and gas well drilling operations.

1. BACKGROUND TO THE PROJECT

1.1 Introduction

Reconnaissance Energy Namibia (Pty) Ltd (the Proponent and Operator) holds petroleum exploration rights under the Petroleum Exploration License (PEL) No. 73 covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821. Reconnaissance Energy Namibia (Pty) Ltd, is a subsidiary of Reconnaissance Oil and Gas Corporation, a Toronto, Canada and London, UK listed public company.

The company intend to drill two (2) stratigraphic oil and gas wells to a Total Depth (TD) of about 2500 m (2.5 km) in order to study the geology and petroleum systems of the PEL 73 and the Eastern Etosha Basin of Namibia. Depending on the outcomes of the proposed initial drilling operations, additional drilling operations may be undertaken within the license area.

1.2 Project Location

PEL No. 73 covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821 fall within the Kavango Basin forming part of the greater Etosha Basin of northern Namibia and the greater Kalahari Basin of Southern Africa (Figs. 1.1 -1.5). PEL 73 is situated in Kavango West and East Regions of north-eastern Namibia (Figs. 1.3 and 1.4). A total of eight (8) potential well drilling locations were initially identified in Blocks 1819 and 1820 and only two (2) locations (Wells locations 5-6 and 6-2) will be drilled (Figs. 1.5 and 1.6).

The proposed well drilling locations 5-6 and 6-2 falls in the Ncamangoro and Mashare Constituencies of the Kavango West and East Regions, respectively (Figs. 1.5 and 1.6). Ncamangoro Mashare Constituencies falls within the boundaries of the Mbunza and Sambyu Traditional Authorities, respectively.

1.3 Project Motivation

The implementation of the proposed drilling operations is vital step in trying to understand the geology, stratigraphy and the petroleum system of the eastern part of the Etosha Basin and greater Kalahari Basin. The results from the proposed drilling operations will be used to optimise the geological and petroleum system exploration models and assist in evaluating the possibility of the newly discovered Kavango Basin being able to contain potential economically viable hydrocarbon reserves. Finding hydrocarbons (oil and gas) and the development of a successful oil and gas industry in Kavango East or West regions will have direct and indirect benefits to Namibia and its people and to include the following:

- Increased earnings by the State through rights rentals and payment of direct and indirect taxes;
- Increased understanding and knowledge of the Etosha and greater Kalahari Basins petroleum systems of Namibia that could finally led to the discovery of economic oil or gas or both resources that will change the economic landscape of Namibia for benefits of its people;
- Contributions to the national geosciences skills development and knowledge transfer through on job training and short-term job attachments of Namibians;

- ❖ Contributions to the short and long-term strategies of attracting investments in the petroleum exploration sector in Namibia through new data acquisition, research, monitoring and management.

- ❖ Contribution to the long-term strategy that will promote the coexistence of petroleum operations with other land users in Namibia;

- ❖ Direct contributions to the training of young Namibians through contributions to the national training fund;

- ❖ Contributions to economic growth through ongoing exploration investments and potential future oil and gas discovery;

- ❖ Creation of employment opportunities through short and long-term contacts, and;

- ❖ Contribution to the development of local infrastructures to support the ongoing oil and gas exploration opportunities.

The socioeconomic impacts of exploratory drilling will primarily be concerned with provision of temporary employment, supply of services and demands on local infrastructure services. The socioeconomic impacts will be small and short term, since the duration of drilling activities is predicted to be only between 20 – 30 days. However, such impacts will start before mobilisation of equipment to the drilling site occurs, and will continue even after drilling has finished.

Subject to safety, commercial and other considerations, Reconnaissance Energy Namibia (Pty) Ltd plans to maximise the use of Namibian goods and services providers for the drilling operations, in accordance with its commitment to shared prosperity in its host countries. Many of the jobs associated with oil and gas exploratory drilling require highly specialised skillsets, the majority of which will be supplied by the international drilling companies contracted by Reconnaissance Energy Namibia (Pty) Ltd. Nonetheless, as a company committed to creating shared prosperity in its host countries, Reconnaissance Energy Namibia (Pty) Ltd is seeking to maximise the employment and development opportunities of suitably-qualified Namibian personnel wherever possible.

1.4 Project Spatial Extent and Scope of the Assessment

The spatial scope of the proposed drilling operations covers the following locations:

- ❖ Drilling locations immediate impact zones: The area likely to be directly influenced by the drilling activities at the well location and includes: a radius of 150 m site operational areas, campsite, material storage and all the support services and equipment, and;

- ❖ Drilling location broader impact zone including the access road and all the surrounding socioeconomic zones of the local constituency / communal area, regional (Kavango East and West Regions) and national (Namibia) likely to be positively or negatively affected by the proposed drilling operations and logistics.

Figure 1.1: Regional location of PEL No. 73 covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821 (Source: Risk-Based Solutions, 2015).

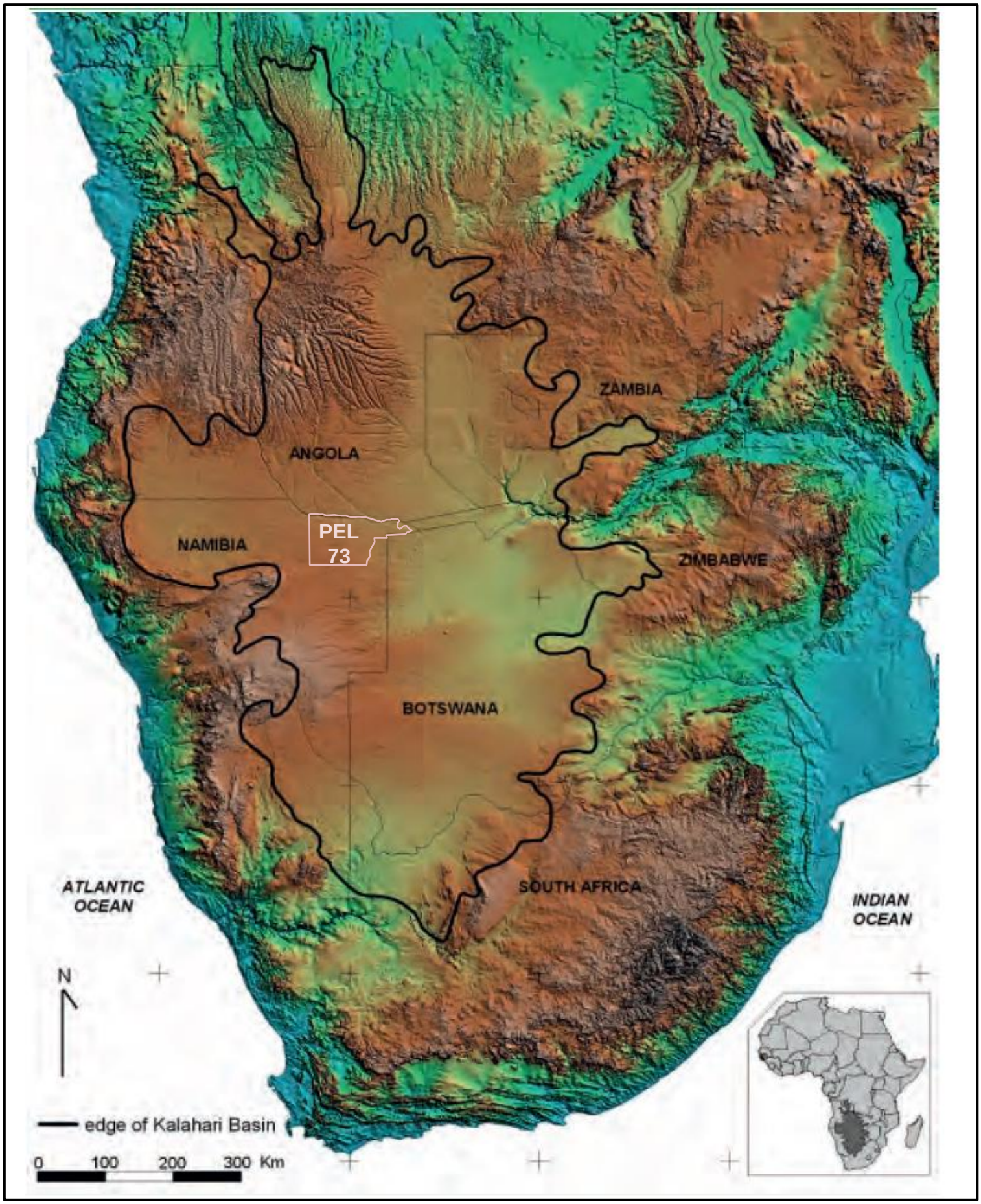


Figure 1.2: Lateral extent of Kalahari Group sediments (Source: Haddon, 2005)

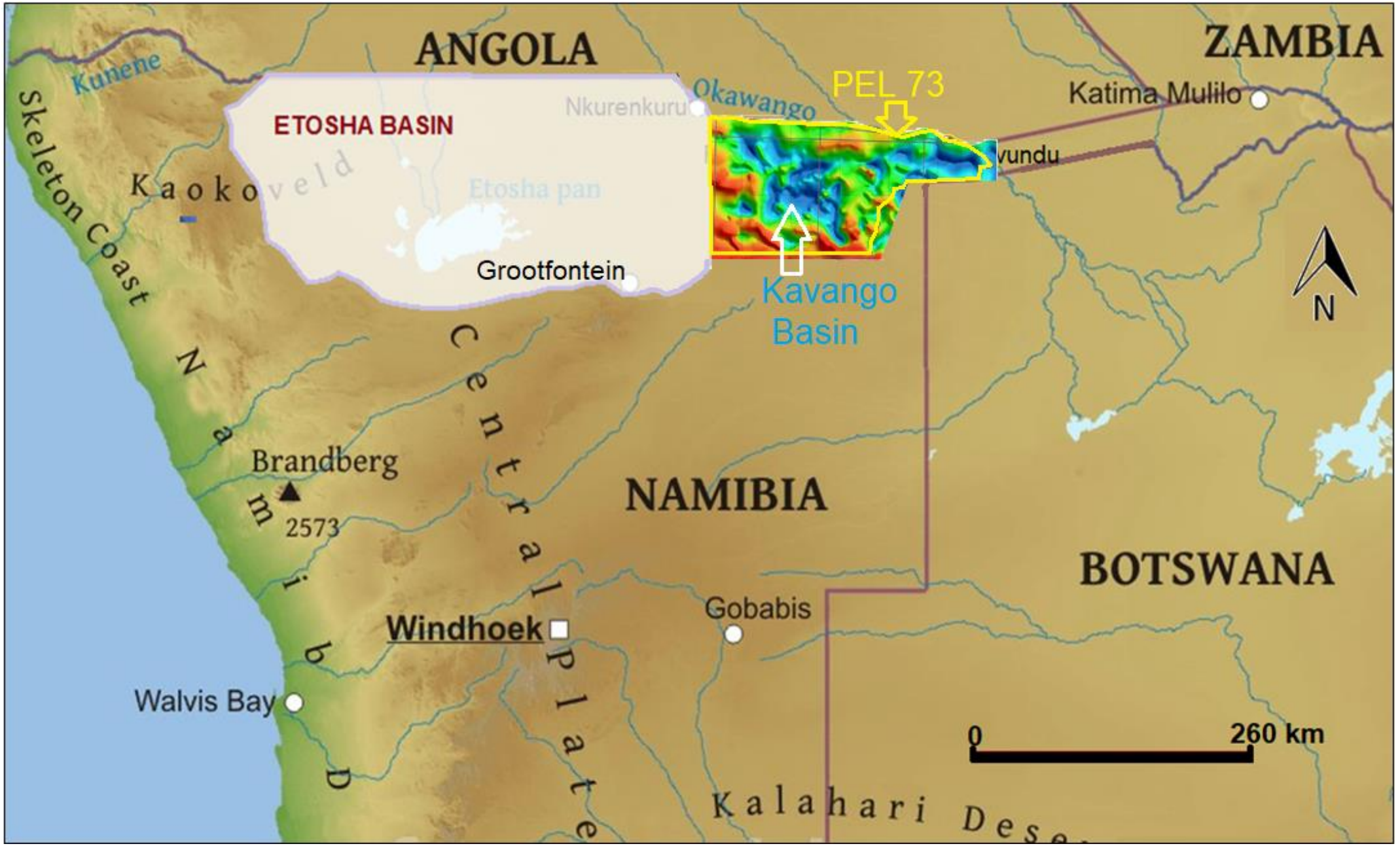
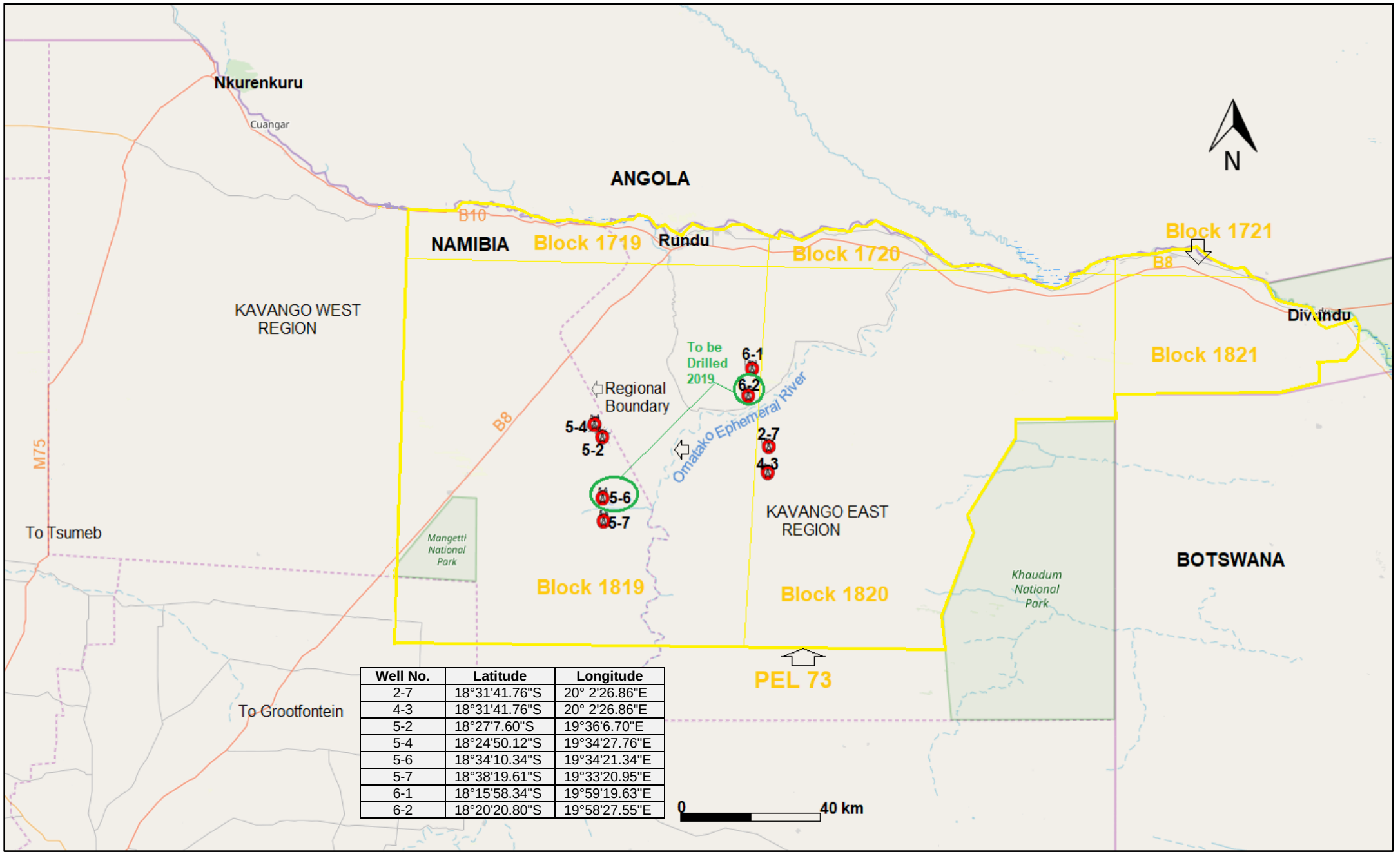


Figure 1.3: The Kavango Basin showing the location of the PEL 73 covering 1719, 1720, 1721, 1819, 1820 and 1821 (Source: www.freeworldmaps.net).



Well No.	Latitude	Longitude
2-7	18°31'41.76"S	20° 2'26.86"E
4-3	18°31'41.76"S	20° 2'26.86"E
5-2	18°27'7.60"S	19°36'6.70"E
5-4	18°24'50.12"S	19°34'27.76"E
5-6	18°34'10.34"S	19°34'21.34"E
5-7	18°38'19.61"S	19°33'20.95"E
6-1	18°15'58.34"S	19°59'19.63"E
6-2	18°20'20.80"S	19°58'27.55"E

Figure 1.4: Kavango West and Kavango East Regional boundary and the wells locations (Data Source: www.mme.gov.na and Reconnaissance Energy Namibia, 2019).

