PROSPECTING RIGHT APPLICATION

BASIC HYDROGEOLOGICAL STUDY

Basic Hydrogeological Study for the proposed Prospecting Right Application of Coal on Portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS within the Magisterial District of Middelburg, Mpumalanga Province.

ULIBO RESOURCES (Pty) Ltd
Reg Nr: 2013/099506/07

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REPORT PREPARED BY:

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DMRE REF: MP 30/5/1/1/2/17258 PR.

Report Credentials.

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Project details

Report type	**Basic Hydrogeological Study for a Prospecting Right Application**	
Project title	Basic Hydrogeological Study for the proposed Prospecting Right Application for Ulibo Resources (Pty) Ltd on Portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, Situated in the Magisterial District of Middelburg, Mpumalanga Province.	
Mineral (s)	Coal	
Client	Ulibo Resources (Pty) Ltd	
Site location	Remaining Extent of the Farm Bankfontein 445 JS, Portion 38 of the Farm Groenfontein 440 JS and Portion 05 of the Farm Arendsfontein 464 JS, Situated in the Magisterial District of Middelburg, Mpumalanga Province.	
Version	1	
Date	03 April 2023	
		Electronic signatures
		Compiled by
Compiled by	Khulekani Zwane (Hydrogeologist) Singo Consulting (Pty) Ltd	
Reviewed by	Mutshidzi Munyai (Hydrogeologist) Singo Consulting (Pty) Ltd (Water Resources Science (Professional Natural Scientist), Environment Science (Candidate Natural Scientist) (SACNASP Registration Number 122464)	
Final review and approval	Dr. Kenneth Singo (Principal Consultant of Singo Consulting (Pty) Ltd)	

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Table 1: Critical Report Information

Critical Information incorporated within the Basic Hydrogeological Study:	Relevant section in report
Details of the specialist who prepared the report	Appendix A, P: 42
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A, P: 42
Project Background Information, including the proposed activities description	Chapter 1, P: 7
An indication of the scope of, and the purpose for which, the report was prepared	Chapter 1. P: 8
An indication of the quality and age of base data used for the specialist report	Chapter 9, P: 39
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	November 2022
A description of the methodology implemented in preparing the report or carrying out the specialised process comprehensive of equipment and modelling used;	Chapter 3, P: 10
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Chapter 1, P; 9
An identification of any areas to be avoided, including buffers	Chapter 4, p; 18
A map overlaying the proposed activity including the associated infrastructures on the environmental sensitivities of the site including containing buffer zones	Chapter 4, P: 18
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Chapter 5, P; 30
Any mitigation and conditions measures for inclusion in the EMPr	Chapter 7, P;40
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	
An analytic opinion as to whether the proposed activity or portions thereof should be Authorised-i.e. specific recommendations	Chapter 8, P; 42
Regarding the acceptability of the proposed activity or activities; and	
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Chapter 7, P; 38
A description of any consultation process that was undertaken during carrying out the study	BAR
Any triggered Water Uses according to section 21 of the National Water Act 36, 1998.	None
Any other information requested by the competent authority.	-

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1 INTRODUCTION

1.1 Background Information

Ulibo Resources (Pty) Ltd has appointed Singo Consulting (Pty) Ltd as an independent consulting company to conduct a basic hydrogeological study. The hydrogeological study is being conducted in support of a prospecting right application on Portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, Situated in the Magisterial District of Middelburg, Mpumalanga Province.

The proposed activity has a potential to contaminate the groundwater through possible accident of leakage and infiltration to the sub-surface.

Chapter 3 of the National Water Act (Act 36 of 1998) requires that a person who owns, control, occupies, uses the land is responsible for preventing pollution of water resources and is also responsible to remedy (correct) the effects of the pollution. It is with this Act that the hydrogeological report was deemed necessary for the site to gather all relevant information related to groundwater and its related potential impacts.

Ulibo Resources (Pty) Ltd is planning to prospect with the application of drilling to recover cores, which will be analysed for further delineation.

The goal of this study:

- Prediction of the environmental impact of the proposed prospecting activity on the geohydrological regime of the area.
- To assess the quality condition of surface and groundwater within and around the prospecting area, and to draft a water monitoring programme for the project site and provide recommendations.
- Forecasting the effects of the activity on the receiving environment.

1.2 Proposed Activities

The activities involved during the life of the project will be in phases, the outlined activities considered are the ones which have the potential of negatively or positively impacting the groundwater regime in the area in terms of quality and quantity.

- Clearing of vegetation to create roads and drilling areas.
- Drilling Process.
- Removal of cores and core logging.

1.3 Scope of Work

The scope of hydrogeological assessment consisted of the following tasks:

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- A desktop review and short baseline hydrogeological description of the site area, including review of:
    - Surface water drainage and its potential impact on groundwater.
    - Aquifer characterization.
- Aquifer Classification
- Hydrogeological Modelling
    - Numerical Groundwater flow.
        - Model inputs
        - Model Calibration
        - Scenario Modelling

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2 TERMS OF REFERENCE

The baseline hydrogeological assessment for the project area is mainly constructed by a combination of desktop study and site-specific field study. Most of the information used for this study was compiled with an aid of nearby study sites information and experience from similar geohydrological settings. All collected data will be compiled to construct a conceptual geohydrological model.

Table 2: The following aspects were covered in this hydrogeological study

Aspect	Description
Desktop Study	➢ Project Initiation and Data Collection ➢ Review available site specific hydrogeological and hydrological information to conceptualize the different aquifer systems and their interaction with surface water features in the area.
Aquifer classification	➢ Aquifers will be classified into either minor or major aquifer types and dominant water source will be identified
Reporting	Writing a comprehensive geohydrological report outlining all the findings and existing environment of the proposed project area. This groundwater specialist report compiles all methodologies, findings, quantitative analysis (geochemical assessment and modelling outcomes), impact assessments, recommendations (proposed monitoring programme and recommended mitigation measures for predicted impacts) and conclusions. Appendices to the specialist report will include laboratory results.

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METHODOLOGY

3.1 Desktop Study

Desktop or literature review is defined as a task which involves review of existing research/ information which is relevant to the project needs.

A literature review of all available relevant data was undertaken to provide more data as needed. The data from the literature review was correctly referenced and incorporated into the final research report. Data was compiled using science literature (journals, textbooks, papers, maps, and so on), GIS data from Singo Consulting (Pty) Ltd, DWS, SAWS weather station records, and other relevant scientific work conducted on the subject region. A comprehensive list of all the literature sources utilized in the study report can be found in the reference list.

3.2 Drilling and sitting of boreholes.

Exploration boreholes will be drilled one at a time at various locations throughout the proposed project area. Drill hole depths will average 100 meters and will be determined onsite as the drilling program advances, depending on past hole depths and dips. Between certain wetlands and waterways, a 100-meter buffer will be maintained. A 100-meter buffer must be maintained from public highways.

After the drill site has been gated off, cleared drilling will begin. Following the drilling, immediate rehabilitation will take place. The site will be repaired after each hole is drilled before the drilling crew moves on to the next planned hole. This procedure will be repeated until all holes have been drilled.

3.3 Groundwater availability assessment

The availability of groundwater as a water source depends largely upon surface and subsurface geology as well as climate. The porosity and permeability of a geologic formation control its ability to hold and transmit water. Porosity is measured as a ratio of voids to the total volume of rock material and is usually described as a percentage.

Shallow, weathered and/or fractured rock and relatively low yielding aquifer systems are underlain over 80 percent of South Africa. By contrast, appreciable quantities of groundwater can be abstracted at relatively high rates from dolomitic and quarzitic aquifer systems located in the northern and southern parts of the country respectively, as well as from a number of primary aquifers situated along the coastline.

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3.4 Groundwater systems

The aquifer systems in South Africa can be divided into two major types: **primary** and **secondary** aquifers.

Primary aquifers: The primary aquifers are: 1. Coastal sand, gravel and unconsolidated material along the South African coast, such as areas along the west coast at Port Nolloth, Doringbaai, Lambertsbaai, Langebaan, Atlantis, Cape Flats, Gansbaai, Bredesdorp, Stilbaai, Alexandria, Boesmansriviermond, Kidds beach, Richards bay; 2. Sand and gravel along stream beds such as those along the Crocodile and Caledon rivers, at De Aar, De Doorns, Rawsonville, Pietersburg (Polokwane), Messina, and Makatini Flats (Kok, 1991).

Characteristics of Primary Aquifers include but not limited to:

- Usually, shallow unconfined systems and groundwater surface in the aquifer is at atmospheric pressure (100 kPa).
- Mostly consist of unconsolidated material, usually less than 30 m thick.
- Contain 1 to 20 percent water by aquifer volume.
- Recharge rate is generally high. Some 15 to 30 percent of rainfall would infiltrate into aquifers.
- Geohydrological characteristics of aquifer do not vary greatly over short distances.
- The transportation of contaminants in the primary aquifers is slow because of high effective porosity.

Secondary aquifers: The degree of fracturing of rocks in South Africa is dependent upon the tectonic history of rocks as well as the rock composition. For example, competent rocks, such as dolerite and quartzite and sandstones, fracture more readily than incompetent or ductile rocks, such as dolomite and shale. The magnitude of fracturing does not necessarily determine how much water an aquifer can transmit. It is estimated that at depths greater than 60 m, about less than one percent of the fractures transmit significant amounts of water. However, within quartzite rocks, significant yields are possible at greater depths.

Typical characteristics of secondary or fracture flow aquifers are:

- Fractured flow aquifers are either confined or unconfined aquifers. The confined aquifers are overlain by sediments or rock of confining nature, which limits direct recharge from rainfall.
- They belong to shallow systems, usually less than 60 m thick and in exceptional circumstances can be about 200 m thick.
- Characteristics of aquifers as well as borehole yields vary greatly over short distances.

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4 PHYSIOGRAPHICAL AND GEOLOGICAL SETTING

4.1 Project Location

A locality map created by QGIS software illustrates detailed and comprehensive information regarding the surrounding settlements and infrastructure. The project area is situated on Portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, Situated in the Magisterial District of Middelburg, Mpumalanga Province. The project area as shown in Figure *1* is situated approximately 17 km South-east of the center of Middelburg town and approximately 33 km East of the center of eMalahleni town.

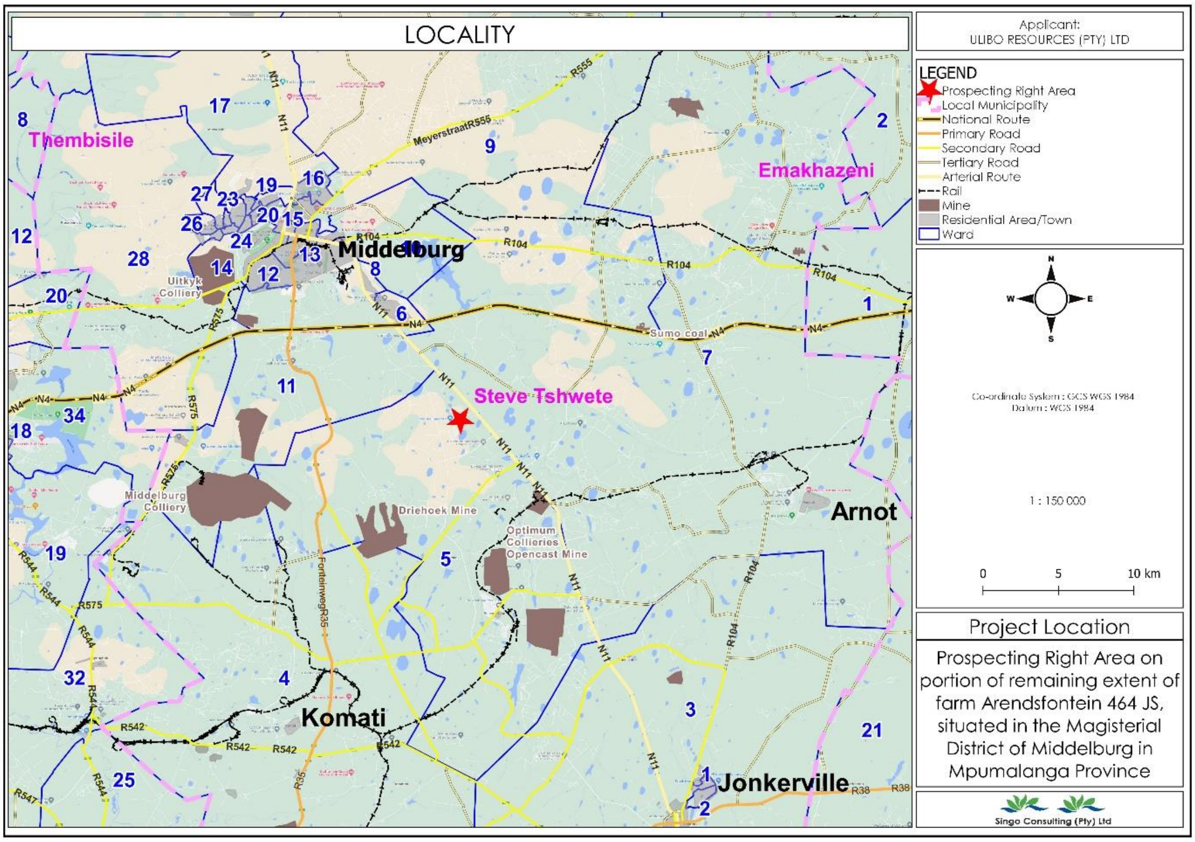

Figure 1: Locality Map of the Study area

4.2 Climate

Climate, amongst other factors, influences soil-water processes and water availability in open to air systems in a water balance. The most influential climatic parameter is rainfall and evaporation. Rainfall intensity, duration, evaporative demand, and runoff were considered in this study to indicate rainfall partitioning within the project area.

In Middelburg, the monthly distribution of average daily maximum temperatures (Figure 2) shows that the average midday temperatures range from 19°C in June to 32°C in January. The

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region is the coldest during June and July when the mercury drops to -1°C on average during the night. The area receives approximate an average 52mm of rain per year, with most rainfall only occurring during summer months.

Figure 3 shows the average rainfall values for the general area per month. This area receives its lowest rainfall during July (2mm) and the most rainfall during December (109mm). The Köppen Climate Classification suggests that the site is situated in a subtropical highland climate with dry winter that receives rainfall in the summer months (Kottek, et al., 2006).

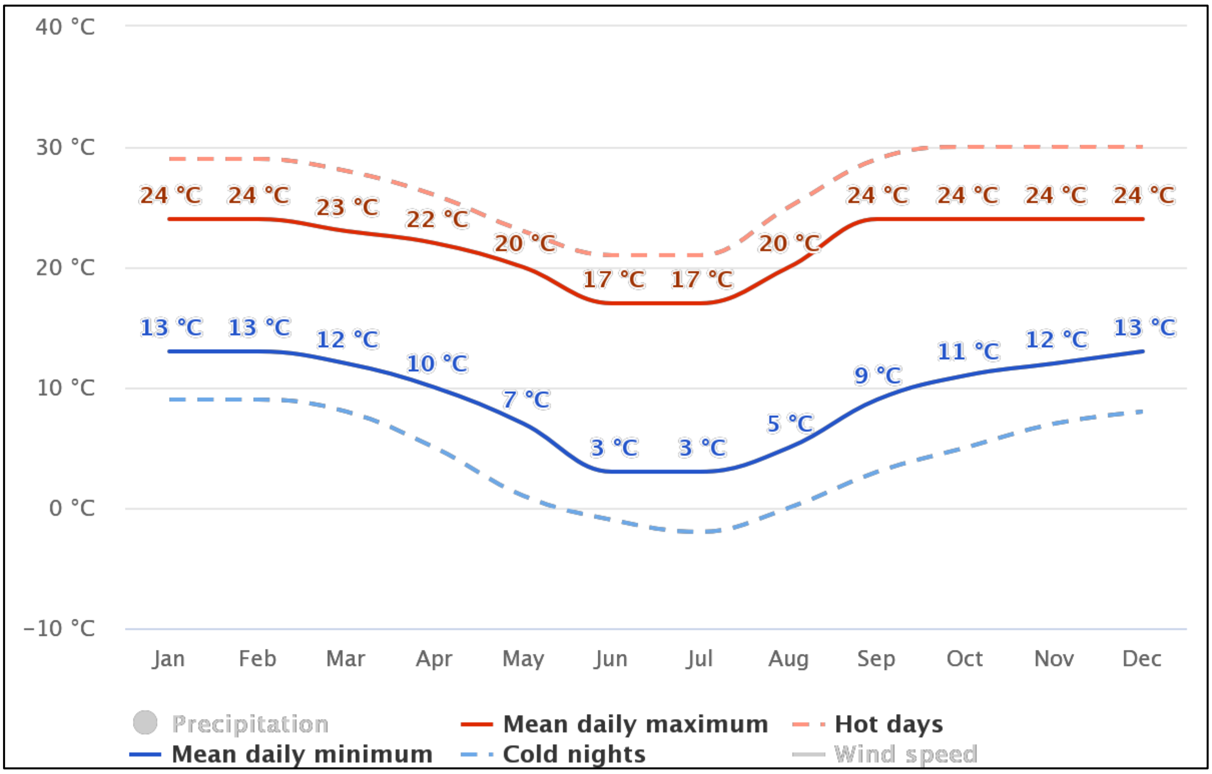

Figure 2: Average Monthly temperature (Meteoblue, 2023)

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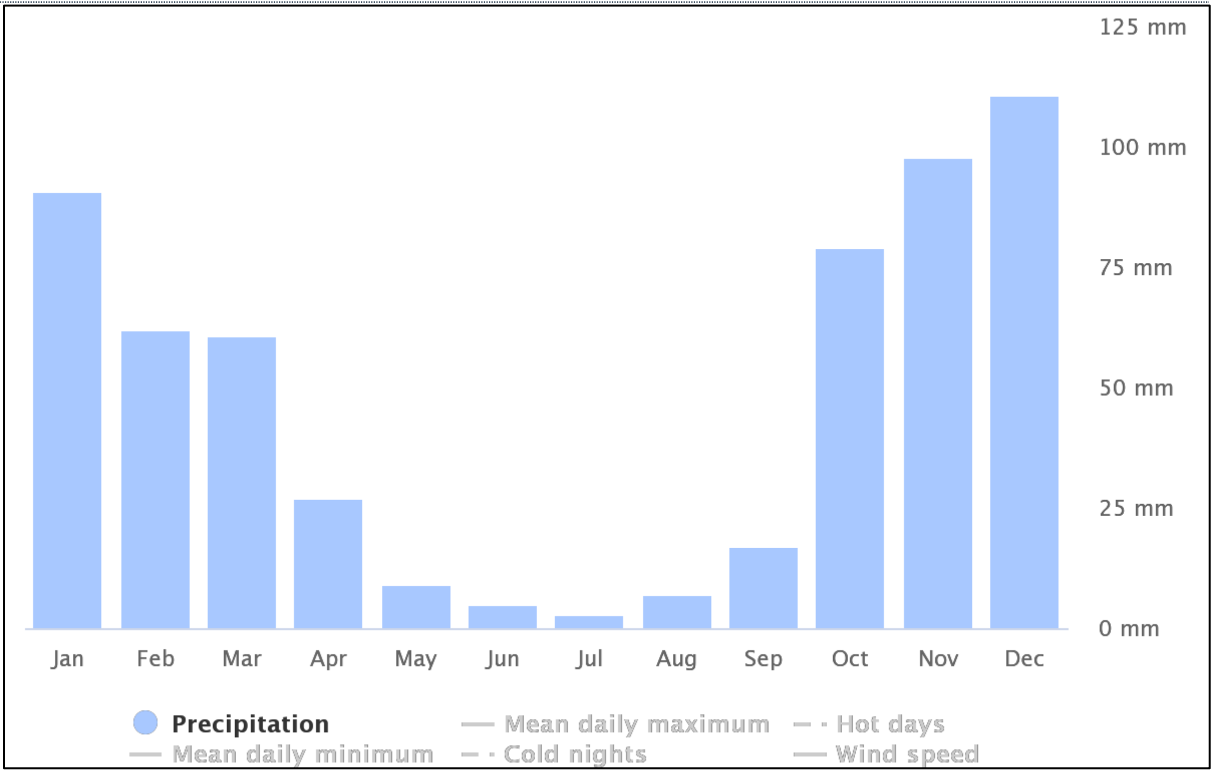

Figure 3: Average monthly rainfall map (Meteoblue, 2023)

Mean Annual Precipitation

As stated above, the area is located within quaternary catchment B12C, and the average mean annual precipitation (MAP) is in the order of 707 mm/annum and the mean annual evaporation (MAE) is in the order of 1550 mm/annum (S-Pan) with an area of 529 km^2 for the catchment (WRC, 2015).

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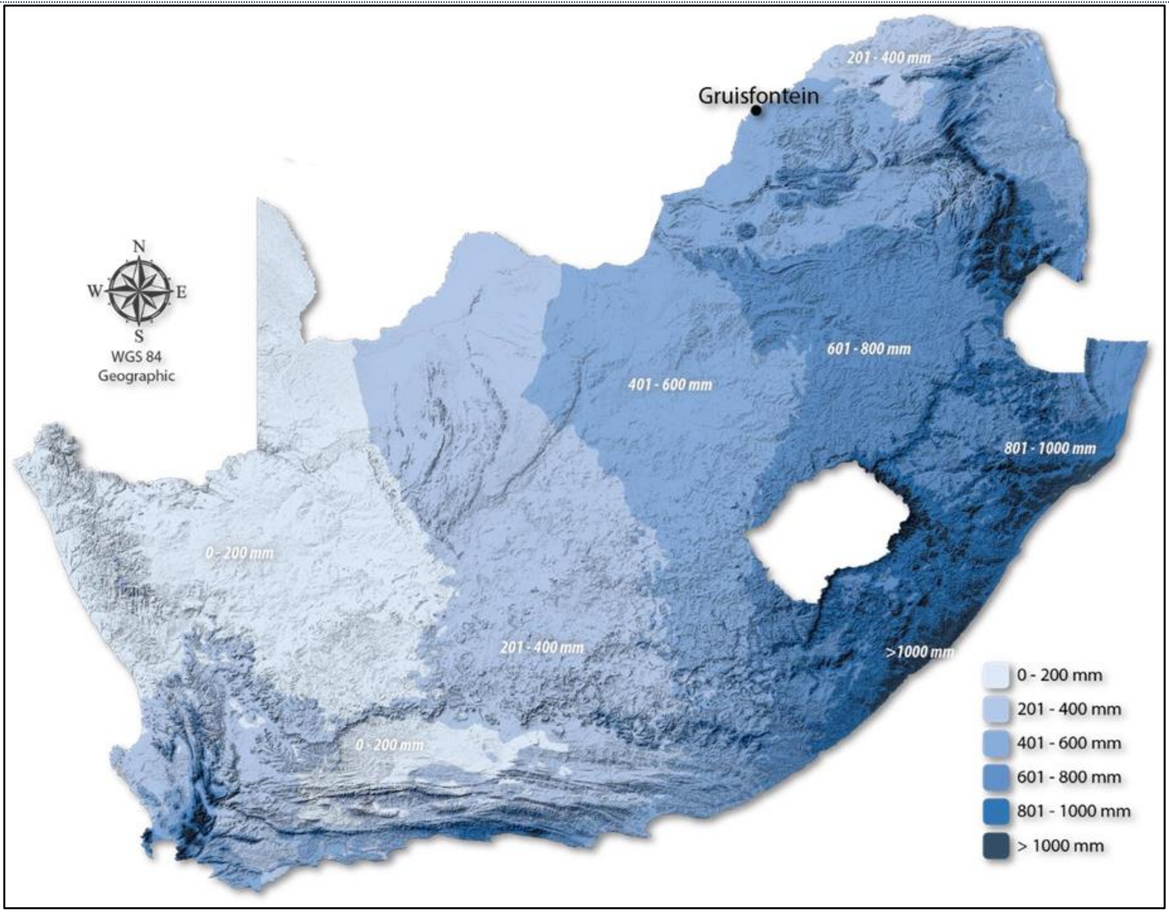

Figure 4: Average yearly rainfall map of RSA

4.3 Drainage and Topography

The topography is a field of geoscience and planetary science and is concerned with local detail in general, including not only relief but also natural and artificial features, and even local history and culture. The flow of water during rainy seasons flows from the area of high elevation to the area of low elevation. The topography of the proposed prospecting area has approximately an elevation varying from 1600 mamsl to 1618 mamsl with an overall estimated slope of 2.1%. The Figure 4 below indicates that the following waterbodies exists within and nearby the prospecting right area:

- Dam
- Non-perrenial
- Depression
- Channeled valley bottom
- Seep

The site is located on a B12C quaternary catchment, B12A forms part of the Upper Olifants Sub-Water Management Area, which is part of the Olifants Water Management Area. The site lies in the Upper Olifants sub-catchment which forms part of the Olifants River Catchment. Locally drainage is towards the Klein-Olifants tributary, it flows towards northern-east direction which then drains to Klein-Olifants River. The Klein-Olifants River is a tributary of the Main Olifant River. The Klein-Olifants River system feeds into the Middelburg Dam. Sustained flow of high quality water to this dam is important. On larger scale, drainage occurs towards the generalised flow of the Olifants River of B1 Tertiary catchment.