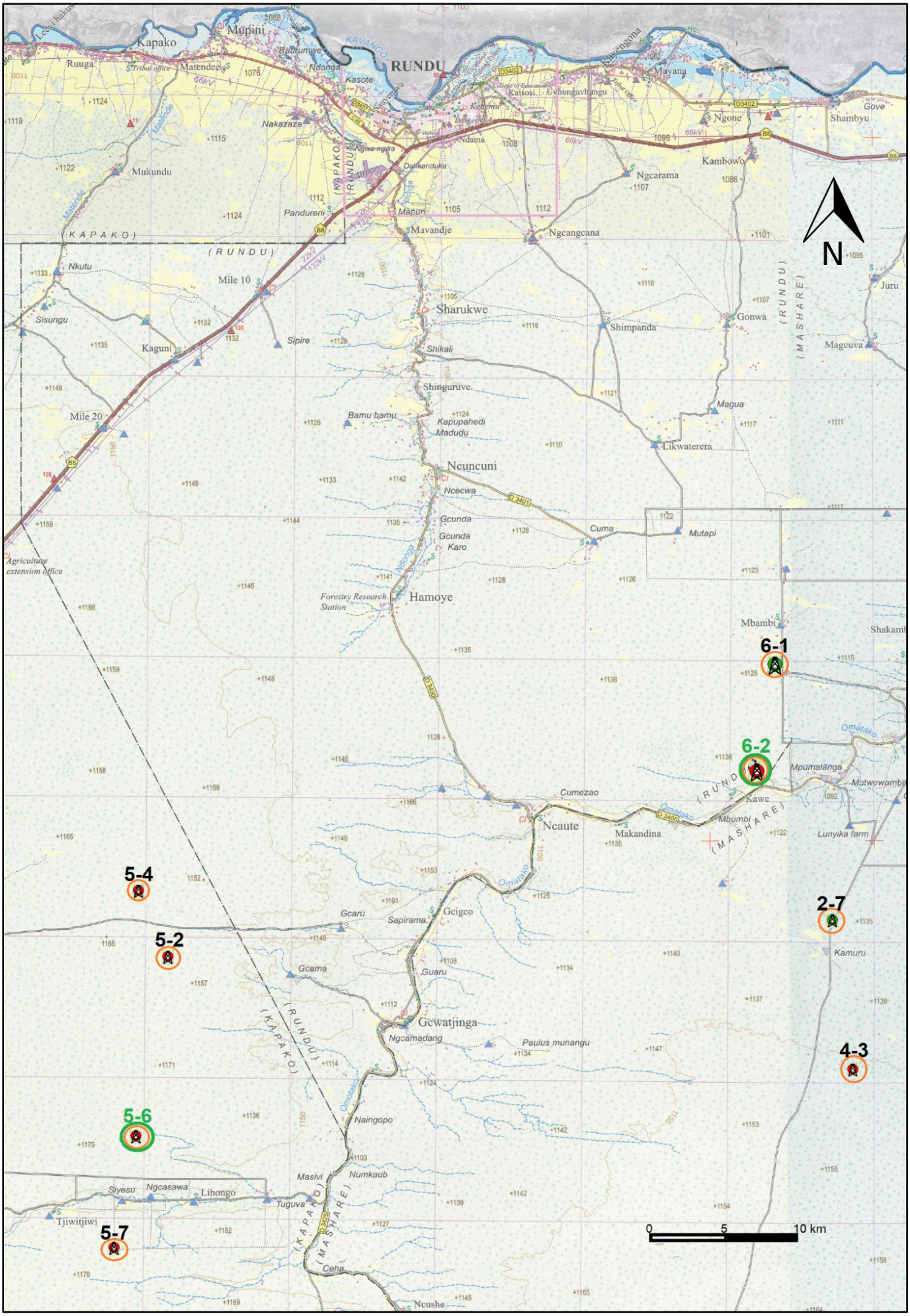
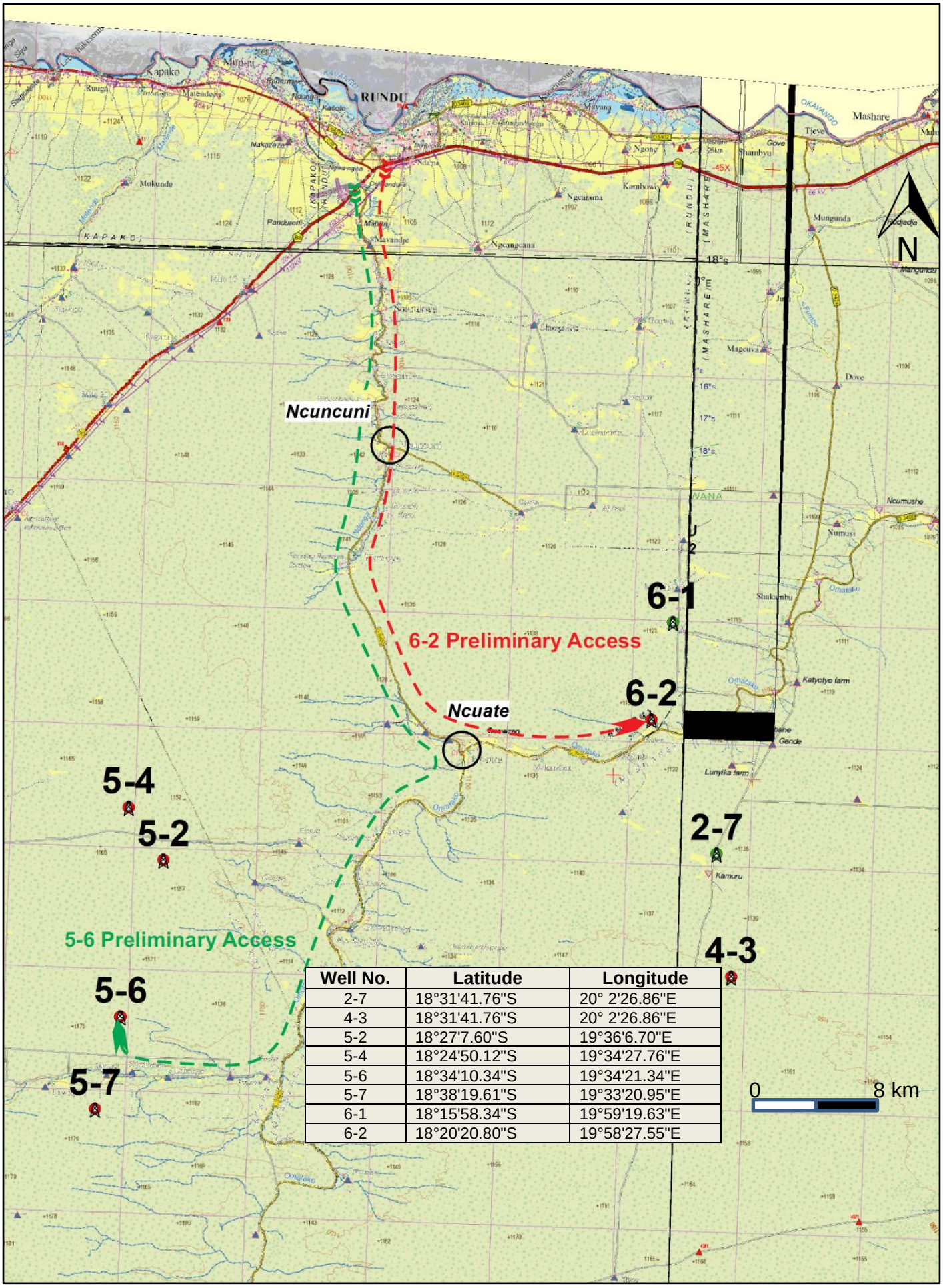


Figure 1.5 Detailed well locations (Source: Extract from the 1: 250000 Map Sheet, Namibia Survey General, 2002).



Well No.	Latitude	Longitude
2-7	18°31'41.76"S	20° 2'26.86"E
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5-4	18°24'50.12"S	19°34'27.76"E
5-6	18°34'10.34"S	19°34'21.34"E
5-7	18°38'19.61"S	19°33'20.95"E
6-1	18°15'58.34"S	19°59'19.63"E
6-2	18°20'20.80"S	19°58'27.55"E

Figure 1.6 Initial access from Rundu to wells 6-2 and 5-6 to be drilled this year in 2019 (Source: Reconnaissance Energy Namibia, 2019).

1.5 Structure of the Scoping Report

The following is the summary structure outline of this scoping report.

- **Section 1:** Project Background;
- **Section 2:** Project Description;
- **Section 3:** Regulatory Framework ;
- **Section 4:** Receiving Environment covering physical environment, Biological environment and socioeconomic environment;
- **Section 5:** Impact Assessment and Methodology;
- **Section 6:** Stakeholders and Public Consultations Process;
- **Section 7:** Term of Reference (ToR) for the EIA and EMP Process;
- **APPENDICES**: (i) CV of the EAP (Dr. Sindila Mwiya).

2. PROPOSED PROJECT DESCRIPTION

2.1 Overview

Reconnaissance Energy Namibia (Pty) Ltd acquired a high resolution geomagnetic survey of the licence area and conducted a detailed analysis of the resulting data and other available data, including reprocessing and reinterpretation of all existing geological and geophysical data. The survey and analysis confirm that the Kavango Basin reaches depths of up to 9.144 km (30,000 feet), under optimal conditions to preserve a thick interval of organic rich marine shales, and is anticipated to hold an active petroleum system.

Reconnaissance Energy Namibia (Pty) Ltd intend to drill two (2) petroleum (oil and gas) stratigraphic wells 5-6 and 6-2) in Blocks 1829 and 1820 in PEL 73. The drilling operations are set to start in the last quarter (Q4) of 2019 between the months of October and December 2019. The proposed drilling operations will be undertaken using a land-based rig. The proposed drilling operations will be undertaken in remote area with challenging logistical arrangements.

2.2 Logistical Arrangements and Site Layout

To prepare for initial drilling, the access road and well site/s may require vegetation clearing, levelling, if necessary, with a bulldozer and/or grader / labour-based option if manpower exists with the local area, with careful consideration given to sensitivities of the receiving environment including: not cutting down of larger trees and protected flora as well as being on a look out for possible unexploded ordinances that may be buried. The scale and duration of site preparation is site-specific and may last for few hours to a couple of days depending on the length of the access or size of the site to be prepared. A temporary drilling campsite will be established around each of the drilling sites. Fig. 2.1 shows an indicative drill site layout to be established at each of the drilling locations. The campsite will accommodated the drilling crew and equipment. Energy supply will be provided by diesel generators for the operations requiring higher voltage while solar will be used for lighting and gas for cooking. Chemical toilets will be provided onsite.

A standard single well site for conventional onshore oil or gas drilling will typically affect a surface area measuring 150 metres by 150 metres (Fig. 2.1). The well site will typically hold the drilling rig and additional equipment along with supervisory accommodation and material storage (Fig. 2.1). Once drilling is completed the affected area will be reclaimed to minimise surface disturbance. Standard drilling supplies such as food and fuel and parts will be obtained in Windhoek or Rundu. Specialised drilling equipment and fluids not available in Namibia will be sourced internationally. Water supply will either be trucked to the site or obtained from two (2) new boreholes that could to be drilled in the area, one (1) each well location.

The boreholes will be drilled an estimated depth of 150 m within the Kalahari Group and polyvinyl chloride (PVC) casing will be installed from 0 – 150 m. Once the drilling operations have completed the water borehole could be handover to the local community with a condition of being able to utilise the boreholes in the event that additional drilling operations becomes necessary in the future. The various components of the rig will be transported to site by a truck and the rig will be built onsite. After drilling completion, the campsite and the rig will be disassembled and the various components will be packed and transported to the next drilling location.

2.3 Drilling Rig and Well Design

2.3.1 Rig Components and Specifications

Onshore drilling rigs can vary quite dramatically depending on what environment and formations the rig will be drilling. Originally, the rigs were nothing more than wooden structures in a “v-frame” structure. Today rigs are built out of steel components that would allow it to be moved after the well drilling operations. Fig. 2.2 shows the key components of a land based rig. Detailed specification of a land-based drilling rig similar to type that will be used for the proposed drilling operations in PEL 73 is shown in Fig. 2.3.

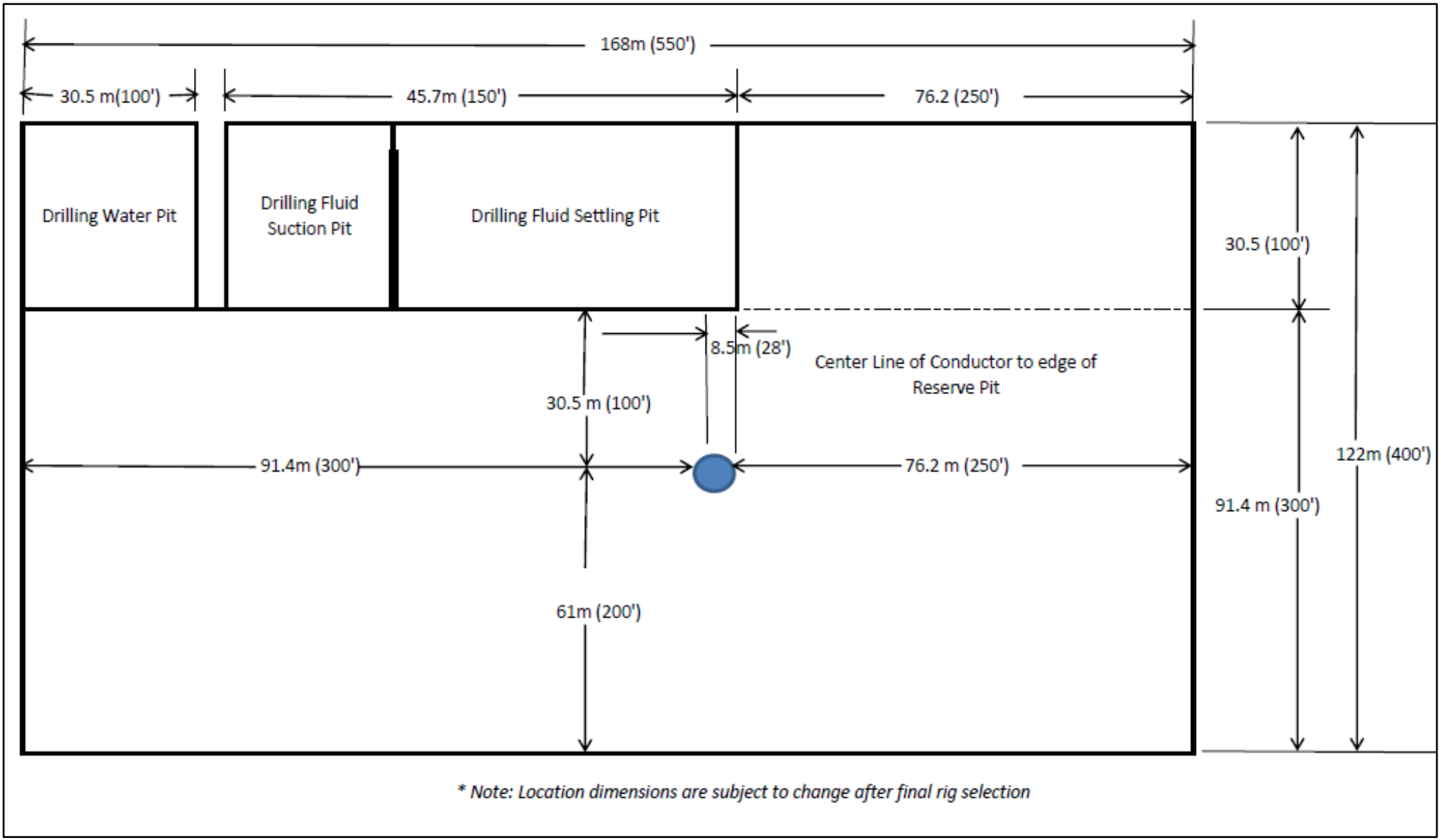

Figure 2.1: Indicative Well site layout (Source: Reconnaissance Energy Namibia, 2019).