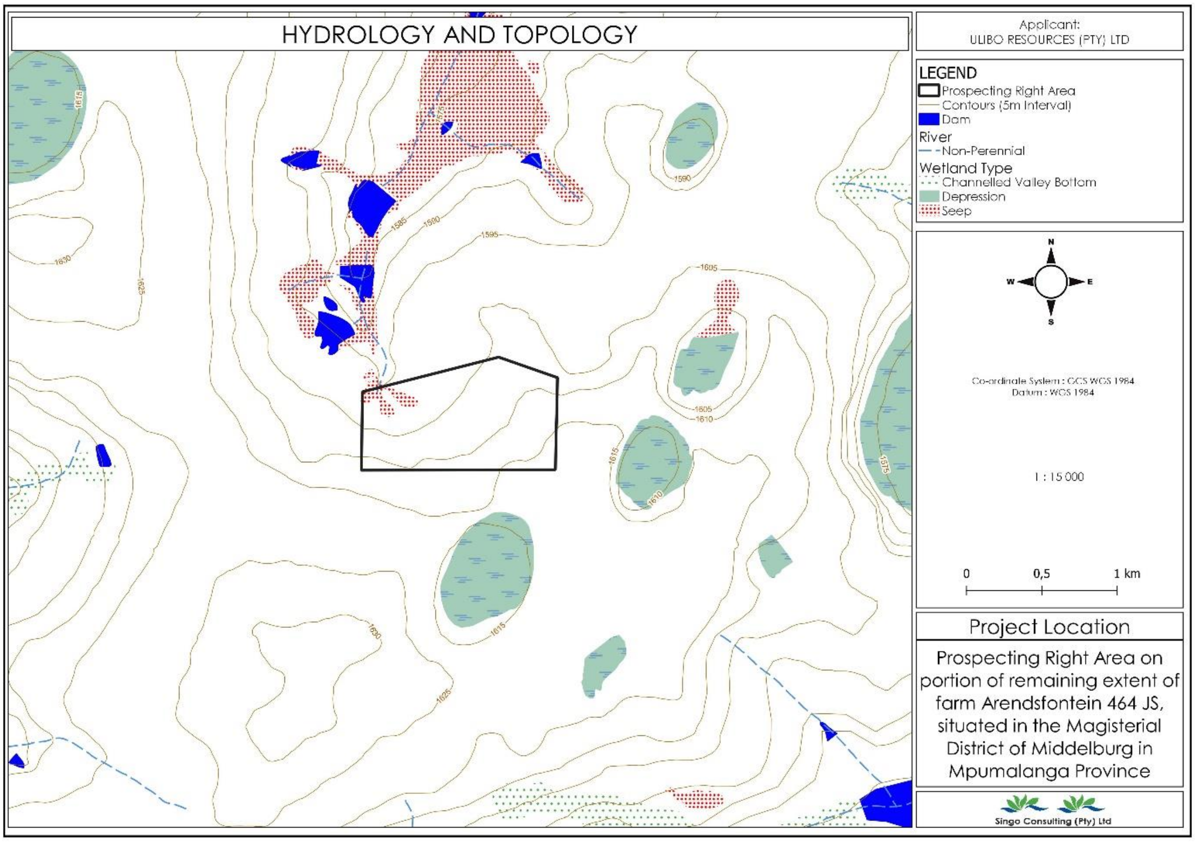

Figure 5: Topology map of the study area

In Figure 6 below the waterbodies identified were found to be within 500 m from the boundaries of the study area. There will be procedures and guidelines put in place for this project to avoid the risk of water contamination through onsite and nearby water resources, such as ensuring strict management of waste material and buffering of 100 m. It will be advised

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on more mitigation measures to ensure the waterbodies as seen on the hydrology map are not contaminated.

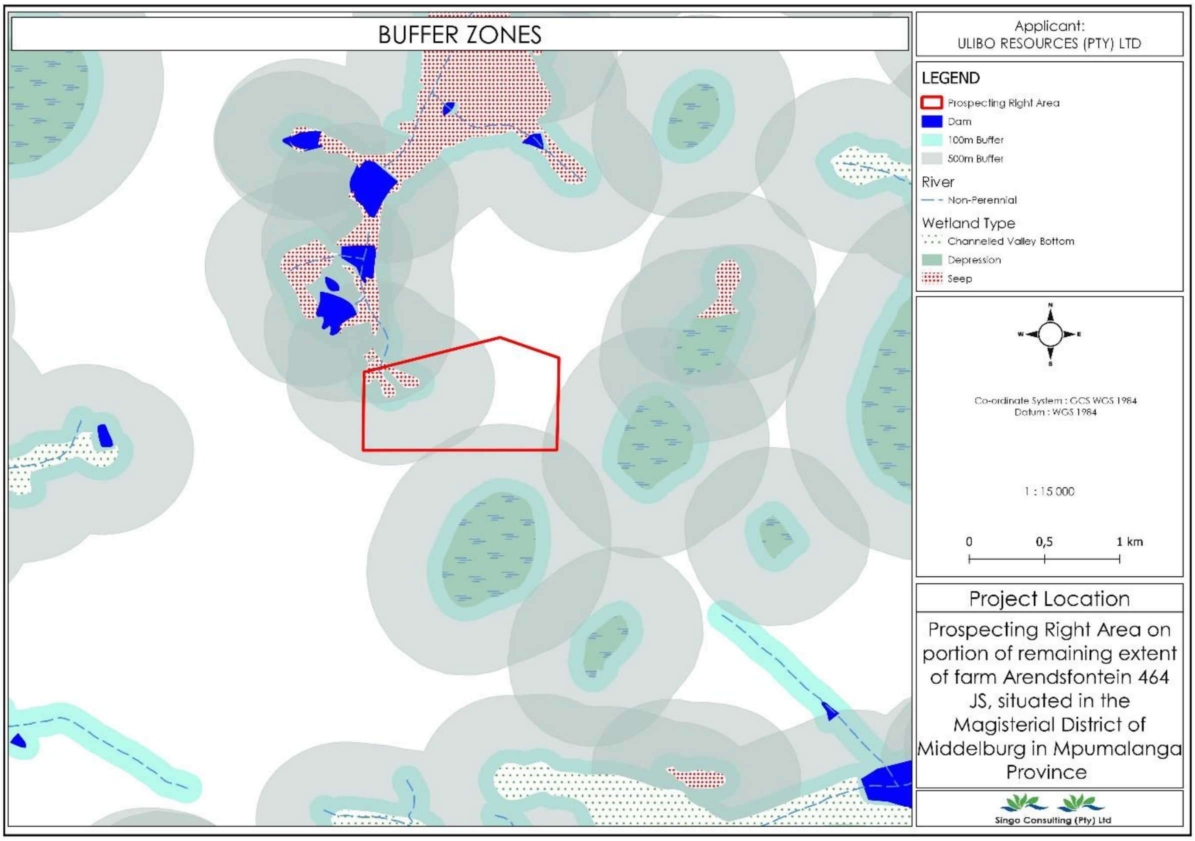

Figure 6: Hydrological and buffer zones map.

4.4 Catchment Information

South Africa's water resources are divided into quaternary catchments, which are the country's primary water management units (DWAF 2011). In a hierarchical classification system, a quaternary catchment is a fourth order catchment below the primary catchments. The primary drainages are further classified as Water Management Areas (WMA) and Catchment Management Agencies (CMA). In accordance with Section 5 subsection 5(1) of the National Water Act, 1998, the Department of Water and Sanitation (DWS) has established nine WMAs and nine CMAs as outlined in the National Water Resource Strategy 2 (2013). (Act No. 36 of 1998). The purpose of establishing these WMAs and CMAs is to improve water governance in various regions of the country, ensuring a fair and equal distribution of the Nation's water resources while ensuring resource quality is maintained.

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The study area falls within the Olifants Water Management Area (WMA) as shown on Figure 7. The quaternary catchment is B12C. The WRC 2012 study, presents hydrological parameters for each quaternary catchment including area and mean annual precipitation (MAP).

Table 3: WRC 2012 Report, WMA, QC

Quaternary Catchment	Water Management Area	S-Pan Evaporation		Rainfall		
		Evaporation Zone	**MAE (mm)**	**Rainfall Zone**	**MAP (mm)**	**Catchment Area**
B12C	Olifants water management	4A	1550	B1B	707	529

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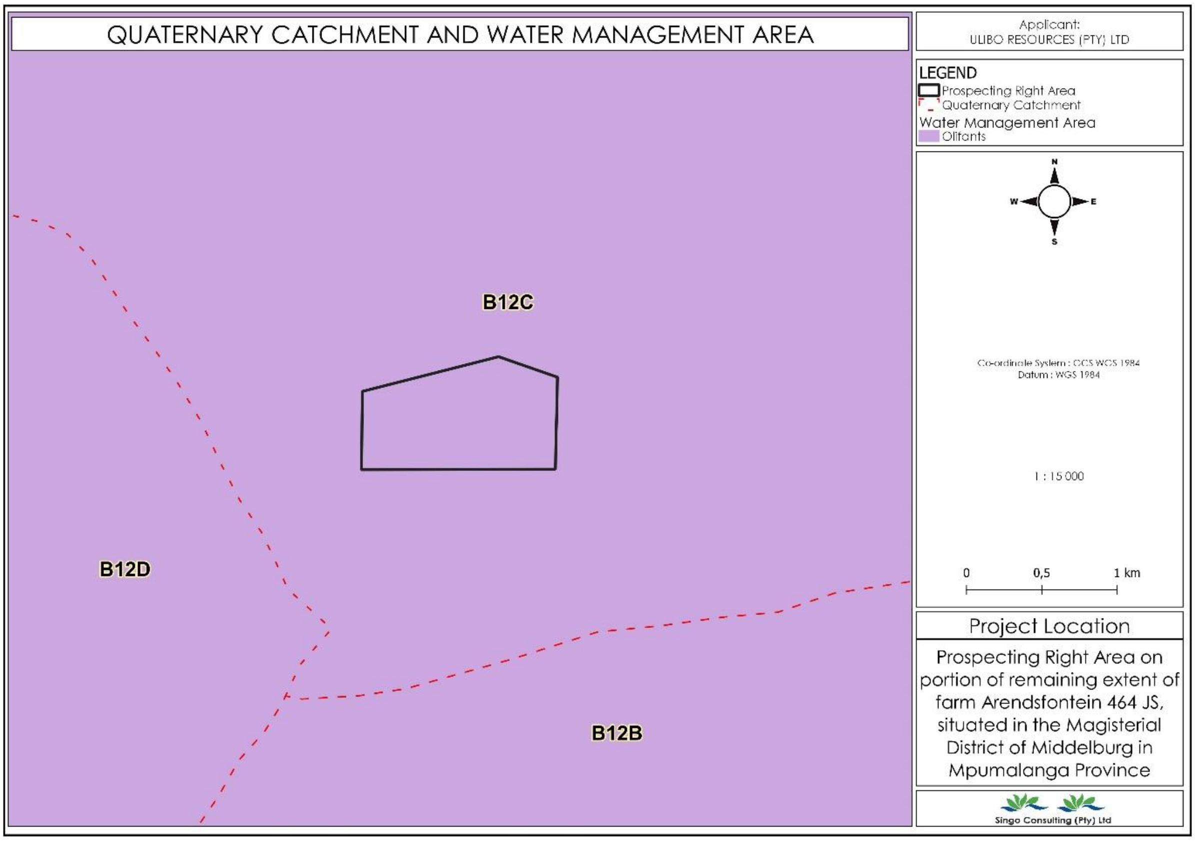