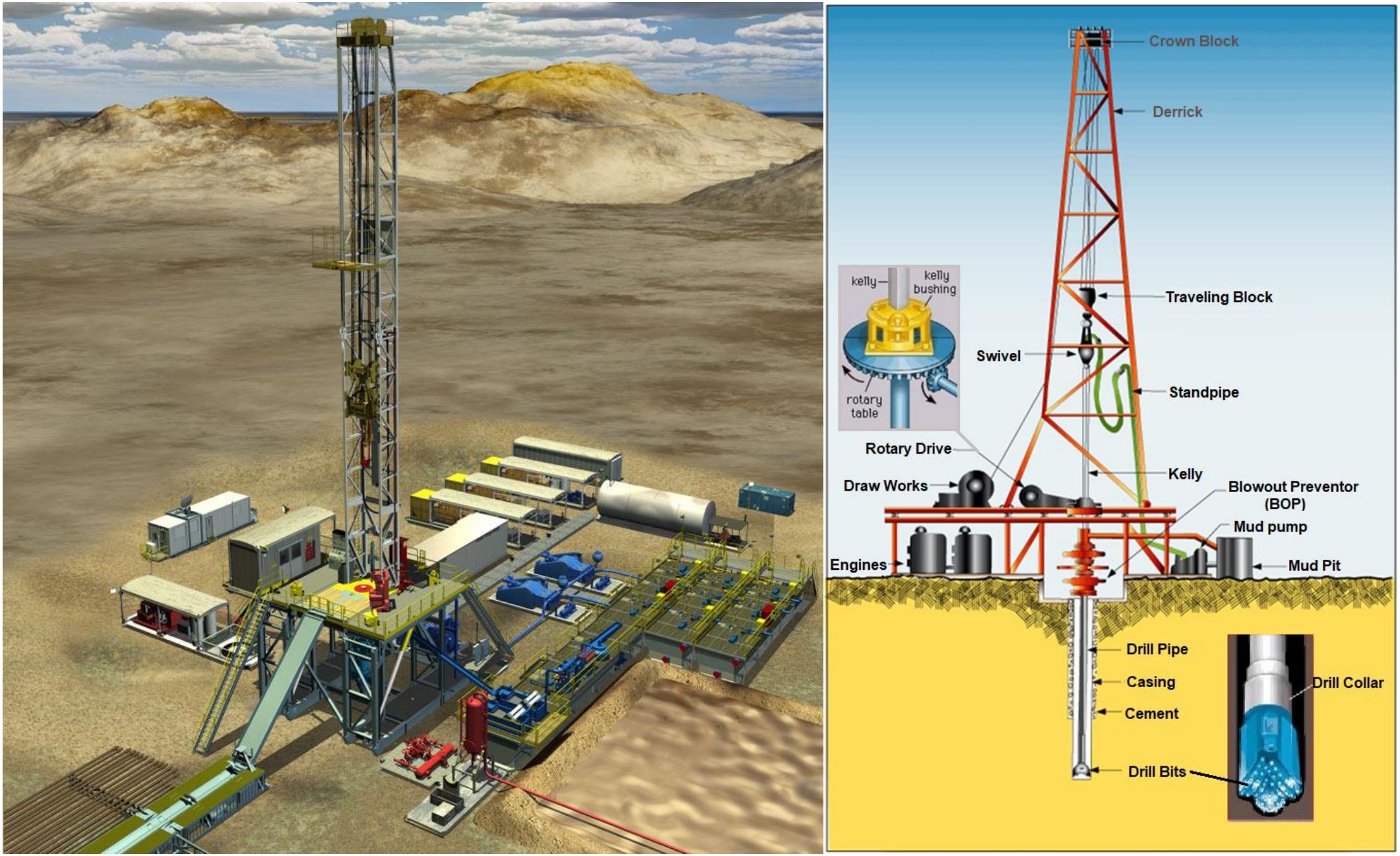

Figure 2.2: Components of an onshore Oil Rig (Source: Modified from www. entranceconsulting.com).

EQUIPMENT SPECIFICATIONS	
WEIGHT	
Total full weight	46 Tonne (excluding truck)
Load per rear axle	8,5 Tonne (approx.)
Tyres	Super single off road or double highway tyres
TRANSPORTING DIMENSIONS	
Length (excluding truck)	17.2 m
Height retracted	4.2 m
Width	2.5 m
OPERATING DIMENTIONS	
Length (excluding truck)	17.2 m
Height retracted	14.0 m
Height extended	23.4 m
Width	2.5 m
Clearance under table	From 1.5 m to 4,1 m with fully extended Outriggers
ENGINE	
1 x Caterpillar C27 ACERT 708kW IND C @ 1800 rpm	
Fuel tank capacity	1450 L
COOLING	
3 x Horizontal cooler for hydraulic system	
1 x Horizontal combined water, after cooler and diesel overflow	
-10° C/14° F to 50° C/122° F design temperature	
TOP DRIVE	
Drive type	Hydraulic
Maximum torque	36 kNm (intermittent)
Rotation brake	For directional drilling
Hydraulic pull-down	200 kN
Hydraulic pull-up	900 kN
Rotary Speed	Variable step less control with torque limiter
Torque & Speed at Gear 3	5 220 Nm (320) bar @ 330 rpm (360 l/min) – nominal
Torque & Speed at Gear 2	20 870 Nm (320) bar @ 82 rpm (360 l/min) – nominal
Torque & Speed at Gear 1	536 000 Nm (320) bar @ 43 rpm (360 l/min) – nominal
Drive through hole	5"
Float Sub & Sub Saver	100mm float
FEED SYSTEM	
Cylinder size	280/200mm
Feed cylinder stroke	2 x 4100mm
Max pressure	350 bar
Pull up	900 kN
Pull down	200 kN
Pullback feed speed	Cylinder 0,4 m/sec, Top Drive 0,8 m/sec
Pull-down feed speed	52 m/min
Working clearance to table	15.9 m (including Floating Sub)

DRILL ROD AND CASING	
Drill rod	Up to range III
Casing	Up to range III
Angle drilling	Up to range II
MAST	
External Mast	Multiple closed cell rectangular sections
Internal Mast	Large diameter central section and rails
Hydraulic Mast erection	Hydraulic Cylinder
Table opening	27,5" (697 mm)
Mast slide	2500 mm
HYDRAULIC SYSTEM	
System type	Full variable flow hydraulic system with load sensing
Hydraulic tank	2400 L AUX tank plus 1000 L operating = 3400 L
Filters	On suction and pressure lines
PIPE HANDLING SYSTEM	
Rotation Angle	0° (parallel to Mast) - 130°
Mounted	2 Axle Trailer with super tyres
Operating Cabin	Also remote control of all hydraulic function
Self alignment and attached to drill Rig with hands off make and brake system	
Full range of screw and welded casings up to Range III and 24 "	

FLUID INJECTION SYSTEM	
Mission Magnum mud pump	4 x 3 x 13
FMC piston pump	220 L per min
Service winch	4 t – 24 m
Wire line winch	2 t – 1800 m of wire rope at 60 m/min
Tool lubrication for DTH	
Power break out for breaking hammer and drill collars	
Power slips	
CONTROL CABIN	
Rotating Cabin for optimal view of Mast top and Mast table	
Air-conditioning and sound abatement for operators comfort	
Ergonomic layout of controls and panels	
PAINT SPESIFICATIONS	
Three coat marine standard system with total of 400 microns DFT	

Figure 2.3: Detailed specification of a land-based drilling rig similar to type that will be used for the proposed drilling operations (Source: Reconnaissance Energy Namibia, 2019).

2.3.2 Overview of the Well Design and Plan

Reconnaissance Energy Namibia (Pty) Ltd intend to drill the proposed two (2) petroleum (oil and gas) stratigraphic wells Nos. 5-6 and 6-2) in PEL 73 to Total Depth (TD) 2500 km (Fig. 2.4). The estimated lithological depths will vary but expected to be as follows:

- ❖ Kalahari Group +/- 200 to 500 m, and;
- ❖ Basalt formation +/- 600 – 900 m.

The following is the summary of the well drilling plan:

(i) Tri – cone, Mud Rotary method to be used through the Kalahari Sands formation assuming the following:

- ❖ Drill 0 – 60m 18 inch;
- ❖ Place 14 inch Steel casing into hole, and;
- ❖ Cement in place.

(ii) Continue drilling from 60 to refusal assuming the following plan:

- ❖ Refusal being, the end of Kalahari sand and as far as possible through the basalt formation, and;
- ❖ If the basalt formation is too hard, percussion drilling will be used to continue the hole until it has gone through the basalt formation.

(ii) Well casing plan:

- ❖ A 5.5 inch casing to case the hole;
- ❖ Casing to be cemented in place, and;
- ❖ Diverter/Rotation Blow-Out Preventer (BOP) will be installed.

(iii) Conduct all safety tests, checks to ensure everything is in place before continuing onto the coring part of the hole;

(iv) Once everything is in place, test, checks completed;

(v) Start lowering HQ barrel (2.5 inch Core barrel), and;

(vi) Start Drilling, retrieving core every 6 m to End of Hole (EOH) (drill and bore holes) or Total Depth (TD).

The list characteristics of the drilling fluids to be used for the proposed drilling operations in PEL 73 is shown in Table 2.1.

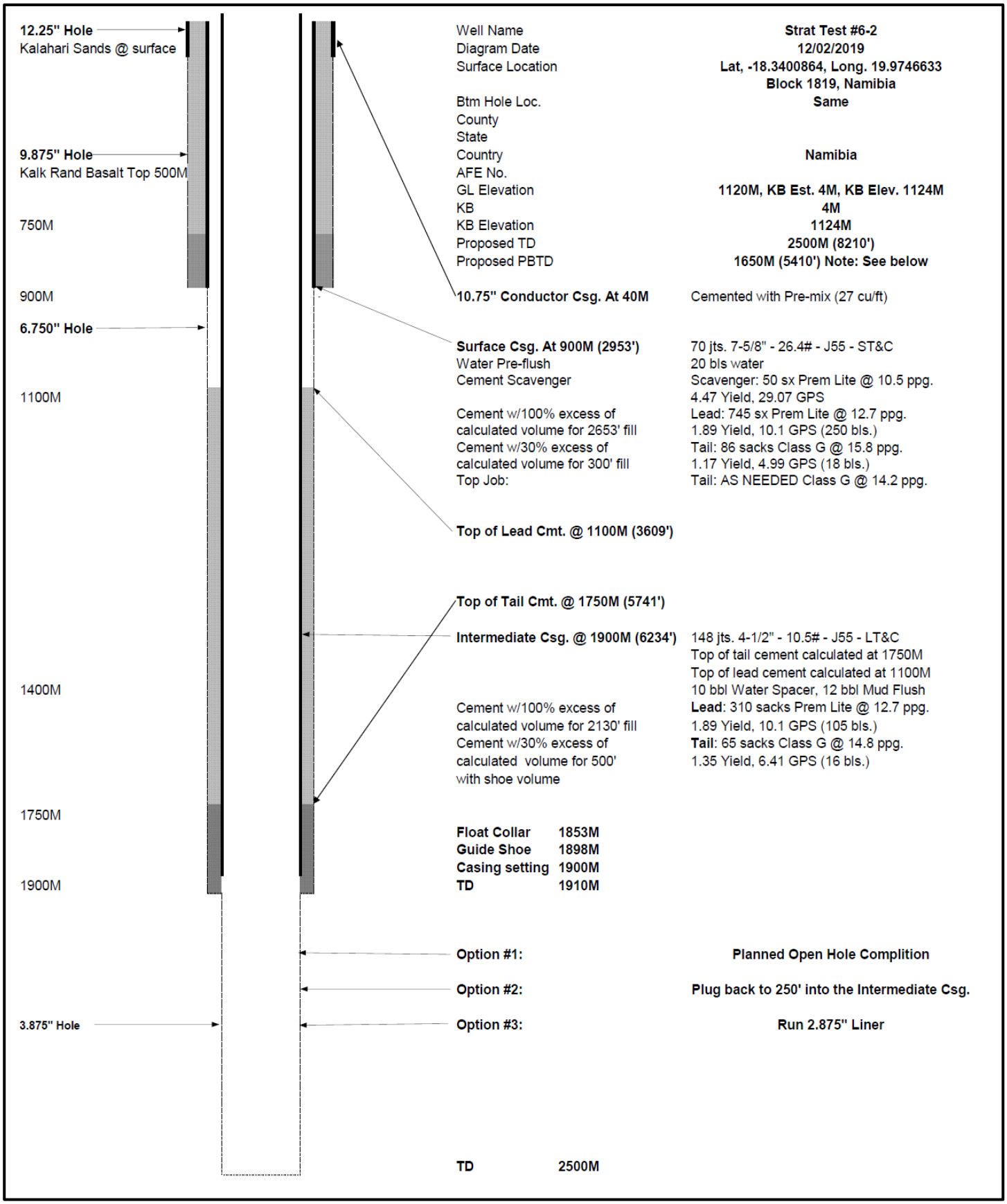

Figure 2.4: Well design (not to Scale) (Source: Reconnaissance Energy Namibia, 2019).

Table 2.1: Drilling fluids characteristics (Source: Reconnaissance Energy Namibia, 2019).

Material	Concentration, lb/bbl	Function	Property	Units	Range
Bentonite	5 - 10	Viscosity / Filtration Control	Density	S.G.	1.2
Potassium Chloride	5 - 60	Inhibition Source of Kio	Funnel Viscosity	sec/qt	45 -60
Caustic Potash	0.25 - 0.75	Alkalinity	Plastic Viscosity	cP	12 - 25
PHPA	0.5 - 1.5	Encapsulation Agent	Yield Point	lb/100 sq ft	10 - 20
Starch	3 - 6	Filtration Control	6rpm(reading)	n/a	8 - 10
Lignite	2 - 4	HTHP Filtration Control	10s Gel Strength	lb/100 sq ft	6 - 8
Barite	As Needed	Weight Material	10m Gel Strength	lb/100 sq ft	8 - 20
Drill Paper	As Needed	Fluid Loss Control Material	API Filtration	mL/30min	8 - 10
LCM Materials	As Needed	Fluid Loss Control Material	Solids Content	v/v %	<6%

2.4 Stages of the Proposed Drilling Operations

The following is the summary of the key stages of the proposed drilling operations:

1. Pre-Construction and Drilling Requirements:

- Confirm location and access route, survey from nearest access point to location;
- Stake location to accommodate drilling contractor's foot print;
- Do overhead power line and buried line locates;
- Confirm surface use agreement with surface owner;
- Confirm that all permits, authorisations, consents and certificates such as Environmental Clearance Certificate (ECC), Radioactive Sources Authorisation, Explosive Permits, Oil Spill Contingency Plan (OSCP), Emergency Response Plan (ERP) and permit to drill are in place, and;
- Confirm water source options and method of transport. A back-up source will need to be confirmed.

2. Construction Phase:

- Drilling contractor construction equipment;
- Build access road and location per approved drilling permit and environmental requirements using acceptable building materials and practices;
- Dig and fence off reserve and water pits with sheep tight fencing or to local requirements, and;
- Drill water supply well and complete. Have rental diesel powered generator available.

3. Mobilisation:

- Drilling contractor drilling rig with support equipment;
- Drilling contractor living quarters and office facilities as required to support drilling personnel and up to 6 operator personnel;
- Mobilise casing, cement and well head equipment to location;
- Hold pre-spud meeting with all personnel, and;
- Notify Reconnaissance management and government of spud date and time.

4. Conductor Casing:

- Drill 12.25" (311.15mm) air/rotary to a minimum of 40 meters (+/- 157'). Set and grout 10.75" Overburden Drilling (OD) conductor in place (Figs. 2.5 and 2.6), and;
- Install diverter or rotating head system in preparation to drill to bottom of the Etjo formation.

5. Drilling surface / intermediate and setting casing and cementing process through up 900 m:

- Pick-up 9.875" (250.825mm) air / mud / rotary surface bit with Bottom Hole Assembly (BHA) as required;
- Have mud loggers rigged up and begin logging at 500 meters;
- Drill to 900 meters (+/-2953'), catch samples every 10 meters;
- Rig-up and run 7.625" Overburden Drilling (OD) casing to within 3 meters (+/- 10') of bottom;
- Cement casing per agreed to specifications;
- After waiting on cement for 6 hrs, cutoff casing and install 3000# wellhead, and;
- Test well head to 100 BAR (1500 PSI).

6. Drilling and continuous Coring from 900 meters (2953') to 1900 m (6234'):

- Install Blow-Out Preventer (BOP) and test to 207 Bar (3000 PSI);
- Test casing 70% of manufactures rating or 100 bar whichever is lower;
- Pick-up 171.45 mm (6.75") clean out bit. Drill out cement and 3m new hole;
- Pull Out of Hole (POOH) lay down tools. Strap or count drill pipe on way out of hole to confirm depth;
- Pick-up coring tools with core bit to cut minimum 63.50 m (2.5") core and Run In Hole (RIH);

- ❖ Begin coring from 903 meters to +/- 1900 meters;
- ❖ Core and retrieve cores as required. Retrieval and storage will be determined by geologist on site. A written procedure will be furnished before coring begins. Catch samples every 3 meters;
- ❖ Make wiper or reaming trips as required by hole conditions;
- ❖ Pull Out of Hole (POOH), deploy coring tools in preparation to run wire line logs;
- ❖ Log per attached logging procedure;
- ❖ Rig-up and run 114.3m (4.5") Overburden Drilling (OD) casing;
- ❖ Cement casing to agreed specifications;
- ❖ Waiting on cement (WOC) 6 hours, and;
- ❖ Land casing and pack-off as required. Test pack-off to 207 bar (3000 PSI).

7. Drilling below 1900 meters to Total Depth (TD) of +/- 2500m (+/-8202'):

- ❖ Pick-up 98.425m (3.875") bit and required Bottom Hole Assembly (BHA);
- ❖ Run In Hole (RIH) to top of cement;
- ❖ Drill ahead from 1900 meters to 2500 meters. Catch samples every 3 m;
- ❖ Circulate samples per geologist's instructions;
- ❖ Be prepared to trip for core as required. If additional coring is required, do so per on-site geologist's instructions otherwise continue per above;
- ❖ At Total Depth (TD), circulate samples, and;
- ❖ Pull Out of Hole (POOH) to run wire line logs according to the logging procedure.