Figure 7: Quaternary Catchment of the study area

4.5 Geology

Regional Geology

Karoo Supergroup

Within the regional geological framework of South Africa, the study area is situated within the northeastern portion of the Main Karoo Basin of the Karoo Supergroup. Rocks of the Karoo Supergroup were deposited from the Late Carboniferous to Middle Jurassic eras, with coal seams deposited during the Permian period (Cairncross, 2001). Although there is still some debate the Main Karoo Basin is widely considered to be a retro-arc foreland system (Catuneanu et al., 1998; Johnson et al., 2006; Hancox and Götz, 2014). The Karoo aged sediments in South Africa were deposited mainly into two distinct tectonic environments. The first being sediments deposited into the Main Karoo Basin (where compressional tectonic stresses were dominant) and the second being sediments deposited into fault-bound basins to the north of the Main Karoo Basin (where rifting and extensional tectonic stresses were dominant) (Hancox and Götz, 2014).

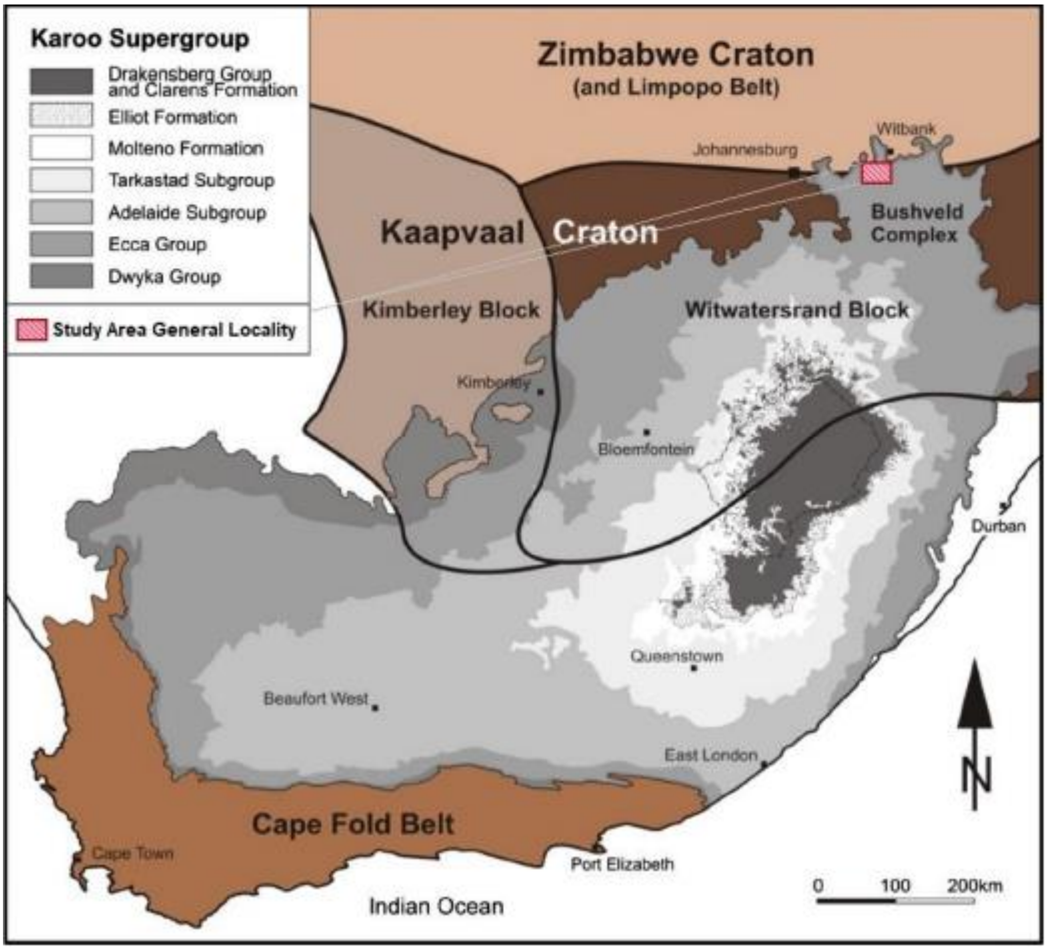

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Figure 8: A Geology of the Main Karoo Basin (Source: Catuneanu et al., 1998; Hancox and Götz, 2014) indicating the suggested boundaries of the Kaapvaal Craton (Source: Bordy et al., 2004)

The sedimentary part of the Karoo Supergroup is subdivided into four main lithostratigraphic units, which from the base up are the Dwyka, Ecca, Beaufort and Stormberg (Molteno, Elliot and Clarens formations) groups (Johnson et al., 1996; SACS, 1980). These are capped by some 1.4 km of basaltic lavas of the Drakensberg Group (Johnson et al., 1996; Veevers et al., 1994), the extrusion of which is related to the break-up of Gondwana (Cox, 1992). The basement to the Karoo Supergroup fill in both the MKB and in the northern basins is heterogeneous (Bordy et al., 2004a; Hancox, 1998; Rutherford, 2009) and this heterogeneity plays a significant control on the nature of the fill.

Local Geology

Karoo Dolerite Suite

The Karoo dolerite, which includes a wide range of petrological facies, consists of an interconnected network of dykes and sills and it is nearly impossible to single out any particular intrusive or tectonic event. It would, however, appear that a very large number of fractures were intruded simultaneously by magma and that the dolerite intrusive network acted as a shallow stockwork-like reservoir.

Dolerite dykes, like many other magmatic intrusions, develop by rapid hydraulic fracturing via the propagation of a fluid-filled open fissure, resulting in a massive magmatic intrusion with a neat and transgressive contact with the country rock. This fracturing mechanism is in contrast to the slow mode of hydraulic fracturing responsible for breccia-intrusions (i.e. kimberlite). For the intrusion to develop the magma pressure at the tip of the fissure must overcome the tensile strength of the surrounding rock. Dykes can develop vertically upwards or laterally along-strike over very long distances, as long as the magma pressure at the tip of the fissure is maintained. The intrusion of dolerite and basaltic dykes are therefore never accompanied by brecciation, deformation or shearing of the host-rock, at least during their propagation (WRC Report Project K860 (2001).

Vryheid Formation

The majority of the economically extracted coal in South Africa occurs in rocks of the Vryheid Formation, which ranges in thickness in the MKB from less than 70.0 m to over 500.0 m (Fig. 6). It is thickest to the south of the towns of Newcastle and Vryheid, where maximum subsidence

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took place (Du Toit, 1918; Cadle, 1975; Whateley, 1980a; Stavrakis, 1989; Cadle et al., 1982) and where the basin was the deepest.

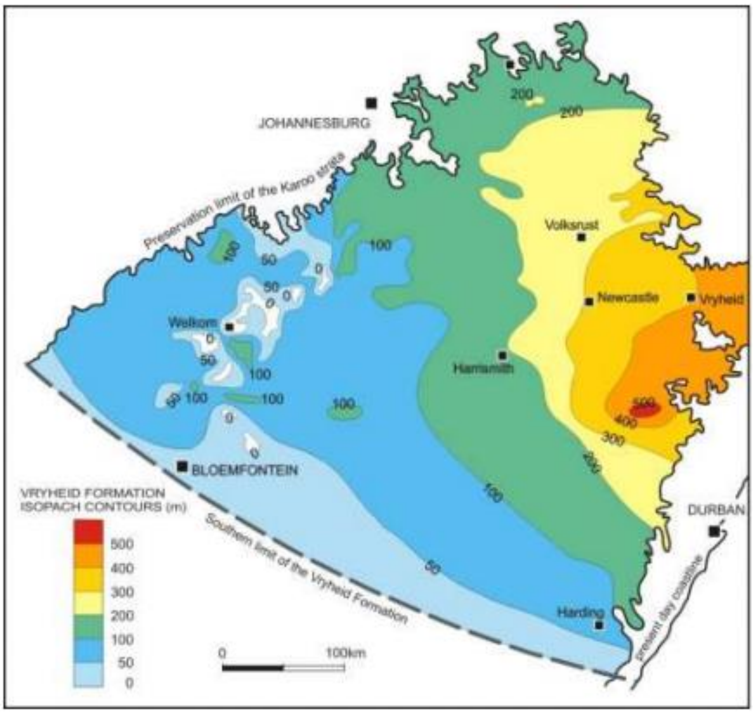

Figure 9: Isopach map of the Vryheid Formation showing the increase in thickness towards the east (from Cadle, 1982).

According to SACS (1980) the basic concept, distinguishing features and boundaries of the Vryheid Formation are those of the "Middle Ecca" as described by Du Toit (1954) and others. Prior to 1973 studies of the Vryheid Formation were largely stratigraphic. This situation changed when Hobday (1973) postulated deltaic depositional systems for the Vryheid Formation, and academic studies became more depositional process orientated.

The stratigraphy of the Vryheid Formation is now described as a succession of five coarsening upward sequences which display a remarkable lateral continuity across the entire distal region of the Karoo Basin (Cadle et al., 1982). In a complete succession each of the five coarsening-upward sequences starts with fine-grained marine facies, which grade upwards into coarser delta front and delta plain-fluvial facies. Several coal seams occur in the Vryheid Formation and these are associated predominantly with the coarser-grained fluvial facies at the top of each sequence. These coal seams can be traced laterally across the entire area of occurrence of the Vryheid Formation in the MKB; however some disagreement exists as to the exact correlation in the various coalfields. Regional differences allow for the considerable

diversity of coal types (organic content), mineral matter composition, and rank (maturity) that is found within the coalfields of South Africa (Falcon, 1986b).

The site, Farm Bankfontein 445 JS, Groenfontein 440 JS and Arendsfontein 464 JS, lies in the Kwaggasnek formation and Rashoop granophyre suite north of the Woestalleen Colliery. This is in the south-eastern part of the Transvaal Supergroup. To the south and north of the site is a Karoo basin exposure of the Vryheid Formation; fine to course grained sandstone, shale, coal seams and diabase respectively.

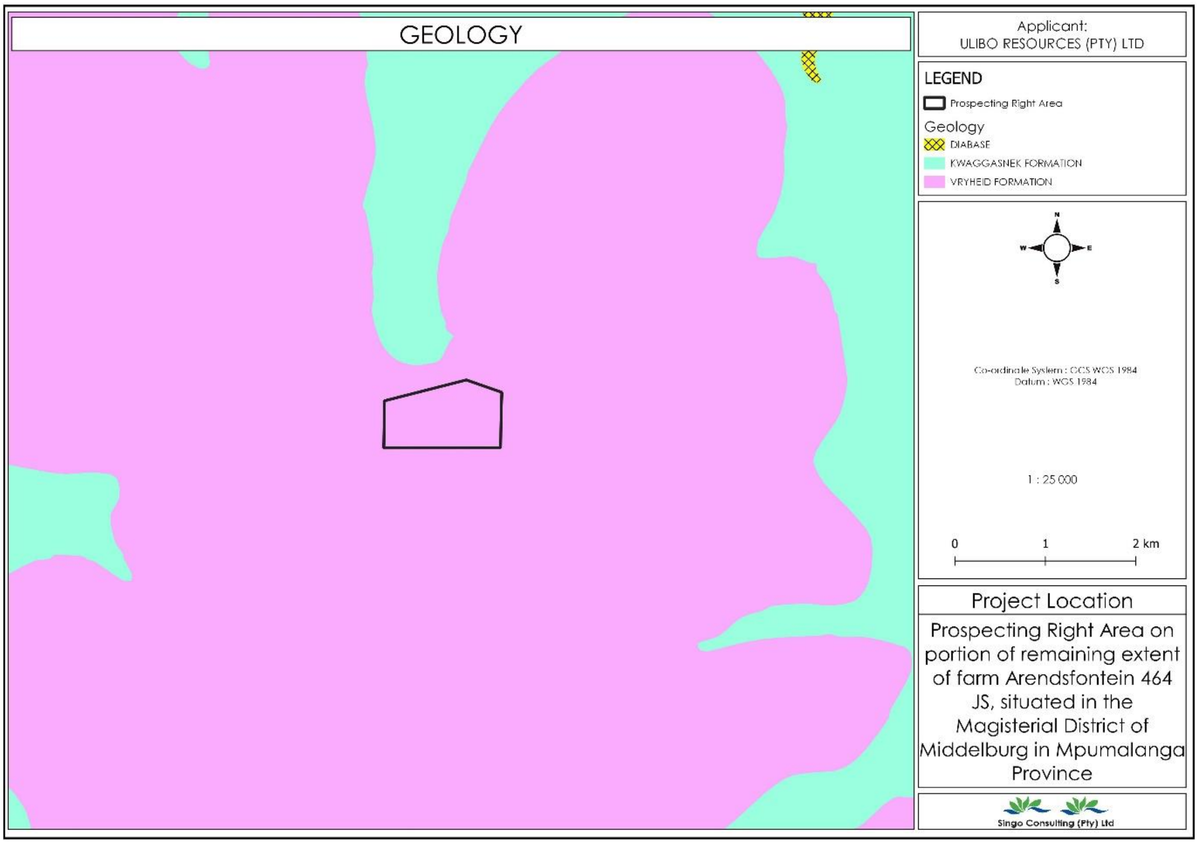

Figure 10: Geology Map of The Area Around the Farm Bankfontein 445 JS.

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5 GROUNDWATER INVESTIGATION

5.1 Hydrogeology

Typically, five distinct aquifer types:

- Basement (fractured Achaean-Proterozoic igneous/ metamorphic)
- Hard rock (e.g., Table Mountain TMG, Waterberg, and Natal Groups sandstone; fractured)
- Karst/ dolomite (dissolution)
- Karoo (fractured and influenced by dykes)
- Porous (intergranular Quaternary alluvial, coastal, Aeolian and other surficial unconsolidated deposits)

The study area falls under the **Karoo (fractured and influenced by dykes).** For effective borehole yields, the boreholes must target the fracture zones in this area.

Regional Groundwater Occurrence and Aquifers.

Based on the geology within the study area, the structural geology, and the geomorphology, the following conditions can arise to enhance aquifer development within the study area:

- The fractured transition zone between weathered and fresh bedrock
- Fractures along contact zones between the host rocks due to heating and cooling of rocks involved with the intrusions
- Contact zones between sedimentary rocks of different types
- Interbed or bedding plane fracturing
- Openings on discontinuities formed by fracturing
- Faulting due to tectonic forces
- Stratigraphic unconformities
- Zones of deeper weathering
- Fractures related to tensional and decompressional stresses due to off-loading of overlying material
- Groundwater occurs within the joints, bedding planes and along dolerite contacts. Groundwater potential is generally low in these rocks, with 87% of borehole yields < 3 l/s.

The pores of the geological units are generally strongly cemented, and fractured flow over secondary structures such as faults, bedding plane fractures, and so on is the primary flow mechanism. Due to the establishment of cooling joints, the intrusion of dolerite dykes and sills

into the fractured aquifer has resulted in the formation of preferential flow routes along the contacts of these lithologies. The dykes may operate as permeable or semi-permeable barriers to prevent water from flowing across them.

5.2 Potential Contaminants

Because this activity will only take place for a brief period of time, the possible pollutants for prospecting are limited and can be easily handled. The following contaminants are expected to be of concern during the prospecting activity.

- Leakage of sewage waste into the soil and flowing to the nearby water resource.
- Hydrocarbon spill into the soil
- Water used as cooling agent of the drill bit
- Removal of the core, residual core might be left on the surface, during rainfall, there is more likely to be leaching.
- Increase in waste around the prospecting area.
- Overflow of the sump and or infiltration of the wastewater from sump

5.3 Groundwater sources and sinks

Following the characterization of the aquifers, contaminant sources and groundwater receptors, the conceptual model was transformed into a numerical model so that the groundwater flow conditions, and mass transport can be solved numerically. A conceptual model is a simplified, but representative description of the groundwater system that illustrates the interaction of the sources, pathways, and receptors at the site.

The SPR conceptual model was first used in the field of environmental engineering in the late 1970"s to describe the flow of environmental pollutants from a source, through different pathways to potential receptors (Holdgate, 1979). Since then the model has been used in several environmental risk assessments (e.g., Environment Agency, 2004, Scottish Government, 2010, Sneddon et al., 2009).

- The **sources** represent any entity that contributes to the groundwater quantity and/or quality
- The **pathways** are the aquifers through which the groundwater and contaminants migrate and
- The **receptors** are humans, rivers or natural ecosystems that depend on the groundwater and will be impacted negatively if the water is depleted by dewatering or is contaminated.

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5.5 National Groundwater Archive Hydrocensus Data

Table 4: Hydrocensus Data (NGA)

Type	Latitude	Longitude	Elevation	Status	Water Level	Identifier
Borehole	-25.84563	29.61725	1540	Unknown	7.31	2529DC00058
Borehole	-25.84562	29.61724	1540	Unknown	7.62	2529DC00057
Borehole	-25.82582	30.56001	1540	Unknown	6.09	2529DC00093

6 AQUIFER CHARACTERIZATION

6.1 Groundwater vulnerability

Vulnerability of groundwater is a relative, non-measurable, dimensionless property (IAH, 1994). It is based on the concept that "some land areas are more vulnerable to groundwater contamination than others" (Vrba and Zaporozec 1994).

The main concerns in terms of possible groundwater contamination from the proposed prospecting activity are as follows:

- During the construction phase, Total Petroleum Hydrocarbon (TPH) contamination is possible due to the presence of heavy machinery on site. Spillages may occur which may impact both the soil and groundwater environment.
- During the prospecting phase, potential contamination may arise due to the drilling wastewater.

Because of the ensuing possibility of possible groundwater contamination from the sources or risks mentioned above, the aquifer's vulnerability is analysed. The following evaluation methodology was used to establish the aquifer's vulnerability to various pollution sources:

Method 1: Aquifer Vulnerability Rating (DRASTIC Method).

Method: 1 evaluates and rates seven key parameters within the hydrogeological setting to determine a final aquifer vulnerability rating.

Aquifer Vulnerability Rating (Drastic Method)

In the DRASTIC method, aquifer vulnerability is determined within hydrogeological settings by evaluating seven parameters denoted by the acronym:

- **D**epth to groundwater – Determined from DWA, GRA2 data, confirmed with a hydrocensus,
- **R**echarge – Obtained from DWA, GRA2 data
- **A**quifer media – Determined from geological maps and test pit profiles
- **S**oil media – Determined from test pit profiles
- **T**opography – Determined by digital elevation data
- **I**mpact on vadose zone – Determined from geological maps and test pit profiles
- Hydraulic **C**onductivity – Protocol to Manage the Potential of Groundwater Contamination form on-site Sanitation (DWAF, 1997).

Each of the parameters is weighted according to its relative importance. The DRASTIC Index is determined by rating each parameter according to a set of tables, multiplying the assigned rating by the parameter weighting and summing the resulting products. The higher the DRASTIC Index; the higher the vulnerability to contamination.

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Table 5: DRASTIC model table rating for the aquifer underlying the study area.

Parameter	Effect	Rating 1	2	3	4	5	6	7	8	9	10	Weight	Site rating	Score
Depth to Water	Increasing depth to water increases time for natural attenuation or remediation of contaminant	> 33m	25 - 33m	17 - 25m		10 - 17m		5 - 10m		2 - 5m	0 - 2m	5	5	25
Recharge	Increasing recharge leads to faster movement of contaminant	0 - 10mm /a	10 - 25mm /a	25 - 37mm/a		37 - 50mm/a	50 - 75mm/a	75 - 110mm/a	110 - 160mm/a	160 - 200mm/a	>200mm/a	4	8	32
Aquifer Media	Increasing porosity increases movement of contaminants		Compact sedimentary rocks with widely spaced fractures	Igneous and/or crystalline metamorphic rocks: fractured	Igneous and/or crystalline metamorphic rocks: fractured and weathered	Compact sedimentary rocks: fractures directly below groundwater level		Compact sedimentary rocks: weathered and fractured	Massive dolomite / limestone. Sand and Gravel		Fractured dolomite / limestone with solution channels	3	4	12
Soil media (Drainage)	increasing soil drainage decreases time for natural attenuation or		Clay loam and silty clay	Silty clay loam, sandy clay and silty loam	Sandy clay loam and loam	Sandy loam	Sandy loam	Shrinking and/or aggregate clay. Loamy sand	Sand. Shrinking and/or aggregate clay	Sand	Sand	2	4	8

	remediation													
Topography (%Slope)	increasing slope promotes runoff and decreases downward contaminant movement	> 18		12 to 18		6 to 12				2 to 7	0 - 2	1	10	12
Impact of the Vadose Zone	Increasing vadose zone conductivity decreases time for natural attenuation or remediation of contamination		Mainly compact tillite	Mainly compact tillite and shale. Lava and Intrusive	Mainly compact tillite, shale and sandstone. Assemblage of compact sedimentary strata, and extrusive and intrusive rocks	Compact sedimentary strata	Compact, dominantly arenaceous strata	Consolidated porous to compact sedimentary strata		Porous unconsolidated to semi consolidated sedimentary strata	Dolomite, chert, subordinate limestone	5	5	25
Hydraulic Conductivity	Increasing vadose zone conductivity decreases time for natural attenuation or	0.03 - 0.69m	0.69 - 1.35m	1.35 - 2.02m	2.02 - 2.68m	2.68 - 3.34m	3.34 - 10m				>10m	3	10	30

	remediation of contamination													
Final Score														122

Table 6: Drastic Model Score for the aquifer in the area.

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The vulnerability index score (DRASTIC index) for the site is 120. Below is a classification table indicating the class description for the index range.

Table 7: aquifer vulnerability table of the aquifer at Middelburg.

Index Range	Class name
≤ 89	Very Low
90 - 105	Low
106 – 140	Medium
141 – 186	High
187 – 210	Very High
≥ 211	Extremely High

The aquifer vulnerability from possible pollution sources is classed as "Moderate". A moderate potential or likelihood for possible contaminated fluids originating from the site to reach the groundwater table exists. A medium aquifer protection level is therefore recommended. As seen on the Figure *11*, the likelihood of groundwater contamination attributed to the material above the ground water table is classified as moderate.