8. Plug and Abandon Hole:

- ❖ Run In Hole (RIH) open ended to plug and abandonment operations (P&A) hole per attached program;
- ❖ Pull Out of Hole (POOH) setting cement plugs per regulatory requirements;
- ❖ Cut-off well head. Install dry hole marker per local requirements;
- ❖ Back fill cellar and reclaim location as required by surface use agreement or permit requirements, and;
- ❖ Rig Down Move Out (RDMO) location.

9. Rehabilitate all surface disturbances and clear the site of any debris;

10. Camp removal, site closure / abandonment.

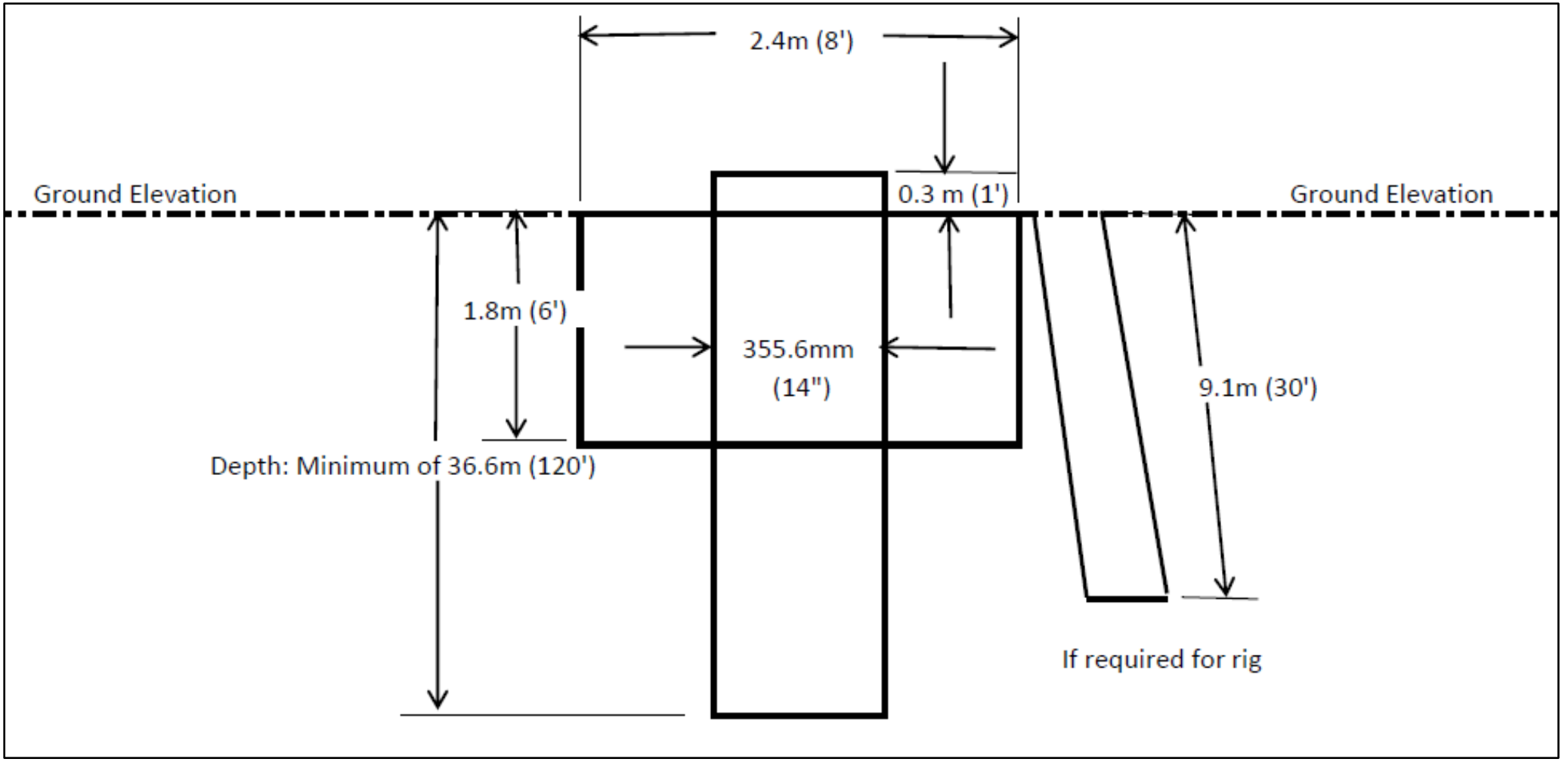

Figure 2.5: Indicative conductor, cellar ring and mouse hole (Source: Reconnaissance Energy Namibia, 2019).

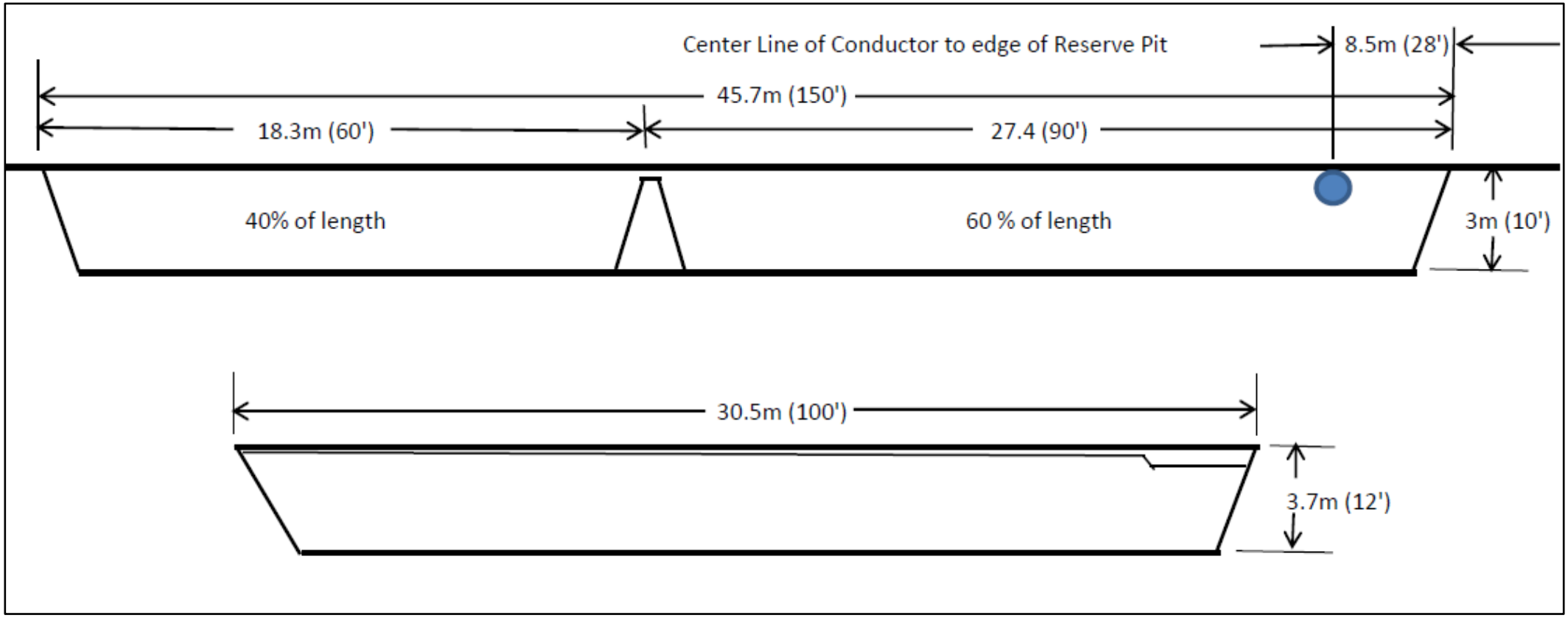

Figure 2.6: Indicative design of the proposed drilling mud reserve pit (Source: Reconnaissance Energy Namibia, 2019).

3. REGULATORY FRAMEWORK

3.1 Petroleum Exploration and Production Legislation

In accordance with the Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991), and in an effort to promote petroleum exploration activities in Namibia, the Ministry of Mines and Energy (MME) has the mandate to issue three types of licenses namely; Reconnaissance, Exploration and Production Licences. Exploration licence is issued under Section 34 of the Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991), and includes any renewal of such licence. A production licence is issued under Section 50 and includes any renewal of such licence.

3.2 Environmental Regulations

Environmental assessment and management in Namibia is governed by the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007). The proposed petroleum exploration activities by Reconnaissance Energy Namibia (Pty) Ltd covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821 falls within the categories of listed activities that cannot be undertaken without an Environmental Clearance Certificate (ECC).

3.3 Legislation Register

The following is the summary of the key legislation relevant to the proposed offshore drilling project in PEL 73:

- Petroleum (Exploration and Production) Act, 1991 and Associated Regulations;
- Environmental Management Act, (No. 7 of 2007) and associated EIA Regulations;
- Immigration Control Act 7 of 1993;
- Customs and Excise Act 20 of 1998;
- The Regional Councils Act, 1992, (Act 22 of 1992);
- The Local Authorities Act, 1992, (Act 23 of 1992);
- Hazardous Substances Ordinance 14 of 1974;
- Atmospheric Pollution Prevention Ordinance 11 of 1976;
- Water Act 54 of 1956, Government Gazette No 217 dated 5 April 1962 and Water Resources Management Act, 2004, (Act No. 24 of 2004);
- Atomic Energy and Radiation Protection Act (Act No. 5 of 2005);
- The Nature Conservation Ordinance, Ordinance 4 of 1975, Amendment Act, Act 5 of 1996 and the current draft Parks and Wildlife Management Bill of 2006;
- The Labour Act 2004, (Act 15 of 2004), amended 2010;

- ❖ Convention on Biological Diversity (“Biodiversity”), 29 December 1993: Objective: To develop national strategies for the conservation and sustainable use of biological diversity;

- ❖ Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES or “Endangered Species”), 1 July 1975: Objective: To protect certain endangered species from over-exploitation by means of a system of import/export permits;

- ❖ United Nations Framework Convention on Climate Change (“Climate Change”), 21 March 1994: Objective: To achieve stabilization of greenhouse gas concentrations in the atmosphere at a low enough level to prevent dangerous anthropogenic interference with the climate system, and;

- ❖ Kyoto Protocol to the United Nations Framework Convention on Climate Change (“Climate Change – Kyoto Protocol”), 1 January 1997: Objective: To further reduce greenhouse gas emissions by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries.

3.4 Standards and Guidelines

Industrial effluent likely to be generated by the proposed drilling operations activities must comply with provisions of the Government Gazette No 217 dated 5 April 1962 (Table 3.1) while the drinking water quality comparative guideline values are shown in Table 3.2.

Table 3.1: R553 Regional Standards for Industrial Effluent, in Government Gazette No 217 dated 5 April 1962.

Colour, odour and taste	The effluent shall contain no substance in concentrations capable of producing colour, odour or taste	
pH	Between 5.5 and 9.5	
Dissolved oxygen	At least 75% saturation	
Typical faecal coli	No typical faecal coli per 100 ml	
Temperature	Not to exceed 35 °C	
Chemical demand oxygen	Not to exceed 75 mg/l after applying a correction for chloride in the method	
Oxygen absorbed	Not to exceed 10 mg/l	
Total dissolved solids (TDS)	The TDS shall not have been increased by more than 500 mg/l above that of the intake water	
Suspended solids	Not to exceed 25 mg/l	
Sodium (Na)	The Na level shall not have been increased by more than 50 mg/l above that of the intake water	
Soap, oil and grease	Not to exceed 2.5 mg/l	
Other constituents	Residual chlorine	0,1 mg/l as Cl
	Free & saline ammonia	10 mg/l as N
	Arsenic	0,5 mg/l as As
	Boron	1,0 mg/l as B
	Hexavalent Cr	0,05 mg/l as Cr
	Total chromium	0,5 mg/l as Cr
	Copper	1,0 mg/l as Cu
	Phenolic compounds	0,1 mg/l as phenol
	Lead	1,0 mg/l as Pb
	Cyanide and related compounds	0,5 mg/l as CN
	Sulphides	1,0 mg/l as S
	Fluorine	1,0 mg/l as F
	Zinc	5,0 mg/l as Zn

Table 3.2: Comparison of selected guideline values for drinking water quality (after Department of Water Affairs, 2001).

Parameter and Expression of the results			WHO Guidelines for Drinking-Water Quality 2nd edition 1993		Proposed Council Directive of 28 April 1995 (95/C/13-1/03) EEC	Council Directive of 15 July 1980 relating to the quality intended for human consumption 80/778/EEC		U.S. EPA Drinking water Standards and Health Advisories Table December 1995		Namibia, Department of Water Affairs Guidelines for the evaluation of drinking-water for human consumption with reference to chemical, physical and bacteriological quality July 1991			
			Guideline Value (GV)		Proposed Parameter Value	Guide Level (GL)	Maximum Admissible Concentration (MAC)	Maximum Contaminant Level (MCL)		Group A Excellent Quality	Group B Good Quality	Group C Low Health Risk	Group D Unsuitable
Temperature	t	°C		-	-	12	25		-	-	-	-	-
Hydrogen ion concentration	pH, 25° C	-	R	<8.0	6.5 to 9.5	6.5 to 8.5	10		-	6.0 to 9.0	5.5 to 9.5	4.0 to 11.0	<4.0 to >11.0
Electronic conductivity	EC, 25° C	mS/m		-	280	45	-		-	150	300	400	>400
Total dissolved solids	TDS	mg/l	R	1000	-	-	1500		-	-	-	-	-
Total Hardness	$CaCO_3$	mg/l		-	-	-	-		-	300	650	1300	>1300
Aluminium	Al	µ g/l	R	200	200	50	200	S	50-200	150	500	1000	>1000
Ammonia	NH_4^+	mg/l	R	1.5	0.5	0.05	0.5		-	1.5	2.5	5.0	>5.0
	N	mg/l		1.0		0.04	0.4		-	1.0	2.0	4.0	>4.0
Antimony	Sb	µ g/l	P	5	3	-	10	C	6	50	100	200	>200
Arsenic	As	µ g/l		10	10	-	50	C	50	100	300	600	>600
Barium	Ba	µ g/l	P	700	-	100	-	C	2000	500	1000	2000	>2000
Berylium	Be	µ g/l		-	-	-	-	C	4	2	5	10	>10
Bismuth	Bi	µ g/l		-	-	-	-		-	250	500	1000	>1000
Boron	B	µ g/l		300	300	1000	-		-	500	2000	4000	>4000
Bromate	BrO_3^-	µ g/l		-	10	-	-	P	10	-	-	-	-
Bromine	Br	µ g/l		-	-	-	-		-	1000	3000	6000	>6000
Cadmium	Cd	µ g/l		3	5	-	5	C	5	10	20	40	>40
Calcium	Ca	mg/l		-	-	100	-		-	150	200	400	>400
	$CaCO_3$	mg/l		-	-	250	-		-	375	500	1000	>1000
Cerium	Ce	µ g/l		-	-	-	-		-	1000	2000	4000	>4000
Chloride	Cl^-	mg/l	R	250	-	25	-	S	250	250	600	1200	>1200
Chromium	Cr	µ g/l	P	50	50	-	50	C	100	100	200	400	>400
Cobalt		µ g/l		-	-	-	-		-	250	500	1000	>1000
Copper after 12 hours in pipe	Cu	µ g/l	P	2000	2	100	-	C	TT##	500	1000	2000	>2000
		µ g/l		-	-	3000[1]	-	S	1000	-	-	-	-
Cyanide	CN^-	µ g/l		70	50	-	50	C	200	200	300	600	>600
Fluoride	F^-	mg/l		1.5	1.5	-	at 8 to 12 °C: 1.5	C	4	1.5	2.0	3.0	>3.0
		mg/l		-	-	-	at 25 to 30 °C: 0.7	P,S	2	-	-	-	-
Gold	Au	µ g/l		-	-	-	-		-	2	5	10	>10
Hydrogen sulphide	H_2S	µ g/l	R	50	-	-	undetectable		-	100	300	600	>600
Iodine	I	µ g/l		-	-	-	-		-	500	1000	2000	>2000
Iron	Fe	µ g/l	R	300	200	50	200	S	300	100	1000	2000	>2000
Lead	Pb	µ g/l		10	10	-	50	C	TT#	50	100	200	>200
Lithium	Li	µ g/l		-	-	-	-		-	2500	5000	10000	>10000
Magnesium	Mg	mg/l		-	-	30	50		-	70	100	200	>200
	$CaCO_3$	mg/l		-	-	7	12		-	290	420	840	>840
Manganese	Mn	µ g/l	P	500	50	20	50	S	50	50	1000	2000	>2000
Mercury	Hg	µ g/l		1	1	-	1	C	2	5	10	20	>20
Molybdenum	Mo	µ g/l		70	-	-	-		-	50	100	200	>200
Nickel	Ni	µ g/l		20	20	-	50		-	250	500	1000	>1000
Nitrate*	NO_3^-	mg/l	P	50	50	25	50		45	45	90	180	>180
	N	mg/l		-	-	5	11	C	10	10	20	40	>40
Nitrite*	NO_2^-	mg/l		3	0.1	-	0.1		3	-	-	-	-
	N	mg/l		-	-	-		C	1	-	-	-	-
Oxygen, dissolved	O_2	% sat.		-	50	-	-		-	-	-	-	-
Phosphorus	P_2O_5	µ g/l		-	-	400	5000		-	-	-	-	-
	PO_4^{3-}	µ g/l		-	-	300	3350		-	-	-	-	-
Potassium	K	mg/l		-	-	10	12		-	200	400	800	>800
Selenium	Se	µ g/l		10	10	-	10	C	50	20	50	100	>100
Silver	Ag	µ g/l		-	-	-	10	S	100	20	50	100	>100
Sodium	Na	mg/l	R	200	-	20	175		-	100	400	800	>800
Sulphate	SO_4^{2-}	mg/l	R	250	250	25	250	S	250	200	600	1200	>1200
Tellurium	Te	µ g/l		-	-	-	-		-	2	5	10	>10
Thallium	Tl	µ g/l		-	-	-	-	C	2	5	10	20	>20
Tin	Sn	µ g/l		-	-	-	-		-	100	200	400	>400
Titanum	Ti	µ g/l		-	-	-	-		-	100	500	1000	>1000
Tungsten	W	µ g/l		-	-	-	-		-	100	500	1000	>1000
Uranium	U	µ g/l		-	-	-	-	P	20	1000	4000	8000	>8000
Vanadium	V	µ g/l		-	-	-	-		-	250	500	1000	>1000
Zinc after 12 hours in pipe	Zn	µ g/l	R	3000	-	100	-	S	5000	1000	5000	10000	>10000
		µ g/l		-	-	5000	-		-	-	-	-	-
			P: Provisional R: May give reason to complaints from consumers					C: Current; P: Proposed; S: Secondary; T#: Treatment technique in lieu of numeric MCL; TT##: treatment technique triggered at action level of 1300 µ g/l					