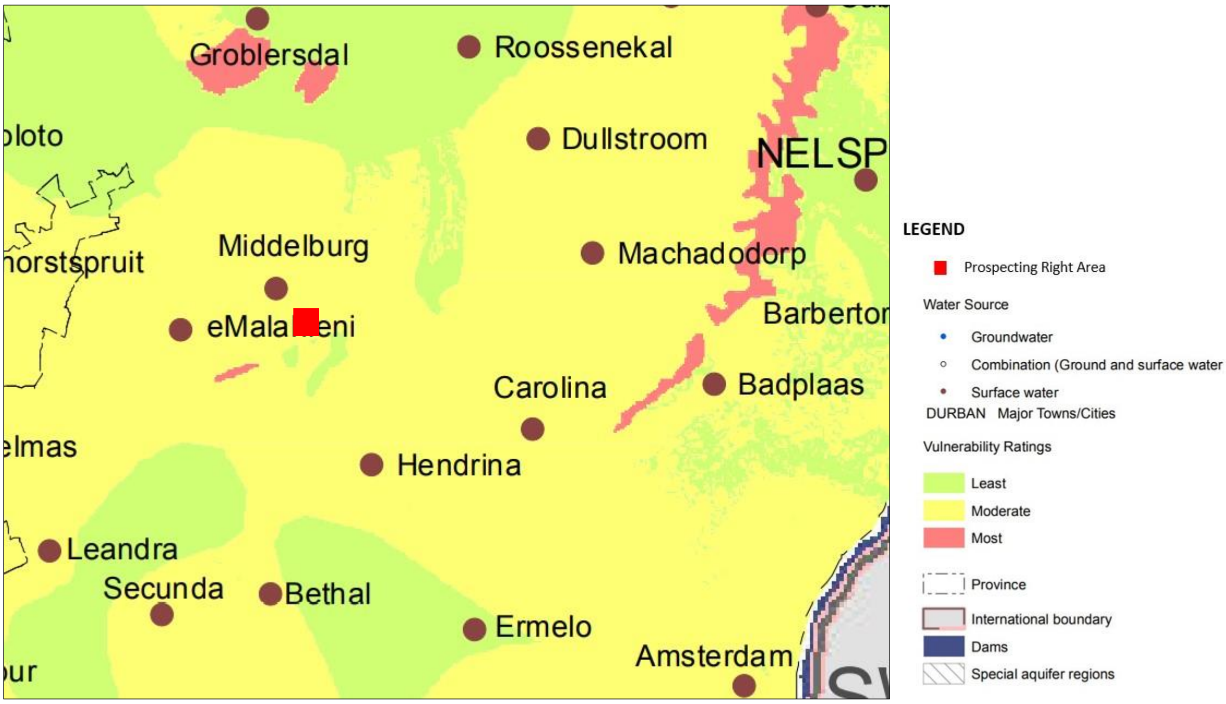

Figure 11: Aquifer Vulnerability of Middelburg (Vegter & Seymour, 2012)).

6.2 Aquifer classification

The classification of aquifers was done using the Aquifer classification Map of south Africa (Matoti, Conrad and Jones, 1999) and 2530 Nelspruit – 1:500 000 Hydrogeological map series (du Toit, 1999) Figure *12*. The Map provides an overview of aquifer that exist within an area, this information helps the decisionmakers to fully understand how over abstraction from the aquifer could affect those in the area.

In general, the aquifer host rock comprises predominantly of Acid / intermediate / alkaline extrusive rocks (rhyolite, felsite and quartz porphyry). The aquifer in the study area region can be referred to as being predominantly intergranular and fractured. These aquifer types generally have very low to medium primary hydraulic conductivity (K-value) and medium to low porosity values (n-value) due to its secondary nature (King, Maritz, & and Jonck, 1998). The aquifer underlying the site can be considered a low to moderate yielding aquifer, with reported yields ranging from 0.5 to 2.0 l/sec (Class d3 aquifer) refer to Figure *12*. The aquifer is an important contributor to groundwater baseflow to streams and rivers (King et al., 1998).

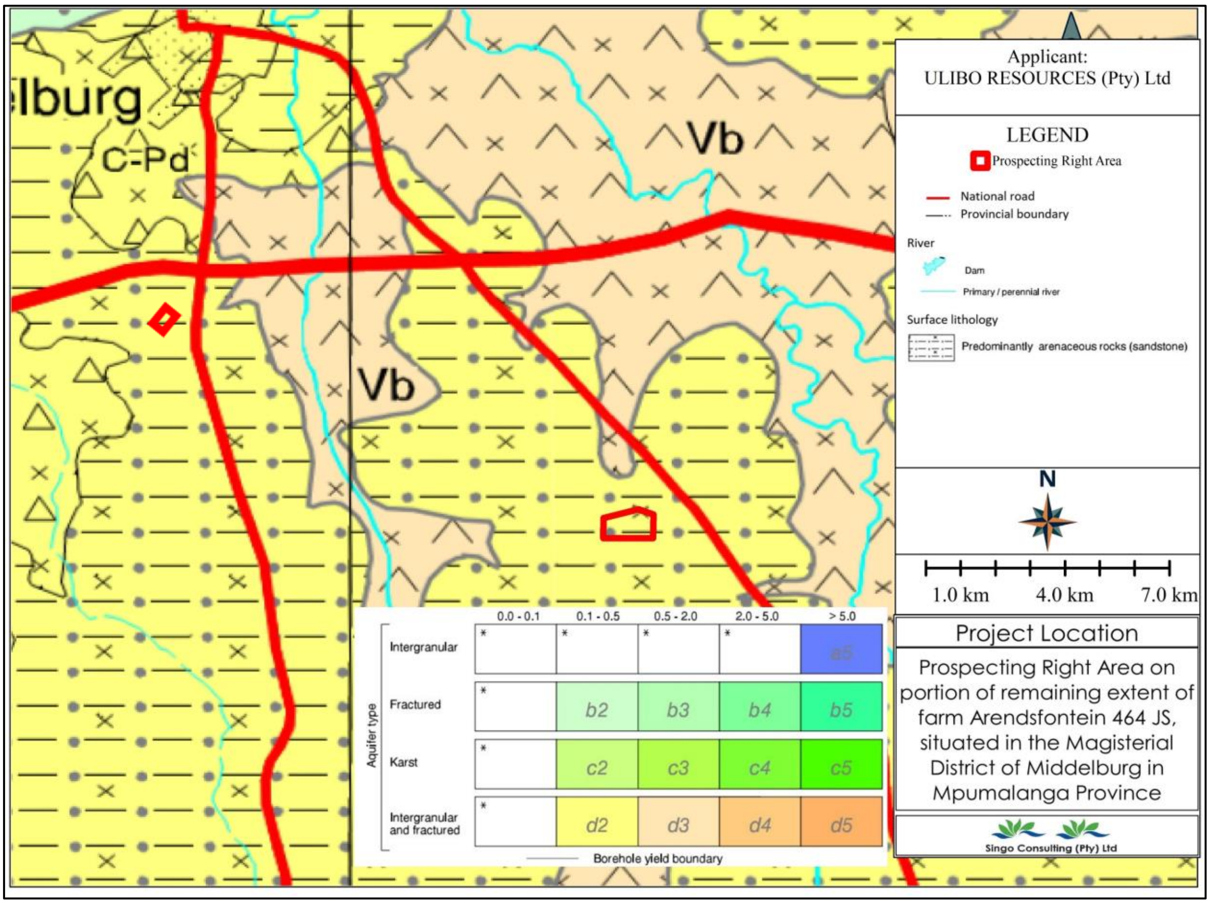

Figure 12: 1:500 000 Regional Hydrogeological map series of RSA

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The *Figure 13* below illustrates aquifer classification of different areas in South Africa. It can be deduced that the project area at **Magisterial District of Middelburg** comprises of Minor aquifers and the dominant water source is Surface water.

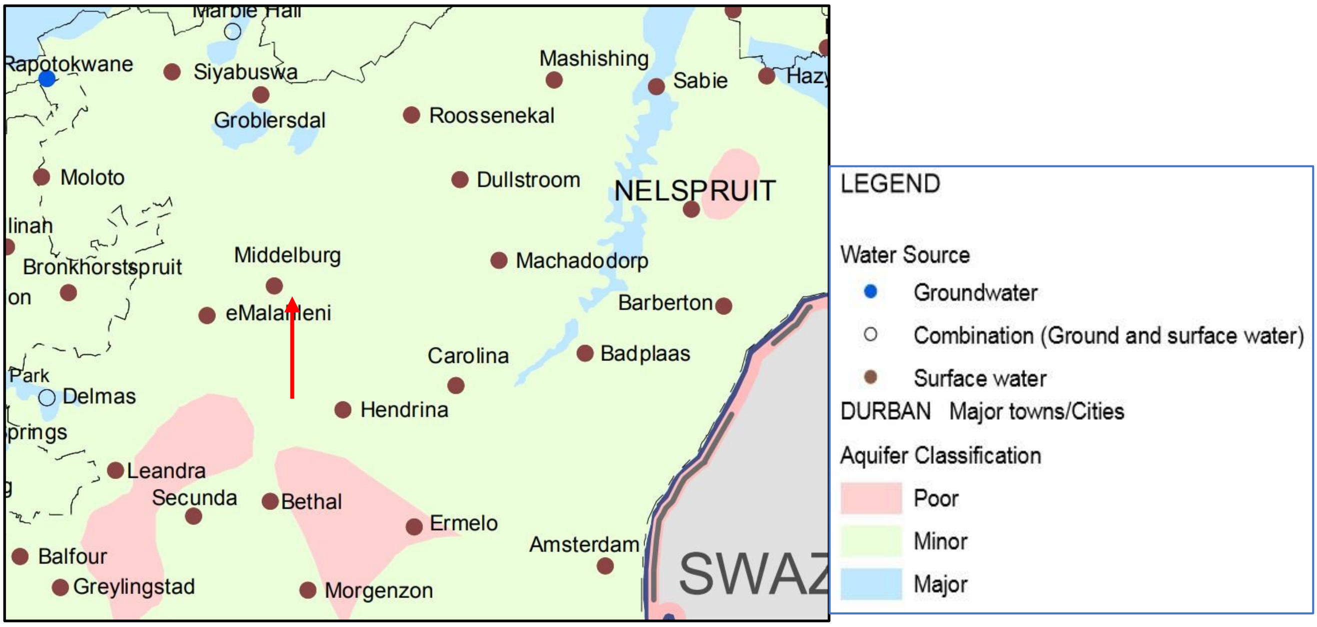

Figure 13: Aquifer Classification of the study area (Source: (Vegter & Seymour, , 2012)).

Table 8: Aquifer characterization

Sole source aquifer	An aquifer used to supply 50% or more of urban domestic water for a given area, for which there are no reasonably available alternative sources should this aquifer be impacted upon or depleted.
Major aquifer region	High-yielding aquifer of acceptable quality water.
Minor aquifer region	Moderately yielding aquifer of acceptable quality or high yielding aquifer of poor-quality water.
Poor aquifer region	Insignificantly yielding aquifer of good quality or moderately yielding aquifer of poor quality, or aquifer that will never be utilised for water supply and that will not contaminate other aquifers.

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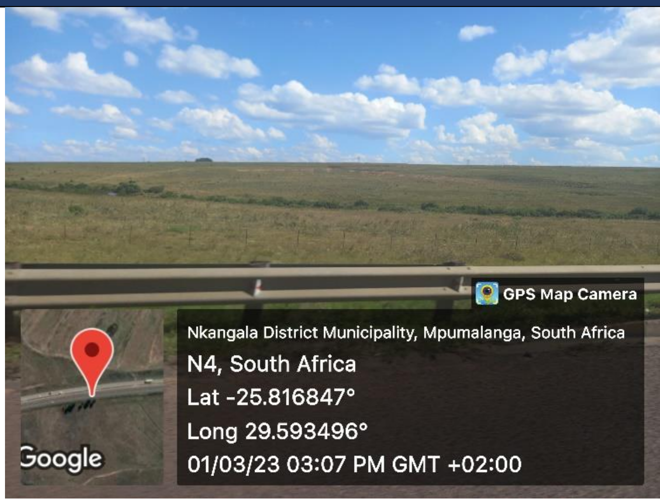
7 HYDROGEOLOGICAL IMPACT ASSESSMENT AND MANAGEMENT PLAN

7.1 Prospecting Phase Impacts

During the prospecting phase, the following impacts are envisioned:

- Clearing of vegetation leading to increased runoff and less infiltration.
- Diesel, oil and petrol spillages from the drill rig and site vehicles, and leaks from mobile toilets leads to soil contamination and water resource contamination (Groundwater and Surface water)
- Increase in volume of contaminated water that needs to be managed within the footprint.
- Increase in waste in the prospecting area (Metal and non-metal).
- Compaction of soil leading to increase in run-off, and decrease in infiltration, impacting groundwater quantity.
- Possible infiltration of water within the sump.