3.5 Summary of the Drilling Permitting Requirements

Based on the analysis of all the key and relevant regulatory systems in Namibia with respect to the proposed drilling operations by in PEL 73, Table 3.3 summarises the likely key and important permits and endorsements that may be required before the proposed drilling can be implemented and need to be assessed further as part of the EIA and EMP phases.

Table 3.3: Summary of the applicable permits, required supporting documents, authorising institution and applicable legal framework / legislation.

Type of Permit / Approval	Studies / Report / Documents Required	Authorising / Institution	Legal Framework
1. Environmental Clearance Certificate (ECC)	Environmental Assessment Study covering Scoping, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP).	Office of the Environmental Commissioner, Ministry of Environment and Tourism (MET)	Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007)
2. Freshwater Abstraction Including Borehole Drilling and Discharge Permits	Summary Report including boreholes location, volumes of freshwater pumped and wastewater likely to be discharged	Department of Water Affairs (DWA), Ministry of Agriculture, Water and Forestry (MAWF)	Water Act 54 of 1956, Government Gazette No 217 dated 5 April 1962 and Water Resources Management Act, 2004, (Act No. 24 of 2004);
3. Oil Spill Contingency Plan (OSCP)	Oil Spill Contingency Plan (OSCP)	Approved / Endorsed by the Ministry of Mines and Energy (MME) – Office of the Petroleum Commissioner	Petroleum (Exploration and Production) Act, 1991 and Associated Regulations
4. Emergency Response Plan (ERP)	Emergency Response Plan (ERP) Report		
5. Radioactive Authorisation (Import and Export Permits) for the use of radioactive sources for logging	Radiation management Plan (RMP). The RMP must be in the prescribed format (Guide Available and the completion of the application form	Authorisation Issued by the National Radiation Protection Authority (NRPA), Ministry of Health and Social Services (MHSS)	Atomic Energy & Radiation Protection Act (Act No 5 of 2005) and Radiation Protection & Waste Disposal Regulations (No 221 of 2011)
6. Explosive Permit (Import and Export) Registration as a Consumer and Importation of Explosives in Namibia including Use, Store and Transportation	Written application for a permit to import, transport, use and store explosives must be submitted	The Inspector General Explosive Control Division Namibian Police Force, Ministry of Safety and Security (MSS)	Explosives Act, 1956 (Act 26 of 1956, as amended) and Regulations (GNR 1604 of 8 September 1972, as amended)
7. Drilling Permit /Letter of Consent to Drill	Pre-Drilling Data Pack (PDDP), Basis of Well Design documents, ECC, Approved Oil Spill Contingency Plan (OSCP), Emergency Response Plan (ERP), and all other key supporting Documents and a mandatory Rig inspection	Ministry of Mines and Energy – Office of the Petroleum Commissioner	Petroleum (Exploration and Production) Act, 1991 and Petroleum Regulations as Amended

The Environmental Clearance Certificate (ECC) is the key permit and linked to all the other subsequent predrilling, drilling and post drilling permits (Table 3.3). The overall objectives of this permit is to make sure that all the environmental issues associated with the proposed project have been addressed and a management plan have been developed to manage / mitigate any likely impacts.

4. RECEIVING ENVIRONMENT

4.1 Overview

The PEL No. 73 covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821 falls within the Kavango West and East Regions. The general license area is sandy averaging around 1115 m above mean sea level (mamsl) and dominated by gently adulating and mature forested Kalahari Longitudinal Dune Belts aligned in east west direction.

4.2 Climate

The license area has a subtropical steppe/ low-latitude semi-arid hot climate (Mendelsohn et al. 2002). Within the license area, annual temperature may averages 23°C. The temperatures are highest on average in November, at above 26°C. The lowest average temperatures in the year occur in July, when it is around 18 °C. The average annual rainfall within the PEL 73 is around 588 mm with up to 730 mm around the northeaster portion of Block 1718 along the Okavango River.

4.3 Socioeconomic Settings

Nkurenkuru is the capital of the Kavango West Region and it's situated about 140 km west of Rundu the regional Capital of Kavango East region. The boundary between Kavango East and West generally follows the Omatako-Omuramba River (Fig. 1.2).

The Kavango West Region covers an area of 24,591.27 km^2 and lies directly south of Angola and the Kavango River and east of Ohangwena and Oshikoto Regions, north of Otjozondjupa Region and west of the Kavango East Region. Kavango West Region is subdivided into eight electoral constituencies namely: Kapako, Mankumpi, Mpungu, Musese, Ncamangoro, Ncuncuni, Nkurenkuru, and Tondoro.

Kavango East Region covers an area of 23,987 km^2 and is bordered by the Kavango West, Otjozondjupa and Zambezi Regions. The constituencies in Kavango East Region include: Rundu Urban, Rundu Rural, Mashare, Mukwe, Ndiyona and Ndonga Linena.

Both regions and the project area are characterised by an extremely uneven population distribution. The interior of the regions are very sparsely inhabited, while the northernmost strip, especially along the Kavango River, has a high population concentration (National Planning Commission, 2012 and Fig. 4.1). According to Mendelsohn *et al*. (2006), the general livelihood of the people in the two regions is derived from small-scale agro-pastoralism, supported by fishing along the Okavango River. Overall, subsistence agriculture comprising animal husbandry (cattle and goats), cultivation of millet and maize and timber logging are an integral part of the day to day survival of the rural population within the project. A socioeconomic assessment has been undertaken as part of the EIA and EMP process in order to assess in detail the socioeconomic settings of the regional and local project area.

4.4 Archaeology

The systematic archaeological investigations of the Kavango East and West Regions revealed human occupations that predate the pre-colonial farming settlements. In addition to archaeological heritage, modern heritage of Kavango East and West Regions is characterised by remnants of numerous historic, sacred cultural sites as well as present-day community graves and cemeteries mainly along the Omatako River basin that are to be avoided by undertaking an assessment of drilling locations as part of the EIA and EMP process.

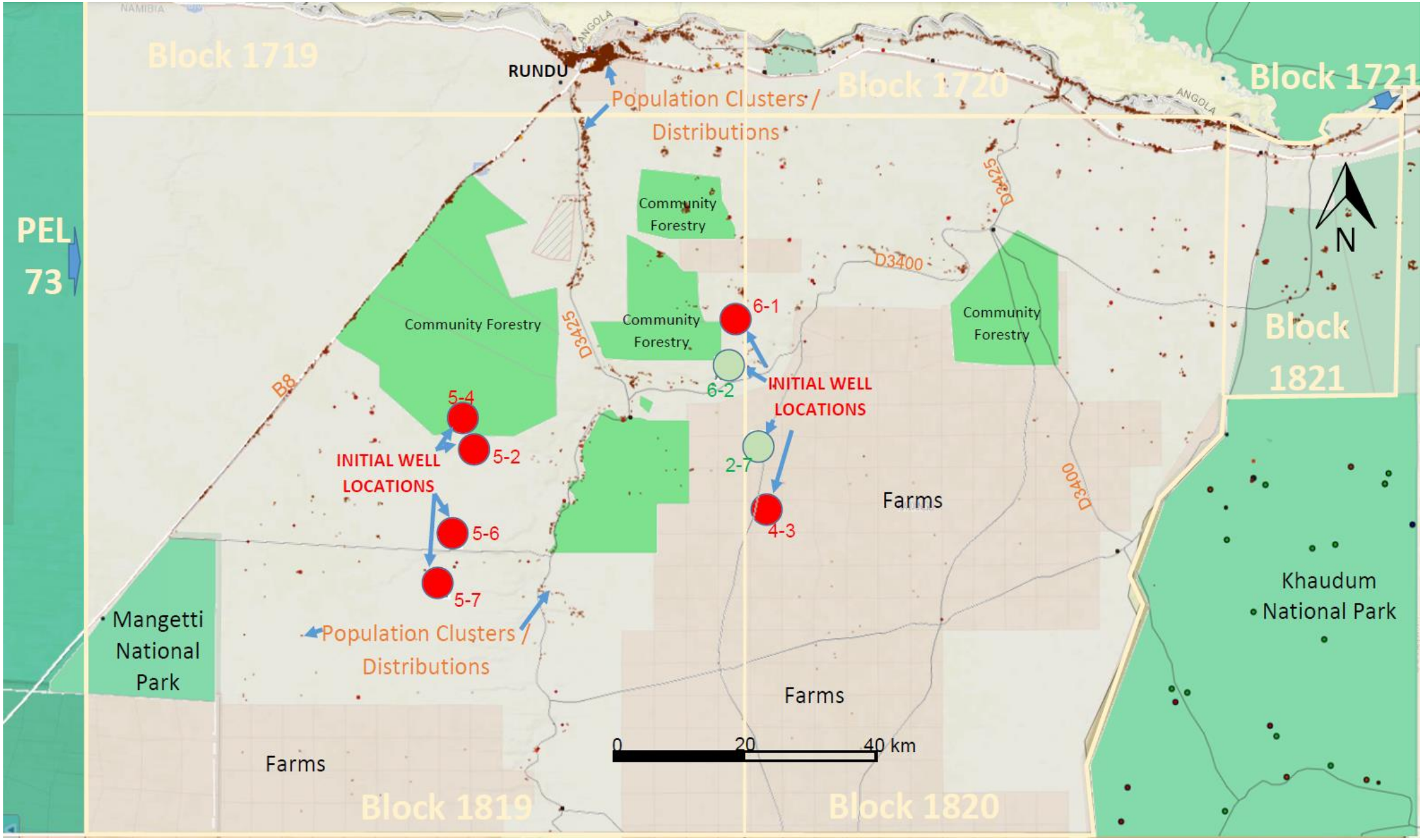

Figure 4.1: Population density, roads and socioeconomic setting around PEL 73 covering Block 1719, 1720, 1721, 1819, 1820 and 1821 and the well locations (Data Sources: www.kavangozambezi.org/en/- arcgis Accessed, March 2019).

4.5 Fauna and Flora

It is estimated that at least 67 species of reptile, 32 amphibian, 116 mammal and 210 bird species (breeding residents) are known to or expected to occur in the general Kavango East and West Regions. It is estimated that at least 107 species of larger trees and shrubs (>1m in height) and up to 111 species of grasses are known to or expected to occur in the general area. Mangetti and Khaudum National Parks as well as a number of Community Forestry are found in the general and all plays a vital role in the protection of biodiversity in the two regions inclusive of the proposed project area (Fig. 4.1). A detailed desktop fauna and flora assessment has been undertaken as part of the EIA and EMP process in order to assess in detail the biodiversity of the project area.

4.6 Water

The study area is located in northern Namibia straddling portions of the East and Western Kavango Regions. By virtue of its location the study area forms part of a low lying peneplain of the Omatako, Cubango-Cuito and Okavango surface water Basins. The land surface gently slopes in the north easterly direction from an elevation of 1200 mamsl in the south western corner to about 1029 mamsl in the north eastern corner of PEL 73. In view of the target exploration sites, it is important to note that sites 5-4, 5-6, 5-2 and 5-7 are situated on the western fringe of a drainage active zone; whereas sites 6-1, 6-2, 2-7 and 4-3 are slight out of the active zone of the Omatako River and are potentially areas of surface water ponding, infiltration and groundwater through flow (Fig. 4.2).

Further south of the PEL No. 73 particularly covering Block 1818, water supply is from groundwater resources associated with the Kalahari Group. According to CSIR (1982), there are three (3) hydrogeological units in the Kalahari Group: namely the upper, middle and lower Kalahari (Table 4.1). Of the three units shown in Table 4.1, the middle Kalahari sandstone is recognised as the most promising aquifer of the three units, whereas the lower Kalahari is reported to be argillaceous and of poor water quality. The deep and regional groundwater flow system equivalent to the lower Kalahari aquifer unit benefits from direct recharge around the rim of the basin and from elevated outcrops, would characteristically artesian (marl and clay confining layer) with elevated total dissolved solids (TDS) due a long resident times, and therefore prone to poor water quality (Fig. 4.3). This system is not expected to be shallower than 160 m except where elevated by igneous intrusions.

Project falls within the rural, communal areas where water supply is provided by the Rural Water Supply Division within the Department of Water Affairs (DWA) in the Ministry of Agriculture, Water and Forestry (MWAF). In private commercial farmland, individual farm owners provide for all their water needs through the application for abstraction permits from the Department of Water Affairs. A detailed assessment of the surface and groundwater situation within the project area has been undertaken as part of the EIA and EMP process.

Table 4.1: Conceptual hydrogeology characteristics of the study area.

GROUP / SEQUENCE	STRATIGRAPHIC UNIT	DESCRIPTION	
		Nature Type	**Aquifer Potential**
Kalahari	Fine and Silt	Aquitard, leaky Aquifer	Low Yielding, locally high Yielding
	Sandstone, Sand & Clay	Aquifer	Low Yielding
	Marl and Clay	Confining Layer	None
	Conglomerate & Gravel	Aquifer	High Yielding
Karoo	Basalt/Sandstone	Aquitard/Weathered	Conditional
Damara	Schist/Quartzite/dolomite	Aquitard/Fractured	Conditional

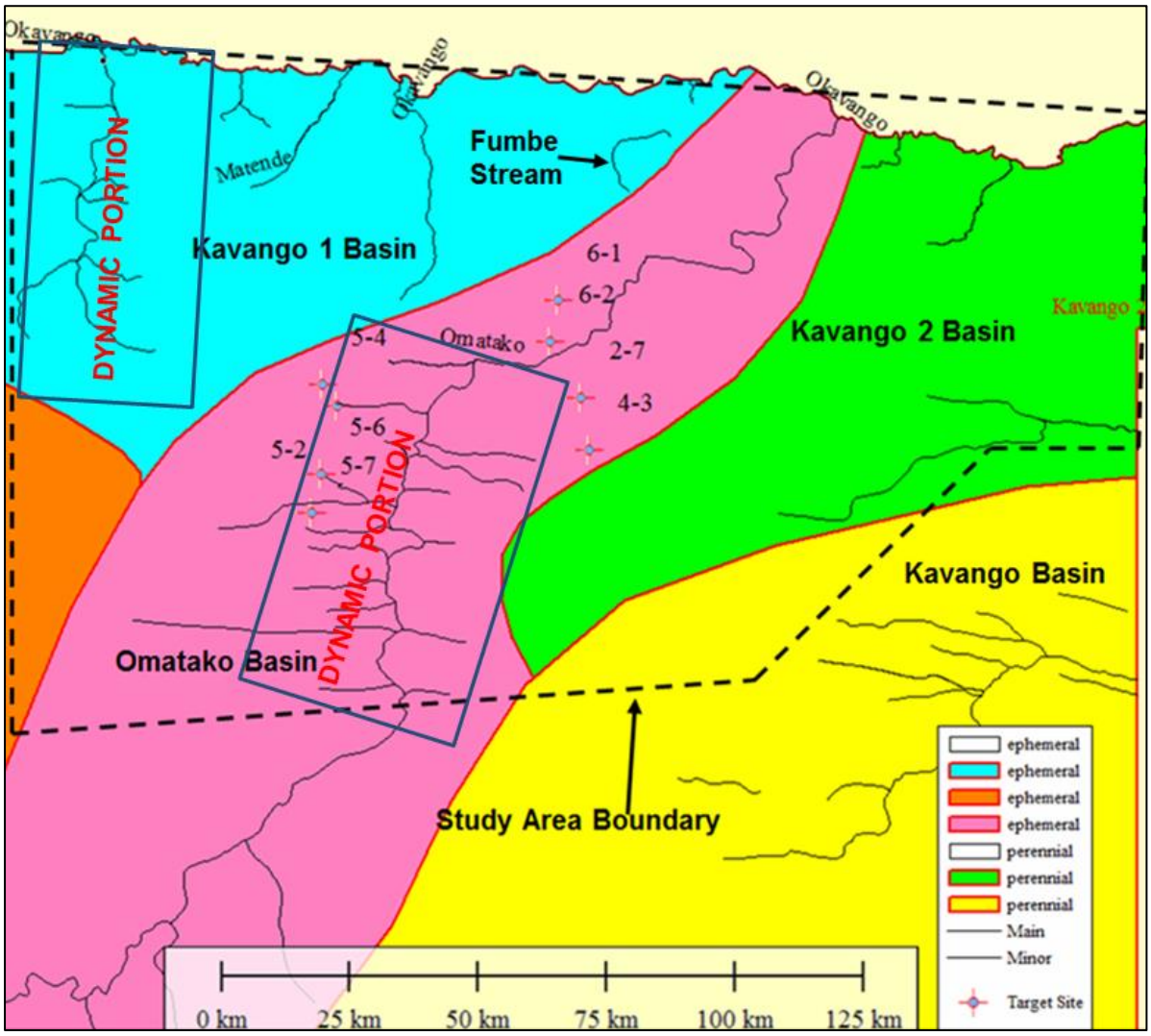

Figure 4.2: Key local drainage system around PEL 73.