Table 9: Site pictures

Description	Picture
Elevation on site	 *(Source: Picture taken by Singo Consulting (Pty) Ltd*

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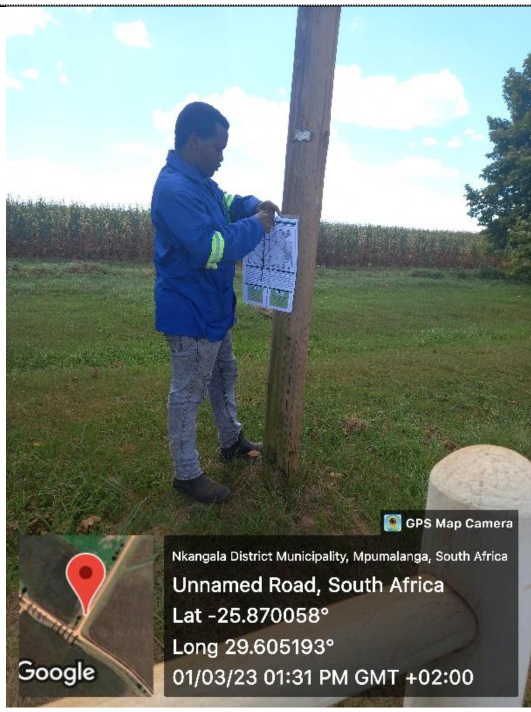
Plugging of Site notices	 *(Source: Picture taken by Singo Cosnulting (Pty) Ltd*

7.2 Management Measures

- All spillages will need to be cleaned up as soon as practically possible.
- All equipment utilizing hydrocarbons will be stored on a hard-standing surface.
- Little to no machinery and vehicle repairs onsite, this could lead to hydrocarbon spills.
- Regular maintenance of the mobile toilets.
- Immediate clearing of the cores to avoid possible leaching.
- Drilled areas will be rehabilitated immediately once done.
- Availability of waste management bins around the prospecting area, for metals and non-metal waste.
- Prohibition signs will be placed at various location around the prospecting area.
- Sumps will not be allowed to overflow.
- Sumps will be lined with impervious layer, to prevent infiltration of wastewater.

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Table 10: Mitigation Measures proposed for the prospecting phase

Description	Proposed Site Mitigations
Absorbent Spill Kits available onsite	➢  *(Source: Absorbent spill kits - Bing images)*
Core logging on an impermeable surface	➢  *(Source: Picture taken by Singo Consulting (Pty) Ltd*
Sump lined with impermeable layer	 ➢ *(Source: Picture taken by Singo Consulting (Pty) Ltd*

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Waste management bins	 (Source: Picture taken by Singo Consulting (Pty) Ltd
Prohibition signs in front of vegetated areas	
Mobile toilets regular maintenance	
Drill rig placed on top of a plastic to prevent hydrocarbon leaks from infiltrating into the soil.	 (Source: Picture taken by Singo Consulting (Pty) Ltd

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7.3 Impact assessment and mitigation measures table

Prospecting right impact assessment Table						
Name of the company: Singo Consulting (pty) Ltd						Sector: Environmental Consulting
Department: Land and water division						
CAUSE/ SOURCE OF THE IMPACT	**RECOMMENDED MEASURES/REMARKS FOR MITIGATION**	**IMPACT RISK BEFORE MITIGATION**	**IMPACT RISK AFTER MITIGATION**	**RESPONSIBLE PERSON(S)**	**WHEN MITIGATION SHOULD BE IMPLEMENTED**	**POTENTIAL IMPACT/ EFFECTS**
Oil, petrol, and diesel due to drill rigs, trucks, and cars.	➢ Diesel, petrol, and oil spill absorbent material available onsite. ➢ No machinery repairs onsite. ➢ Vehicle condition checklist available. ➢ No storage of diesel, oil, and petrol onsite.			➢ The project management team	Before and during the prospecting activities commence.	➢ Respiratory illness. ➢ Risk of cancer in humans. ➢ Reduce photosynthetic ability of plants.
Overflow of waste chamber and leakage of waste with toilet chemicals.	➢ Regular maintenance of the mobile toilets on site to avoid leakage and overflow.			➢ Toilets Hiring Company. ➢ Project management team	Throughout the prospecting phase, from when they start to when they finish.	➢ Biocides used are toxic can cause endocrine disrupting and reproductive effects if ingested.
Clearing of vegetation leading to increased runoff and less infiltration.	➢ Rehabilitate the site by using a hoe to dig the compacted soil, this will allow infiltration.			➢ The project management team	After pegging and drilling	➢ Destroying local ecosystem. ➢ Decrease the availability of water in an area, Groundwater, and surface water.

Vehicles wash wastewater (VWW)	➢ No washing of Machinery or vehicles on site			The project management team	During prospecting period	➢ Harm surface water aquatic ecosystem. ➢ Degrade the quality of surface and groundwater quality. ➢ Muscle cramping or nausea.
Soil compaction during constructing gravel roads to access the site.	➢ Rehabilitate these roads by digging with tractors and ploughing vegetation			The project management team	After the prospecting phase	➢ Destruction of ecosystem. ➢ Increase run-off, decrease groundwater recharge.
Core logging	➢ The core logs of borehole should be cleared immediately after logging.			The project management team	After the prospecting phase	➢ Leaching of core logs into nearby wetlands (Seep and Valley bottom) and compromise water quality.
Disposal of waste such as metals E.g., Iron, around the prospecting area	➢ There will be waste management bins all around the site, to ensure there are no metals on the ground, or any other waste.			The project Management team	Before the prospecting phase commences.	➢ Rust from metals causes tetanus which affects nervous system. ➢ Degrades the quality of groundwater and surface water.

Low impact	**Medium impact**	**High impact**	**Very high impact**

Table 11; Prospecting impacts and mitigation measures

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8 CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion and Summary

Singo Consulting was appointed by Ulibo Resources (Pty) Ltd(pty) Ltd to conduct a basic hydrogeological study in support of a prospecting right application with **DMRE Ref: MP 30/5/1/1/2/17258 PR**. The study area is located on Portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, Situated in the Magisterial District of Middelburg on Mpumalanga Province. The primary concern is associated with hydrocarbon spillage, and reduction of infiltration due to clearing of vegetation in the prospecting area and infiltration of waste wastewater.

The area falls on a minor aquifer, and the surrounding area mostly depends on surface water. The groundwater vulnerability according to the drastic model is classified as Moderate, which implies that the aquifer requires Low level of protection from the surface activity. The outlined groundwater management measures which include the availability of absorbent spill kits, regularly maintained mobile ablutions, and availability of the waste management bins. There will be compliance of the GN704 regulations, National waters Act No. 36 of 1998, NEMA Act 107 of 1998.

8.2. Recommendations

- On site there will be regular maintenance of the mobile toilets.
- Once drilling, the team will rehabilitate the area and ensure the core is out of site.
- Drilling within 100 meters of water resources will be avoided.
- The drilling machine used will be of minimum vibrations to avoid creating fissures in underlying rocks which could influence groundwater migration and leads to water contamination
- Clearing of vast amount of vegetation will be avoided, this is to preserve infiltration.
- Constant availability of waste bins; Compliance of National Environmental Management: Waste Management Act 59 of 2008.
- Compliance of GN 704 4(b) and 7(a) and National Water Act 36 of 1998 (Chapter 3 – Part 4, Section 1 (a)(b).
- No onsite vehicle or machinery repairs such as changing oil.
- No onsite storage of oil, diesel, or petrol.
- Cores will be logged on an impervious surface and will be cleared from the site immediately after logging.
- No washing of vehicles on site.
- The sump will not be allowed to overflow and will be lined with impervious layer.

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APPENDICES

Appendix A: Specialist's qualifications available upon request

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PROSPECTING RIGHT APPLICATION

BASIC HYDROLOGICAL STUDY

Basic Hydrological Study for the proposed Prospecting Right Application on Portion of Portion of the Remaining Extent of the farm Arendsfontein 464 JS, situated in the Magisterial District of Middelburg, Mpumalanga Province.

ULIBO RESOURCES (Pty) Ltd
Reg Nr: 2013/099506/07

REPORT PREPARED BY:

Singo Consulting (Pty) Ltd

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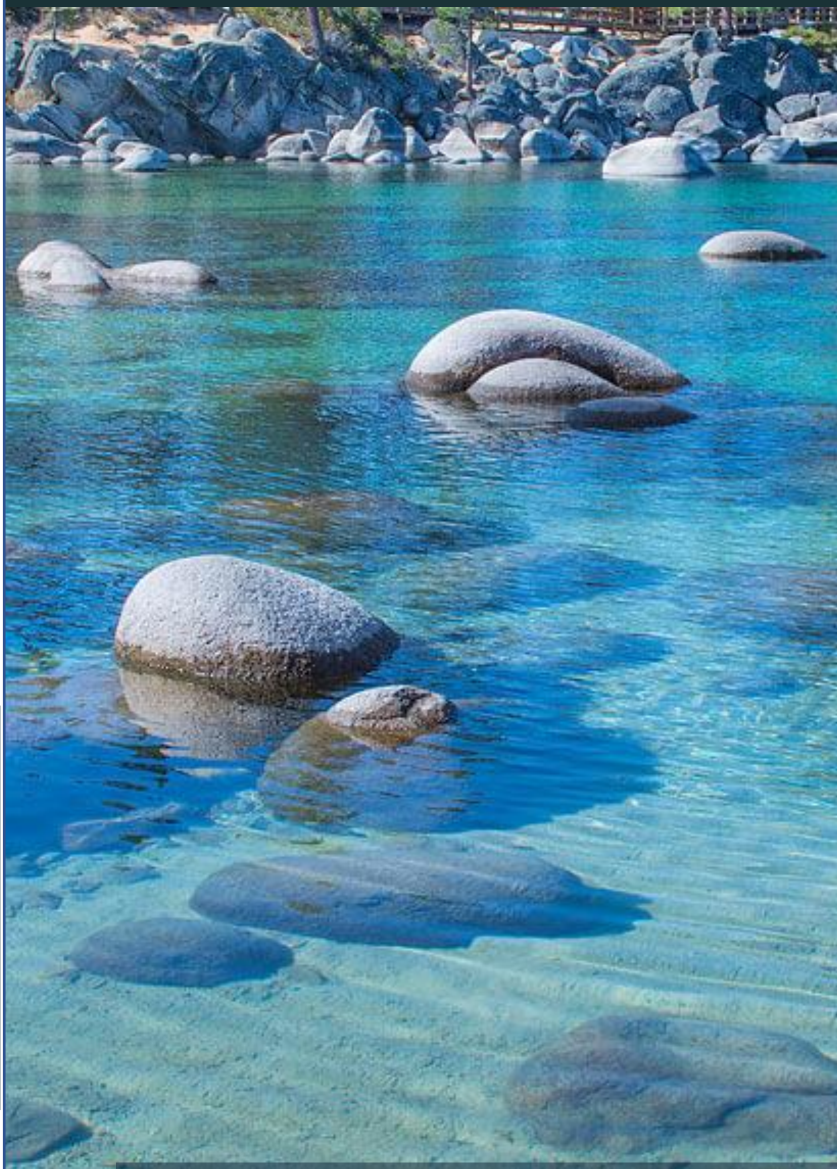

DMRE REF: MP 30/5/1/1/2/ 17258 PR

Report Credentials.