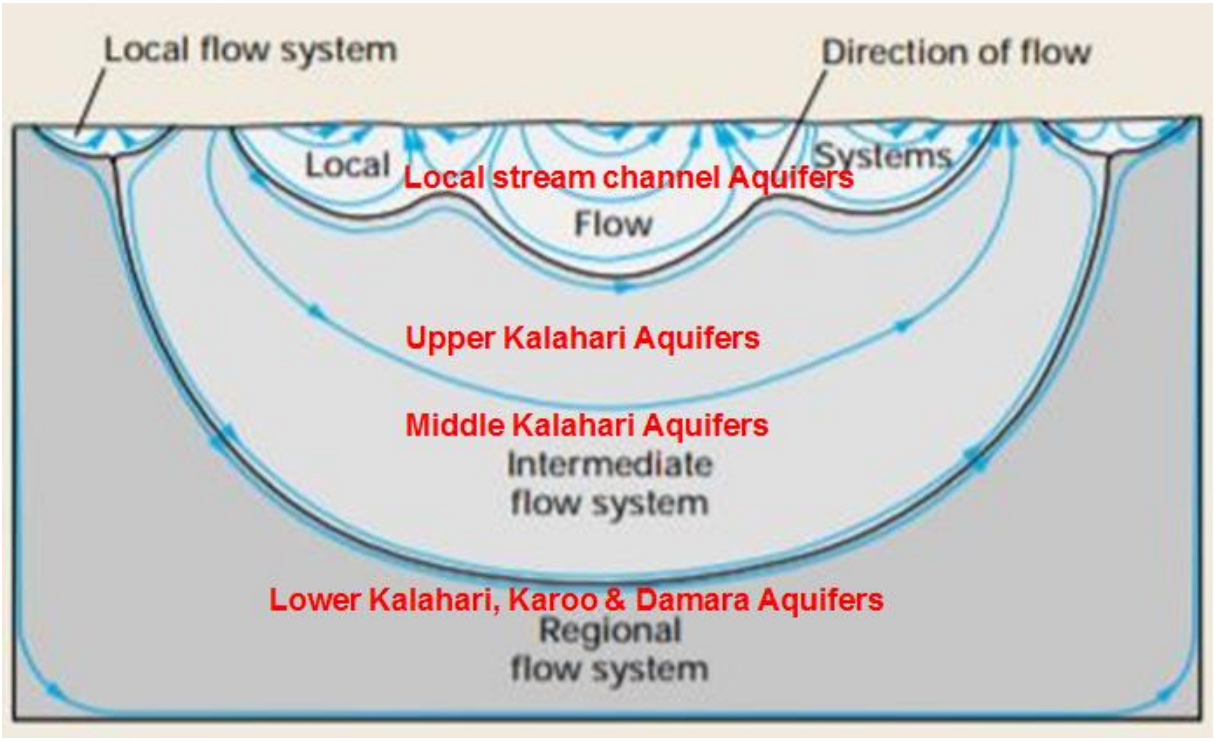

Figure 4.3: Conceptual groundwater flow components around PEL 73.

4.7 Geology and Petroleum System

In the Etosha Basin the Nosib, Otavi and Mulden Groups of the late Precambrian Damara Sequence rest on a basement of mid Proterozoic gneisses, granites, volcanic and metasedimentary rocks (Miller, 1992). According the Miller, (1992), these are overlain by up to 6000 m of extensive platform carbonates of the Otavi Group, which were laid down on the shallow and relatively stable Northern Platform of the Orogen as rifting evolved to spreading and ocean formation to the south and west between 730 and 730 million years.

The Tsumeb Subgroup, overlap basement highs along the basin margins. According to Overseas Petroleum and Investment Corporation, (1991), Stromatolites and algal mats occur extensively throughout the Otavi Group. According to Miller, (1992), grey dolomite predominates but limestone occurs extensively at the top of both the Abenab and Tsumeb Subgroups and near the base of the Tsumeb Subgroup (Maieberg Formation). The upper Tsumeb limestones are black in colour. Oolites are abundant in the middle and upper parts of the Tsumeb Subgroup and sedimentary breccias occur at the base of the Elandshoek Formation (middle Tsumeb Subgroup). The limestones are often foetid, as are the dolomites in places.

Various periods of uplift and exposure led to palaeokarsting at the base and top of the Abenab Subgroup and at the top of the Tsumeb Subgroup. Spreading ceased at about 730 million years. Reversal of plate motion and subduction eventually culminated in continental collision in all branches of the Damara Orogen. D1 deformation in the orogen between 730 and 650 million years ago led to uplift of the Etosha Basin, particularly the margins. A regional unconformity developed at the top of the Tsumeb carbonates. This incised through the Otavi Group sequence and into the basement in the west but it is a paraconformity in the west. Erosional products from D1 uplift in the west were deposited as a northern molasse at least 4000 m thick, the Mulden Group, on the Otavi platform carbonates in the Etosha Basin.

The Mulden sedimentary rocks are proximal in the west and distal in the east (Miller, 1992). The Tschudi Formation arkose at the base (+ 500 m thick), itself a with 350 m maroon basal siltstone in the west, is followed by four upward-fining cycles of the Kombat Formation. The top of the first cycle, the Black Shale Member, is a 93 m thick dense, very dark grey to black carbonaceous shale that has a distinctive electric log trace, is a prominent seismic reflector and is an excellent marker bed throughout the Etosha Basin (Hedberg, 1979). Momper (1982) reports VR values of 0.73 to 1.08 and TOC up to 2.8 wt%. Shales at the top of each of the overlying cycles are green to grey in colour. The uppermost unit of the Mulden Group, the Owambo Formation, consists of four upward-fining cycles of varicoloured sedimentary rocks. Three of the cycles are capped by dolomite. Shale and dolomite are usually grey in colour.

The Karoo Sequence overlies the Owambo Formation unconformably and occurs in a relatively small part of the central Etosha Basin. The basal glaciogenic sedimentary rocks of the Dwyka Formation are overlain by up to 220 m of lower Permian carbonaceous shales and interbedded high-ash coals of the Prince Albert Formation (Miler, 1992). Over 130 m of aeolian sandstone of the Jurassic, Etjo Formation occurs in a well at the Nanzi Pan. Basalts occur in the eastern part of the Etosha Basin. Mulden Group and Karoo Sequence rocks in the Etosha Basin are covered entirely by sands, clays and calcretes of the Kalahari Sequence which exceed 400 m in thickness in the northeast part of the Basin.

5. IMPACT ASSESSMENT AND METHODOLOGY

5.1 Overview

Based on the results of the screening process that has been undertaken as part of the preparation of this Environmental Scoping Report, the proposed project activities (drilling of two stratigraphic wells) in PEL 73 is likely to have significant impacts / influences on the receiving physical, biophysical and socioeconomic environment and requires a full Environmental Assessment (EA) to be undertaken. Environmental Impact Assessment (EIA) and the preparation of Environmental Management Plan (EMP) reports have been prepared in order to support the application for Environmental Clearance Certificate (ECC).

The environmental assessment process has been undertaken in accordance with the provisions of the Environmental Impact Assessment (EIA) Regulations 30 of 2012 and the Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) as outlined in Fig. 5.1. The overall impact assessment approach for this project has adopted the Leopold matrix framework, which is one of the internationally best known matrix assessment methodology available for predicting the impact of a project on the receiving environment. Assessment results of the magnitude, duration, extent and probability (significant) of the potential impacts due to the proposed project activities interacting with the receiving environment are discussed and presented in form of a matrix table in this Section.

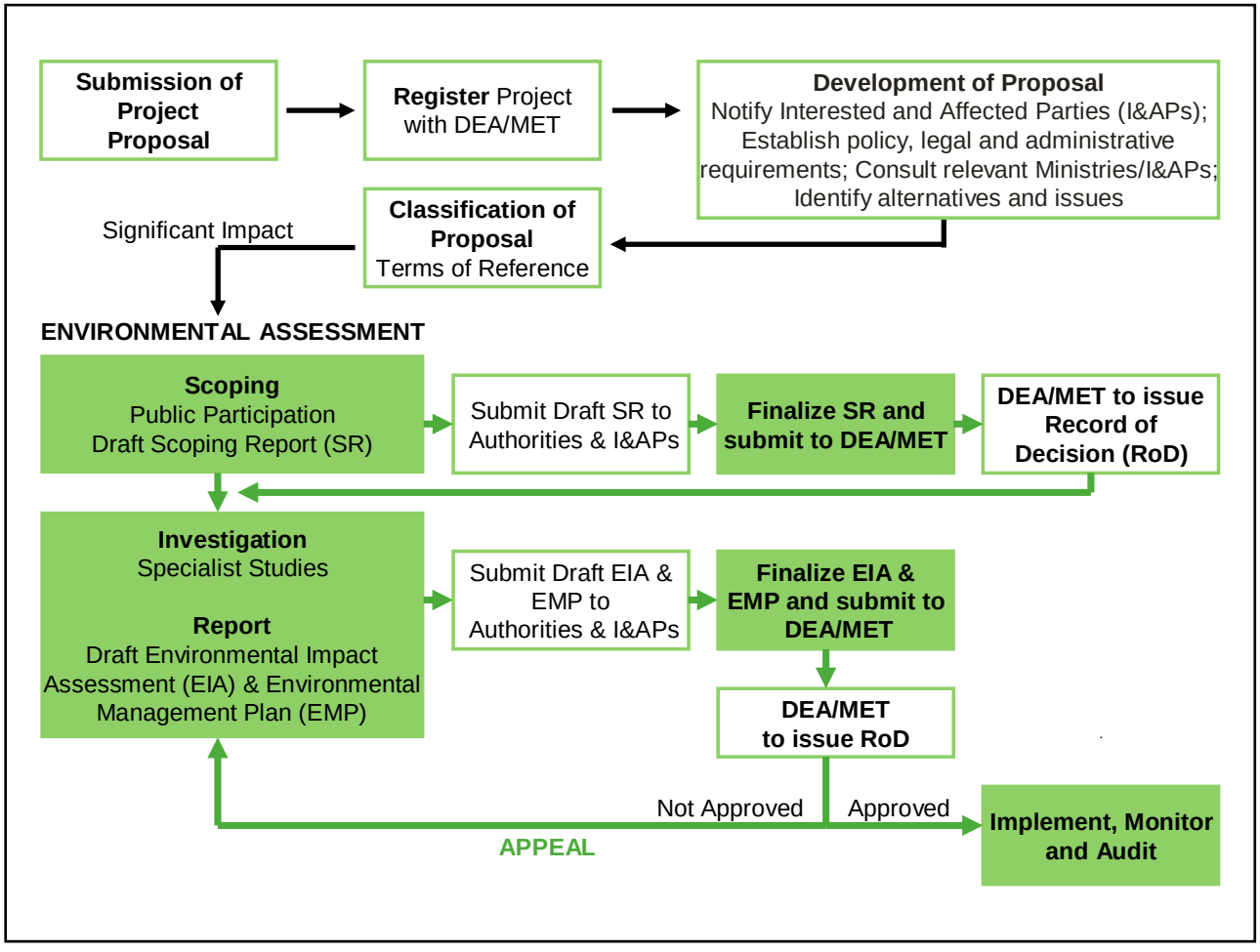

Figure 5.1: Schematic presentation of Namibia's Environmental Assessment Procedure.

5.2 Identification of Likely Positive Impacts

The following are the key likely positive impacts that will be evaluated during the full EIA for the proposed two (2) stratigraphic wells drilling operations:

- Increased earnings to the State Revenue through annual petroleum rights rentals and local taxes payable;
- Increased temporal contracts and employment opportunities for local services providers and local revenue circulation from ancillary (industrial support) service demands;
- Demand for some public services may increase;
- In event of discovery, unemployment may decrease;
- Utility payment increase and infrastructure may be expanded, and;
- Improved knowledge on the natural resources and in particular the deeper subsurface profile of the Etosha Basin.

As part of the EIA process, a socioeconomic specialist study will be undertaken focusing on quantifying the likely actual positive socioeconomic contributions that the proposed drilling operations will have on the Namibian economy as well as in an event of a discovery.

The overall approach will rely on data available from the Ministry of Mines and Energy as well as Namcor with respect to the various monetary contributions made by petroleum operators in the last five (5) years.

The EIA has provided recommendations that aimed at enhancing the positive impacts with mitigation measures provided in the EMP. A Socioeconomic Assessment with special focus on national, regional (Kavango West and Kavango East Regions) has been undertaken as part of the EIA.

5.3 Identification of Likely Negative Impacts

5.3.1 Summary of Sources and Likely Key Negative Impacts

The likely key sources of negative environmental (physical, biological and socioeconomic/cultural/ archaeological) impacts can be divided into two (2) main categories and these are:

(1) Routine and physical presence operational activities:

(i) Pre-construction and drilling requirements;

(ii) Construction phase;

(iii) Mobilisation;

(iv) Spudding and Conductor casing;

(v) Drilling surface / intermediate and setting casing and cementing process through up 900 m;

(vi) Drilling and continuous coring from 900 meters (2953') to 1900 meters (6234');

(vii) Drilling below 1900 meters to total depth, estimated at 2500 meters (+/- 8202');

(viii) Plug and abandon hole;

(ix) Rehabilitate all surface disturbances and clear the site of any debris, and;

(x) Camp removal, site closure / abandonment.

(2) Unplanned accidental events:

(i) Major land accidental incidence such as diesel / oil spill / fire / explosion.

5.3.2 Summary of Receptors Likely to be Negative Impacted

Based on the finding of this Environmental Scoping Report, the following is the summary of the key environmental receptors that may be negatively impacted by the proposed activities and will be assessed in detail in the EIA process with mitigation measures to be provided in the EMP:

(i) **Physical environment:**

- ❖ Water quality;
- ❖ Physical infrastructure and resources;
- ❖ Air quality, noise and dust;
- ❖ Landscape and topography;
- ❖ Soil quality, and;
- ❖ Climate change influences.

(ii) **Biological environment:**

- ❖ Habitat;
- ❖ Protected areas and resources;
- ❖ Flora;
- ❖ Fauna, and;
- ❖ Ecosystem functions, services, use values and non-use or passive use.

(iii) **Socioeconomic, cultural and archaeological environment**

- ❖ Local, regional and national socioeconomic settings;
- ❖ Subsistence agriculture;
- ❖ Community forestry;
- ❖ Tourism and recreation, and;
- ❖ Cultural, biological and archaeological resources.

Based on the findings of this scoping report, it's highly recommended that fauna and flora specialist study be conducted to have an overview of key resources / protected areas / resources / ecosystems that may be affected by the proposed two (2) stratigraphic wells drilling operations.

5.4 Impact Assessment Criteria

5.4.1 Impact Definition and Screening

For the purpose of this report and the EIA and EMP Reports to be prepared, a natural and/or human environmental impact is defined as: "Change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects." (ISO 14001).

All proposed Project activities (routine and non-routine) were considered during the Scoping Phase in terms of their potential to:

- ❖ Interact with the existing environment (physical, biological and social elements), and;
- ❖ Breach relevant national legislation, relevant international legislation, standards and guidelines, and corporate environmental policy and management systems.

Where a Project activity and receptor were considered to have the potential to interact, the impact has been defined and ranked according to its significance. Table 5.1 provides the definition of different categories of impacts identified.

The EIA and EMP phases will assess the potential impacts resulting from routine Project activities, assuming that the Project activity that may cause an impact will occur but the impact itself is dependent on the likelihood (Probability) (Table 5.1).

Correct control measures through the implantation of the EMP and monitoring thereof has been prepared aimed at reducing any negative significant impacts on the receiving environment as the results of the proposed project activities.

The mitigation measures priority have focused on measures aimed at preventing the occurrence of negative impacts. In the absence of specific information on receptors and mitigation measures, the precautionary approach and the environmental principles as outlined in the Environmental Management Act, 2007, (Act No. 7 of 2007) have been adopted with an allocation of a medium or high importance / sensitivity to such receptors.

Table 5.1: Definition of impact categories.

Nature of Impact	Adverse	Considered to represent an adverse change from the baseline, or to introduce a new undesirable factor.
	Beneficial	Considered to represent an improvement to the baseline or to introduce a new desirable factor.
Type of Impact	Direct	Results from a direct interaction between a planned or unplanned Project activity and the receiving environment.
	Indirect	Results from the Project but at a later time or at a removed distance or which may occur as a secondary effect of a direct impact.
	Cumulative	Results from (i) interactions between separate Project-related residual impacts; and (ii) interactions between Project-related residual impacts in combination with impacts from other projects and their associated activities. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
Duration of Impact	Short-term	Predicted to last only for a limited period but will cease on completion of the activity, or as a result of mitigation/reinstatement measures and natural recovery typically within a year of the project completion.
	Medium-	Predicted to last only for a medium period after the Project finishing, typically one to five years.
	Long-term	Continues over an extended period, typically more than five years after the Project's completion.
	Permanent	Occurs during the development of the Project and causes a permanent change in the affected receptor or resource that endures substantially beyond the Project lifetime.
Scale of Impact	Local	Affects locally important environmental resources or is restricted to a single habitat/biotope, a single community.
	Regional	Affects nationally important environmental resources, or an area that is nationally important/protected or has macro-economic consequences.
	National	Affects nationally important environmental resources, or an area that is nationally important/protected or has macro-economic consequences.
	International	Affects internationally important resources such as areas protected by international Conventions
	Transboundary	Impacts experienced in one country as a result of activities in another.
Probability	Negligible	Possibility negligible
	Improbable	Possibility very low
	Probable	Distinct possibility
	Highly Probable	Most likely
	Definite	Impact will occur regardless of preventive measures

5.4.2 Sensitivity of Receptors

Potential environmental and social effects will be assessed in relation to the baseline conditions, i.e. the conditions that would prevail should the project not proceed. For the purpose of this assessment, receptors are defined as elements of the natural or human environment which may interact with, or be interacted by, the project.

Baseline conditions are those that existed at the time of the assessment. Impact identification will be considered in terms of receptors and resources sensitive to changes (Table 5.2):

- **Physical environment** (Water quality, physical infrastructure and resources, air quality, noise and dust, landscape and topography, soil quality, and Climate change influences);
- **Biological environment** (Habitat, protected areas and resources, flora, fauna and ecosystem functions, services, use values and non-use or passive use), and;

- **Socioeconomic, cultural and archaeological environment** (Local, regional and national socioeconomic settings, subsistence agriculture, community forestry, tourism and recreation and cultural, biological and archaeological resources).

It is recognised that some receptors and resources may be more vulnerable to change or to have greater importance than others. Within the project area of influence, the importance and sensitivity of receptors (physical, biological and human) was determined based on professional judgement and taking into account:

- Relevant legislative or policy standards or guidelines;
- Relative importance/value assigned to existing social or environmental features and receptors;
- Capacity of the receptor to absorb change, and;
- Capacity of the receptor to recover from change.

In evaluating the severity of potential environmental impacts, the following factors have been taken into consideration:

- Receptor/ resource characteristics: The nature, importance and sensitivity to change of the receptors / target or resources that could be affected;
- Impact Magnitude: The magnitude of the change that is induced;
- Impact Duration: The time period over which the impact is expected to last;
- Impact Extent: The geographical extent of the induced change, and;
- Probability of Occurrence: Chance of an impact occurring;
- Regulations, Standards and Guidelines: The status of the impact in relation to regulations (e.g. discharge limits), standards (e.g. environmental quality criteria) and guidelines.

The overall impact severity has been categorised using a semi-quantitative subjective scale as shown in Table 5.2 for sensitivity of receptors, Table 5.3 for magnitude, Table 5.4 for duration, Table 5.5 for extent and Table 5.6 probability.

Table 5.2: Overall Scoping phase sensitivity assessment matrix results for the proposed stratigraphic oil and gas well drilling operations in PEL 73 onshore Kavango West and Kavango East Regions.

SENSITIVITY				PHYSICAL ENVIRONMENT						BIOLOGICAL ENVIRONMENT					SOCIOECONOMIC, CULTURAL AND ARCHAEOLOGICAL ENVIRONMENT				
SENSITIVITY RATING		CRITERIA		Water Quality	Physical infrastructure and Resources	Air Quality, Noise and Dust	Landscape Topography	Soil Quality	Climate Change Influences	Habitat	Protected Areas	Flora	Fauna	Ecosystem functions, services, use values and non-Use or passive use	Local, regional and national socioeconomic settings	Subsistence Agriculture	Community Forestry	Tourism and Recreation	Cultural, Biological and Archaeological Resources
1	Negligible	The receptor or resource is resistant to change or is of little environmental value.																	
2	Low	The receptor or resource is tolerant of change without detriment to its character, is of low environmental or social value, or is of local importance.																	
3	Medium	The receptor or resource has low capacity to absorb change without fundamentally altering its present character, is of high environmental or social value, or is of national importance																	
4	High	The receptor or resource has moderate capacity to absorb change without significantly altering its present character, has some environmental or social value, or is of district/regional importance.																	
5	Very High	The receptor or resource has little or no capacity to absorb change without fundamentally altering its present character, is of very high environmental or social value, or is of international importance.																	
SOURCES OF POTENTIAL IMPACT	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	1.	Pre-construction and drilling requirements																
		2.	Construction phase																
		3.	Mobilisation																
		4.	Spudding and Conductor casing																
		5.	Drilling surface / intermediate and setting casing and cementing process through up 900 m																
		6.	Drilling and continuous coring from 900 meters (2953') to 1900 meters (6234')																
		7.	Drilling below 1900 meters to total depth, estimated at 2500 meters (+/-8202')																
		8.	Plug and abandon hole																
		9.	Rehabilitate all surface disturbances and clear the site of any debris																
		10.	Camp removal, site closure / abandonment																
	UNPLANNED ACCIDENTAL EVENTS	11.	Major land accidental incidence such as diesel / oil spill/ fire / explosion (Note: Well Control arrangements and related Emergency Response Plan (ERP) are designed to bring the risk of any unplanned accidental event to ALARP (As Low As Reasonably Practicable) and tolerable																

Table 5.3: Scored on a scale from 0 to 5 for impact magnitude.

SCALE	DESCRIPTION
0	No observable effect
1	Low effect
2	Tolerable effect
3	Medium high effect
4	High effect
5	Very high effect (devastation)

Table 5.4: Scored time period (duration) over which the impact is expected to last.

SCALE	DESCRIPTION
T	Temporary
P	Permanent

Table 5.5: Scored geographical extent of the induced change.

SCALE	DESCRIPTION
L	Limited impact on location
O	Impact of importance for municipality;
R	Impact of regional character
N	Impact of national character
M	Impact of cross-border character

5.4.3 Likelihood (Probability) of Occurrence

The likelihood (probability) of the pre-identified events occurring has been ascribed using a qualitative scale of probability categories (in increasing order of likelihood) as shown in Table 5.6. Likelihood is estimated on the basis of experience and/ or evidence that such an outcome has previously occurred. Impacts resulting from routine/planned events (i.e., normal operations) are classified under category (E).

Table 5.6: Summary of the qualitative scale of probability categories (in increasing order of likelihood).

SCALE	DESCRIPTION
A	Extremely unlikely (e.g. never heard of in the industry)
B	Unlikely (e.g. heard of in the industry but considered unlikely)
C	Low likelihood (egg such incidents/impacts have occurred but are uncommon)
D	Medium likelihood (e.g. such incidents/impacts occur several times per year within the industry)
E	High likelihood (e.g. such incidents/impacts occurs several times per year at each location where such works are undertaken)

5.4.4 Significance Criteria

In order to assess the overall level of an impact, the following was established:

- ❖ The sensitivity or importance of the receptor (Table 5.2), and;
- ❖ The magnitude of the effect occurring and the change to the existing baseline conditions as a result of the project (Tables 5.3 – 5.6).

The assessment of the level of impacts has been based on a four-point scale, where adverse impacts identified as 'Major' or 'Moderate' are considered 'Significant' and 'Minor' adverse impacts are considered as 'Not Significant'. Positive impacts have been classified simply as 'beneficial', where applicable.

'None' is where a resource or receptor will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible', or is indistinguishable from natural background variations.

The framework for assessing the level of adverse significance impacts is outlined in Table 5.7 with the example of the EIA matrix to be used in assessment significance negative impact shown in Table 5.8.

A combination of the sensitivity of the receiving environment (Table 5.2) and the magnitude, duration, extent and probability (Tables 5.3 – 5.6) of the impact under consideration determines the significance of the impact (Tables 5.7 and 5.8). It is important to note that impacts will be considered / evaluated without the implementation of mitigation measures.

The need for appropriate mitigation measures to be presented in the EMP Report will be determined on the basis of the impact assessment to be presented in the EIA report.

Table 5.7: Summary of the significance negative impact rating.

IMPACT SEVERITY (Magnitude, Duration, Extent, Probability)	**RECEPTOR CHARACTERISTICS (SENSITIVITY)**				
	Very High (5)	**High(4)**	**Medium (3)**	**Low (2)**	**Negligible (1)**
Very High (5)	Major [5/5]	Major [4/5[	Moderate [3/5]	Moderate [2 /5]	Minor 1/5
High (4)	Major [5/4]	Major [4/4]	Moderate [3/4]	Moderate [2/4]	Minor[1/4]
Medium (3)	Major [5/3]	Moderate[4/3]	Moderate[3/3]	Minor[2/3]	None[1/3]
Low (2)	Moderate [5/2]	Moderate[4/2]	Minor[3/2]	None[2/2]	None[1/2]
Negligible (1)	Minor [5/1]	Minor [4/1]	None [3/1]	None [2/1]	None [1/1]

Table 5.8: Summary of the EIA matrix to be used in assessment significance negative impact of proposed stratigraphic oil and gas well drilling operations in PEL 73 onshore Kavango West and Kavango East Regions on the receiving enviroment.

IMPACT SEVERITY (Magnitude, Duration, Extent, Probability)	RECEPTOR CHARACTERISTICS (SENSITIVITY)				
	Very High (5)	High(4)	Medium (3)	Low (2)	Negligible (1)
Very High (5)	Major [5/5]	Major [4/5[	Moderate [3/5]	Moderate [2 /5]	Minor 1/5
High (4)	Major [5/4]	Major [4/4]	Moderate [3/4]	Moderate [2/4]	Minor[1/4]
Medium (3)	Major [5/3]	Moderate[4/3]	Moderate[3/3]	Minor[2/3]	None[1/3]
Low (2)	Moderate [5/2]	Moderate[4/2]	Minor[3/2]	None[2/2]	None[1/2]
Negligible (1)	Minor [5/1]	Minor [4/1]	None [3/1]	None [2/1]	None [1/1]

				PHYSICAL ENVIRONMENT						BIOLOGICAL ENVIRONMENT					SOCIOECONOMIC, CULTURAL AND ARCHAEOLOGICAL ENVIRONMENT				
				Water Quality	Physical infrastructure and Resources	Air Quality, Noise and Dust	Landscape Topography	Soil Quality	Climate Change Influences	Habitat	Protected Areas	Flora	Fauna	Ecosystem functions, services, use values and non-Use or passive use	Local, regional and national socioeconomic settings	Subsistence Agriculture	Community Forestry	Tourism and Recreation	Cultural, Biological and Archaeological Resources
SOURCES OF POTENTIAL IMPACT	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	1.	Pre-construction and drilling requirements																
		2.	Construction phase																
		3.	Mobilisation																
		4.	Spudding and Conductor casing																
		5.	Drilling surface / intermediate and setting casing and cementing process through up 900 m																
		6.	Drilling and continuous coring from 900 meters (2953') to 1900 meters (6234')																
		7.	Drilling below 1900 meters to total depth, estimated at 2500 meters (+/-8202')																
		8.	Plug and abandon hole																
		9.	Rehabilitate all surface disturbances and clear the site of any debris																
		10.	Camp removal, site closure / abandonment																
	UNPLANNED ACCIDENTAL EVENTS	11.	Major land accidental incidence such as diesel / oil spill/ fire / explosion																

6. STAKEHOLDERS AND PUBLIC CONSULTATIONS

6.1 Overview

During the consultations process Draft Scoping and EIA Reports as well as summarised background reports have been the key sources of information for all the stakeholders. The Namibian Environmental regulations requires that identified interested and affected parties get access to the Draft scoping or assessment and management reports and have the opportunity to submit comments in writing. These comments have to be included in the final reports. Although a written commenting is sufficient to meet the legal requirements, it might in certain cases be appropriate to convene public meetings, especially for activities which might affect intensively the interests of stakeholders. If meetings are held for public commenting, smaller, focused meetings may be preferable to ensure adequate time for comment, rather than larger meetings where few people have the opportunity to speak.

There is a variety of ways to gather opinion from the more vulnerable groups and ensure that they can meaningfully participate, e.g. use of community representatives such as councillors and traditional authority leadership, interviews and meetings. Beside the public review of the reports, there are other stages, which are relevant for consultation. The Regulations stipulate that also the scoping report should be provided to interested and affected parties for comments. During the review process the Office of the Environmental Commissioners (OEC) has the right to convene a further public hearing. Taking this into account, public consultation is more a cross-cutting process during the whole environmental assessment process rather than a particular step linked to the specific stage of the assessment. Therefore, public consultation should be planned from the beginning on of the assessment. This scoping report / ToR include provisions on the concrete public consultation measures also called communication plan, envisaged for the assessment process.

6.2 Notification of Stakeholders

According to the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007), a person conducting a public consultation process must give notice to all potential interested and affected parties of the application which is subjected to public consultation by means of the following:

(a) Fixing a notice board at a place conspicuous to the public at the boundary or on the fence of the site where the activity is taking place;

(b) Give written notice to:

  (i) The owners and occupiers of land adjacent to the site where the activity is taking place;

  (ii) The local authority council, regional council and traditional authority;

  (iii) Any other organ of state that has jurisdiction in respect of any aspect of the activity;

(c) Advertising the application once a week for two consecutive weeks in at least two newspapers circulated widely in Namibia.

The notice board or advertisement referred to must ***(a)*** must give details of the application which is subjected to the public consultation and in this case the proposed two (2) stratigraphic wells drilling operations in the PEL No. 73 covering Blocks 1719, 1720, 1721, 1819, 1820 and 1821, Etosha Basin, Kavango West Region, Northern Namibia. ***(b)*** state *(i)* that the application is to be submitted to the Environmental Commissioner in terms of these regulations; *(ii)* the nature and location of the activity; *(iii)* where further information on the activity can be obtained; and ***(c)*** the manner in which and the person to whom representatives in respect of the application may be made.

The notice referred to must be of a size at least 60cm by 42cm. When complying with this regulation, the person conducting the public consultation process must ensure that ***(a)*** information containing all relevant facts in respect of the application is made available to potential interested and affected parties; and ***(b)*** consultation by potential interested and affected parties is facilitated in such a manner that all potential interested and affected parties are provided with a reasonable opportunity to comment on the application.

The EIA Regulations clearly state that potential interested and affected parties must be provided with a reasonable opportunity to comment on the application under section 21(6) of the EIA Regulations.

6.3 Registration of Interested and Affected Parties (I&AP)

As part of the consultation process for Interested and Affected Parties (I&AP) also called stakeholders in this report an applicant responsible for an application must open and maintain a register which contains the names and addresses of the following:

(i) All persons who, as a consequence of the public consultation process conducted in respect of that application, have submitted written comments or attended meetings with the applicant;

(ii) All persons who, after completion of the public consultation process referred to in paragraph (a), have requested the applicant responsible for the application, in writing, for their names to be placed on the register; and

(iii) All organs of state which have jurisdiction in respect of the activity to which the application relates.

An applicant responsible for an application must give access to the register to any person who submits a request for access to the register in writing.

6.4 Role and Responsibilities of Registered I&AP (Stakeholders)

According to the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012, a registered interested or affected party (I&AP) (Stakeholder) is entitled to comment in writing, on all written submissions made to the Environmental Commissioner by the applicant responsible for the application, and to bring to the attention of the Environmental Commissioner any issues which that party, believes may be of significance to the consideration of the application, as long as –

(a) Comments are submitted within 7 days of notification of an application or receiving access to a scoping report or an assessment report; or

(b) The interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

6.5 Stakeholders Assessment

6.5.1 Overview

In accordance with Reconnaissance Energy Namibia (Pty) Ltd Requirements, the identification and assessment of stakeholders, and issues of importance to them, is key step of the EIA process. The assessment of the key stakeholders in terms of their likely interest and role to the EIA process for the proposed two (2) stratigraphic wells drilling operations has been undertaken as part of the internal Stakeholder Engagement Plan (SEP). Central government, regional governments, local and traditional authorities as well as local and international environmental groups will all be part of the consultative process with respect to the proposed drilling operations. Table 6.1 shows a list of the key stakeholder institutions / originations / community that will be contacted / engaged / consulted as part of the Scoping, EIA and EMP process for the proposed two (2) stratigraphic wells drilling operations.

Table 6.1: Key stakeholder institutions / originations / community that will be contacted / engaged / consulted as part of the Scoping, EIA and EMP Process.

STAKEHOLDER GROUP	STAKEHOLDERS CATEGORY
Namibia Central Government Ministries	Ministry of Mines and Energy
	Ministry of Environment and Tourism
	Ministry Agriculture, Water and Forestry
	Ministry Urban and Rural Development
	Others to be identified
Namibia Regional Government	Kavango West Regional Council
Namibia Local Government	Nkurenkuru Town Council
	Kavango East Regional Council
	Rundu Town Council
	Others to be identified
Traditional Authorities	All traditional authorities covered by the PEL 73
Namibia State Owned Enterprises	National Petroleum Corporation of Namibia (NAMCOR)Namibia
	Others to be identified
Business (Private Sector) Organisation Associations / Bodies	Chamber of Mines of Namibia
	Namibia Chamber of Commerce and Industry (NCCI)
	Namibia Petroleum Associations
Project Contractors and Business Partners	Drilling Operations Contractor
	Land logistics company
	Others to be identified

6.5.2 Proposed Timing for Stakeholders Consultations

6.5.2.1 Draft Scoping Report and Public Notices

Following the completion of the Draft Scoping Report with ToR, notices through the local newspaper advertisements as well as via special courier and emails have been distributed to all the key stakeholders and the interested general public. In order for Interested and Affected Parties (I&AP) (stakeholders) to have easy access to the reports, hardcopies will be printed and distributed as follows:

1. WINDHOEK - Risk-Based Solutions (RBS) CC: 41 Feld Street Ausspannplatz,

Corner of Lazarett and Feld Street and on RBS Website (www.rbs.com.na);

2. WINDHOEK - Ministry of Mines and Energy Library, 1 Aviation Road;
3. WINDHOEK - Windhoek Public Library, Lüderitz Street;
4. Kavango West Region, Main Road, Nkurenkuru, Kavango West Region;
5. Nkurenkuru Town Council, Main Road, Nkurenkuru, Kavango West Region;
6. Kavango East Region, Maria Mweringere Road, Government Office Park, Rundu, Kavango East Region;
7. Rundu Town Council, Usivi Road, Rundu, Kavango East Region, and;
8. Other to be identified (such as operational Constituency Offices in Kavango West and Kavango East Regions) with documents submitted through the Office of the Governors in both regions.

6.5.2.2 Consultation Meetings

Following the advertisement and circulation of notices to all the key stakeholders in **April and May 2019** two (2) meetings were organised in Nkurenkuru and Rundu in consultation with the Offices of the Governors (Kavango West and Kavango East regions) and the Local Authorities (Nkurenkuru and Rundu Town Councils). Well attended public /stakeholder meetings were held in Nkurenkuru, Kavango West Region and Rundu, Kavango East Regions on the 9th and 10th May 2019 respectively.

6.5.2.3 Application for Environmental Clearance Certificate

Following the completion of the stakeholder consultation process all the comments / feedback provided by the stakeholders will be included in the final reports. The final Scoping Report (to be included as an Annex to the EIA), the EIA and EMP report will then be submitted to support the application for Environmental Clearance Certificate (ECC) to the Environmental Commissioner in the Ministry of Environment and Tourism (MET) through the Competent Authority, the Petroleum Commissioner in the Ministry of Mines and Energy (MME).

The final reports in support of the application for Environmental Clearance Certificate for the proposed two (2) stratigraphic well drilling operations in PEL 73 are planned to be submitted to the authority for the Records of Decisions (RDs) in **July 2019**.

7. TERMS OF REFERENCE

7.1 Objectives of the Environmental Assessment (EA)

The main objective of the environmental assessment process described in this Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report has been to evaluate the biophysical and socioeconomic as well as other associated environmental components of the proposed project site and surrounding areas. The environmental assessment (EA) process covered the preparation of the Environmental Scoping report and this Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report.

The overall aim of the EA has been to investigate, assess and document the likely temporary or long-term positive and negative health, social and environmental impacts of the proposed project activities on receiving environment.

7.2 Scoping Study Conclusion

Based on the extent, duration, intensity and likely negative and positive impacts / influences of the proposed two (2) stratigraphic wells drilling operations covering PEL No. 73, it's hereby concluded that a full Environmental Impact Assessment (EIA) and the development of an Environmental Management Plan (EMP) must be undertaken.

The EIA and EMP must be undertaken in accordance with the provisions of the Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991) and associated amendments, the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012, the Environmental Management Act, 2007, (Act No. 7 of 2007) and Reconnaissance Energy Namibia (Pty) Ltd requirements as well as all other relevant Namibian laws, regional and international environmental and petroleum exploration standards and practices applicable onshore oil and gas drilling operations.

7.3 Recommendations for EIA and EMP

7.3.1 Aims and Objectives of the EIA and EMP

The overall aims and objectives of undertaking the full Environmental Assessment (EA) covering are:

- To assess all the likely positive and negative short- and long-term environmental which includes socioeconomic impacts on the local environment covering PEL No. 73 and using appropriate assessment guidelines, methods and techniques covering the complete proposed project cycle from implementation to drilling operations completion. The EIA and EMP reports have been prepared with reasonable skill, care and diligence in accordance with professional standards and practices existing at the date of performance of the assessment and that the guidelines, methods and techniques shall conform to the national regulatory requirements, process and specifications in Namibia and in particular as required by the Ministry of Environment and Tourism and the Ministry of Mines and Energy and Reconnaissance Energy Namibia (Pty) Ltd corporate requirements;

- Provide a single complete document which will satisfy the requirements of authorities in Namibia;
- Identify and meet all legal and legislative requirements;
- Provide information on the environmental factors and constraints considered in the project options;
- Describe the biophysical, cultural, social and environmental baseline conditions of the current environment;
- Identify and quantify the impact, the project activities will have on the biophysical, cultural and social environment;
- Identify mitigation methods available to minimise the potential of adverse environmental impacts;
- Identify constraints associated with the mitigation methods recommended, and allow provision for modification;
- Identify the residual environmental impacts expected to arise and evaluate their impact on the environment;
- Provide information on the consideration of alternative drilling methods to avoid and minimise the potential of adverse environmental impacts, and;
- Provide all necessary information for the Environmental management and monitoring programme.

7.3.2 Summary EIA Terms of Reference (ToR)

Summary of the proposed activities, alternatives and key issues to be considered during the Environmental Assessment (EA) process covering EIA and EMP stages are provided in Table 7.1. The EIA and EMP reports have been prepared in line with the January 2015 MET Environmental Assessment Reporting Guideline.

Table 7.1: Summary of the proposed activities, alternatives and key issues to be considered during the Environmental Assessment (EA) process covering EIA and EIA provided as part of the ToR.

PROPOSED PROJECT ACTIVITIES	ALTERNATIVES CONSIDERED	KEY ISSUES TO BE EVALUATED AND ASSESSED WITH ENVIRONMENTAL MANAGEMENT PLAN (EMP) / MITIGATION MEASURES PREPARED	
1. Pre-construction and drilling requirements 2. Construction phase 3. Mobilisation 4. Spudding and Conductor casing 5. Drilling surface / intermediate and setting casing and cementing process through up 900 m 6. Drilling and continuous coring from 900 meters (2953') to 1900 meters (6234') 7. Drilling below 1900 meters to total depth, estimated at 2500 meters (+/-8202') 8. Plug and abandon hole 9. Rehabilitate all surface disturbances and clear the site of any debris 10. Camp removal, site closure / abandonment, and; 11. Major land accidental incidence such as diesel / oil spill/ fire / explosion	(i) Drilling locations: Alternative locations have been identified and out of the eight (8) sites initially selected, only two (2) will be drilling for now. Additionally, the locations of each of the two (2) wells to be drilling can also be moved around an event that site-specific location is not environmentally favourable (ii) Other Alternative Land Uses: Agriculture Conservation and Tourism (iii) Ecosystem Function (What the Ecosystem Does (iv) Ecosystem Services (v) Use Values (vi) Non-Use, or Passive Use (vii) The No-Action Alternative (viii) Others to be identified during the public consultation process	Potential land use conflicts / opportunities for coexistence between proposed exploration and other existing land uses such as agriculture, community forestry, conservation and tourism	
		Physical Environment	1. Water quality 2. Physical infrastructure and resources 3. Air quality, noise and dust 4. Landscape and topography 5. Soil quality 6. Climate change influences.
		Biological Environment	1. Habitat 2. Protected areas and resources 3. Flora 4. Fauna 5. Ecosystem functions, services, use values and non-use or passive use.
		Socioeconomic, cultural and archaeological environment	1. Local, regional and national socioeconomic settings 2. Subsistence agriculture 3. Community forestry 4. Tourism and recreation 5. Cultural, biological and archaeological resources
		Environmental Management Plan (EMP) Providing Mitigation Measures and Monitoring Plan	Mitigation shall focus on the following in order of preference: 1. Enhancement, e.g. provision of new habitats; 2. Avoidance, e.g. alternative / sensitive design to avoid effects on ecological receptors; 3. Reduction, e.g. limitation of effects on receptors through design changes; and 4. Compensation, e.g. community benefits such as a water well being provided.

7.3.3 Specialist Studies to be undertaken for EIA and EMP

It's hereby recommended that the following desktop specialist studies shall also be undertaken as part of the Environmental Assessment Process leading to the preparation of the EIA and EMP Reports for the proposed two (2) stratigraphic well drilling operations in PEL 73:

(i) Flora and fauna;

(ii) Socioeconomic;

(iii) Ground and surface water;

(iv) Archaeology, and;

(v) Others as may be identified during the consultation process and as may be required.

The Environmental Assessment process inclusive of all the specialist studies has been undertaken in accordance with the provisions of the Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991) as amended, the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012, the Environmental Management Act, 2007, (Act No. 7 of 2007) and Reconnaissance Energy Namibia (Pty) Ltd requirements as well as all other relevant Namibian laws, regional and international environmental and petroleum exploration standards and practices applicable for onshore stratigraphic oil and gas well drilling operations.

7.3.4 EMP Framework

The overall focus of the EMP framework has been to develop mitigation measures appropriate for each activity likely to have an impact on the environment. Mitigation is the purposeful implementation of decisions or activities that have been designed to reduce the undesirable impacts of a proposed action on the affected environment.

7.4 Summary of the Environmental Assessment Process Steps

The steps to be taken are summarised as follows:

(i) Project screening process was undertaken in October 2018 – March 2019;

(ii) A Draft Environmental Scoping / Background Information Document (BID) Report prepared in November 2018 – March 2019;

(iii) Specialist studies (Flora, Fauna, Water, Socioeconomic and Archaeology) implemented in November – December 2018;

(iv) March 2019 the project registered with the Environmental Commissioner in the Ministry of Environment and Tourism (MET) via the Competent Authority (Petroleum Commissioner in the Ministry of Mines and Energy);

(v) March 2019, Draft Environmental Scoping / Background Information Document (BID) Report releases to the public/ Stakeholders/ Interested and Affected Parties (I&APs);

(vi) During the month April 2019, meetings held in Kavango East and West Regions (Nkurenkuru and Rundu), public / stakeholders notices issued in the local newspapers advertisements as well as via direct emails communications to key stakeholders as applicable;

(vii) April – May 2019 prepare the Draft EIA and EMP Reports and finalise the Scoping / BID Report;

(viii) June 2019 undertake additional consultations on the findings of the EIA and EMP and comments and inputs from the stakeholder consultations used to finalise the EIA and EMP Report, and;

(ix) July 2019 submit to the Environmental Commissioner in the Ministry of Environment and Tourism (MET) through the Competent Authority, the Petroleum Commissioner in Ministry of Mines and Energy (MME) by the end of June 2019.

8. BIBLIOGRAPHY

Bechstadt, T., Jager, H., Spence, G., Werner, G., 2012. Late Cryogenian (Neoproterozoic) glacial and post-glacial successions at the southern margin of the Congo Craton, northern Namibia: facies, palaeogeography and hydrocarbon perspective, Geological Society, London, Special Publications, 2012, 368:381-393

CSIR, 1982. Final report on the geophysical and hydrogeological investigation of the groundwater of Hereroland, South West Africa.

First African Oil Corporation, 2005. Preliminary evaluation of the hydrocarbon potential of the Etosha (Owambo) Basin, Namibia. Internal report. Ministry of Mines and Energy.

Frimmel, H.E., Klotzli, U., Siegfried, P. 1996b. New Pb-Pb single zircon age constraints on the timing of Neoproterozoic glaciation and continental break-up in Namibia. Journal of Geology, **v 104**. pp. 459-469.

Haddon, I.G., 2005. The Sub-Kalahari Geology and Tectonic Evolution of the Kalahari Basin, Southern Afrika, University of Witwatersrand, Johannesburg, 360 pp

Hoffman, K.H. 1994a. New constraints on the timing of continental breakup and collision in the Damara Belt, 30. Abstr: Proterozoic crustal & metallogenic Evolution, 29Aug. - 1 Sept., Windhoek, Geological Society of Namibia. Namibia, 79 pp.

Gray, D. R., Foster, D. A., Meert, J. G., Goscombe B. D., Armtrong, R., Trouw, R. A., Passchier, W. 2008. A Damara orogen perspective on the assembly of southwestern Gondwana. Geological Society of London, Special Publications, **v 294**, pp. 257- 278

Kamona, A.F., and Gunzel, A. 2007. Stratigraphy and base metal mineralization in the Otavi Mountain Land, Northern Namibia: A review and regional interpretation, Godwana Research, **v 11**, 396-413.

McFarland J., 2009. How do seismic surveys work? Oil and Gas Lawyer Blog, http://www.oilandgaslawyerblog.com/2009/04/how-do-seismic-surveys-work.html.

Miller, R.McG. 1997. The Owambo basin of northern Namibia, 237-317. In: Selley, R.C. (Ed) Sedimentary Basins of the World: African Basins, Elsevier, Amsterdam, 394 p.

Mendelsohn, J., & el Obeid, S., 2003. Sand and Water. A profile of the Kavango Region. – Cape Town & Windhoek: Struik Publishers & RAISON.

Mendelsohn, J., & el Obeid, S., 2004. Okavango River. The flow of a lifeline, Cape Town & Windhoek: Struik Publish-ers & RAISON.

Mendelsohn, J., Jarvis, A., Roberts, C., & Robertson, T., 2002. Atlas of Namibia, Cape Town: David Phillips Publishers.

Miller, R.McG. 1992. The geology of Namibia: Neoproterozoic to Lower Palaeozoic, Geological Survey of Namibia, Windhoek, **v 2**.

Miller, R.McG. 2008. The geology of Namibia: Neoproterozoic to Lower Palaeozoic, Geological Survey of Namibia, Windhoek, **v 2**.

Miller, R., McG, Pickford M., and Senut, B., 2010. The Geology, Palaeontology and Evolution of the Etosha Pan, Namibia: Implications for terminal Kalahari Deposition. South African Journal of Geology, Vol. 113, p. 307-334,

Moore, C.H. 2001. Carbonate reservoirs. Porosity evolution and diagenesis in a sequence stratigraphic framework. Developments in sedimentology, Elsevier, Amsterdam, **v 55**, pp. 341-355.

National Planning Commission, 2012. Namibia 2011 Population and Housing Census Preliminary Results. Windhoek, National Planning Commission.

Namibia Meteorological Services, 1997. Monthly and Annual Rainfall Normal for selected stations in Namibia which are used in the 10-Day Rainfall Bulletins. Windhoek, Namibia Meteorological Services.

Overseas Petroleum and Investment Corporation, 1991. Geological report on the OPO-1 Well, Etosha Basin, Exploration Report.

Tucker, M.E., and Wright V.P. 1990. Carbonate Sedimentology. Blackwell Scientific Publications.

Central Bureau of Statistics, 2011. Population and Housing Census, Kavango West Region Tables based on the 4th Delimitation, Windhoek, Namibia. Central Bureau of Statistics.

Wang, L., D'Odorico, P., Ringrose, S., Coetzee, S., and Macko, S. A., 2007. Biogeochemistry of Kalahari sands. Journal of Arid Environments 71(3), 259–272.