Disclaimer

The opinion expressed in this and associated reports are based on the information provided by Ulibo Resources (Pty) Ltd to Singo Consulting (Pty) Ltd ("Singo Consulting") and is specific to the scope of work agreed with Ulibo Resources (Pty) Ltd. Singo Consulting acts as an advisor to the Ulibo Resources (Pty) Ltd and exercises all reasonable skill and care in the provision of its professional services in a manner consistent with the level of care and expertise exercised by members of the environmental profession. Except where expressly stated, Singo Consulting has not verified the validity, accuracy or comprehensiveness of any information supplied for its reports. Singo Consulting shall not be held liable for any errors or omissions in the information given or any consequential loss resulting from commercial decisions or acts arising from them. Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by Ulibo Resources (Pty) Ltd or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to Singo Consulting is both complete and accurate. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s), unless explicitly stated otherwise. These views do not generally refer to circumstances and features that may occur after the date of this study, which were not previously known to Singo Consulting (Pty) Ltd or had the opportunity to assess.

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Project details

Report type	**Basic Hydrological Study for a prospecting right application**
Project title	Basic Hydrological Study for the proposed prospecting right application on Portion of Portion of the Remaining Extent of the farm Arendsfontein 464 JS, situated in the Magisterial District of Middelburg Mpumalanga Province, South Africa.
Mineral (s)	Coal
Client	Ulibo Resources (Pty) Ltd
Site location	On the Portion of Portion of the Remaining Extent of the farm Arendsfontein 464 JS, situated in the Magisterial District of Middelburg Mpumalanga Province.
Version	1
Date	12 April 2023

		Electronic signatures
Compiled by	Khulekani Zwane (Hydrogeologist) Singo Consulting (Pty) Ltd	
Reviewed by	Mutshidzi Munyai (Hydrogeologist) Singo Consulting (Pty) Ltd (Water Resources Science (South African Council for Natural Scientific Professions) (SACNASP Registration Number 122464)	
Final review and approval	Dr. Kenneth Singo (Principal Consultant of Singo Consulting (Pty) Ltd)	

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Table 1: Critical Report Information

Critical Information incorporated within the Hydrological Study:	Relevant section in report
Details of the specialist who prepared the report	Project details, P: 3
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A, P: 44
Project Background Information, including the proposed activities description	Introduction, P: 9
An indication of the scope of, and the purpose for which, the report was prepared	Scope of work, P: 10-11
An indication of the quality and age of base data used for the specialist report	Project details, P: 3
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Surface water impact assessment, P: 34
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Project details, P: 3
A description of the methodology implemented in preparing the report or carrying out the specialised process comprehensive of equipment and modelling used;	Methodology, P: 34
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	N/A
An identification of any areas to be avoided, including buffers	Buffer zone, P: 24
A map overlaying the proposed activity including the associated infrastructures on the environmental sensitivities of the site including containing buffer zones	Buffer zone, P: 24
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Surface water impact assessment, P: 34
Any mitigation and conditions measures for inclusion in the EMPr	Stormwater management plan, P: 39
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Monitoring plan, P: 41
An analytic opinion as to whether the proposed activity or portions thereof should be Authorised-i.e. specific recommendations	Recommendations, P: 42
Regarding the acceptability of the proposed activity or activities; and	Refer to bar
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Stormwater management plan, P: 39
A description of any consultation process that was undertaken during carrying out the study	Refer to bar
Any triggered Water Uses according to section 21 of the National Water Act 36, 1998.	N/A
Any other information requested by the competent authority.	N/A

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1 INTRODUCTION

1.1 Project Background Information

According to the recent World Health Organization (WHO) report, the countries which still have limited access to water for drinking purposes are mainly those in the Sub-Saharan region (Verlicchi and Grillini, 2020). It is with this knowledge that the protection of surface water sources is ensured. According to WHO (2004), Surface water is any body of water that is above ground which includes but not limited to streams, lakes, dams, and wetlands.

Singo Consulting (Pty) Ltd was appointed by Ulibo Resources (Pty) Ltd as an independent consulting company, to conduct a basic hydrological study. The basic hydrological study is being conducted in support to a prospecting right application for Coal situated on Portion of Portion of the Remaining Extent of the farm Arendsfontein 464 JS, situated in the Magisterial District of Middelburg Mpumalanga Province.

Chapter 3 of the National Water Act (Act 36 of 1998) requires that a person who owns, control, occupies, uses the land is responsible for preventing pollution of water resources and is also responsible to remedy (correct) the effects of the pollution. It is with this Act that the hydrological report was deemed necessary for the site to gather all relevant information related to surface water and its related potential impacts.

The goal of this study:

- To assess the quality condition of surface water within and around the prospecting area, and to draft a water monitoring programme for the project site and provide recommendations.
- Prediction of the environmental impact of the proposed prospecting activity on the hydrological regime of the area.
- Forecasting the effects of the activity on the receiving environment.

1.2 Proposed Activities

Prospecting Right Activities which have the potential to impact the surface water and groundwater in the area includes:

- Core-logging.
- Core-Sampling.

- Mapping.
- Core-Drilling.

Prospecting activities will be undertaken over a period of five (5) years and are designed in phases, each phase is conditional on the success of the previous phase. Both invasive and non-invasive methods will be implemented. Invasive are those activities which have footprint or cause harm (if not mitigated or managed properly) or those that have a physical impact on the environment, while non-invasive do not cause any harm or effects on the environment.

Non-invasive: Desktop study of the area has commenced, and this incorporates desktop geographical and geological mapping. This will be followed by detailed geochemical and geotechnical surveys. In turn, this is followed by detailed geophysical studies.

Invasive: A detailed drilling, sampling, assaying and mineralogical study will be carried out. Diamond method will be utilised to prospect Coal. To ensure or minimise impacts on the receiving environment, All the activities will be guided by the project's BAR & EMPr.

1.3 Scope of Work

- Baseline study
  - A desktop study was conducted to evaluate current and previous land uses to assess the implications for hydrology contaminations.
  - Site visit to correlate the information that was collected during the desk study.
  - Maps from the hydrology study will be used to indicate the catchment areas and any strategic points.
  - The Mean Annual Runoff (MAR), peak flow rates and volumes will be estimated for these catchments using WR2012 data.

- Impacts assessment
  - All surface water impacts will be described, and mitigation measures will then be proposed as normally required for the Environmental Impact Assessment/Environmental Management Plan (EIA/EMP), for the construction, operation, decommissioning, and post closure phases.

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1.4 Project Location

The locality map created by the QGIS illustrates a detailed and comprehensive information regarding the surrounding settlements and infrastructure. The project area is situated on Portion of Portion of the Remaining Extent of the farm Arendsfontein 464 JS, situated in the Magisterial District of Middelburg Mpumalanga Province. It is situated approximately 16 km South-east of the center of Middelburg town and approximately 33 km East of the center of eMalahleni town.

As seen on Figure 1 below.

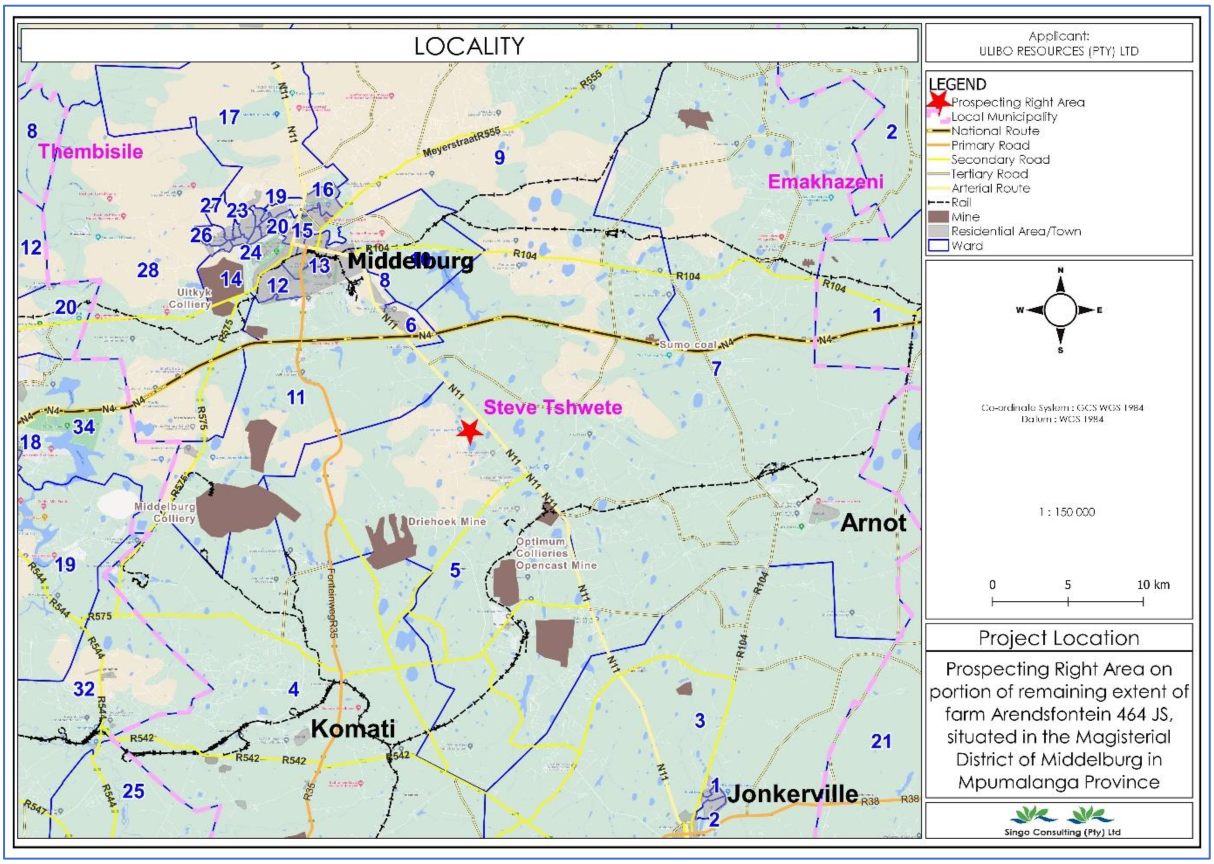

Figure 1: Locality map of the study area

2 RELEVANT LEGISLATION AND STANDARDS

Government Notice 704 (Government Gazette 20118 of June 1999) (hereafter referred to as GN 704), was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources.

- **Condition 5** - which indicates that no residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any prospecting work.
- **Condition 7** - which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution will be prevented from entering a water resource (by spillage, seepage, erosion etc) and ensure that water used in any process is recycled as far as practicable.

2.1 Legal Framework

DWA's vision for water quality management in South Africa is to:

- Ensure the continuous improvement of Water Quality Management.
- Become a recognized world leader in Water Quality Management.
- Be proactive, dynamic, efficient, and effective in its delivery of services to the public.
- Provide the necessary policies and systems to ensure integrated sustainable management of water quality.
- Promote cooperative governance across all spheres of management and
- Ensure a fully capacitated, loyal workforce to support its functions.

2.2 National Legislation

National legislation applicable to surface water management includes:

- Constitution of the Republic of South Africa, 1996 (No. 108 of 1996) – The Bill of Rights states that everyone has the right to an environment that is not harmful to their health or well-being.
- National Water Act, 1998 (Act 36 of 1998) – Provides for the protection of the quality of water and water resources in South Africa and provides for the establishment of Water Management.

2.3 National Policy/Guidelines

National policy and guidelines applicable to surface water management includes:

- South African Water Quality Guidelines, First Edition, 1996 – These guidelines set out the minimum water quality requirements for a range of water quality parameters for each water user.

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- Development of a Waste Discharge Charge System: Framework Document. Second Edition, 2000 – Provides a framework for the implementation of a system to charge for water use such as the discharge of waste that impacts on water resources.
- Best Practice Guidelines for the mining sector, DWAF 2006, 2008 dealing with aspects of DWA's water management hierarchy and deals with integrated mine water management, pollution prevention and minimisation of impacts, water reuse and reclamation and water treatment.
- Best Practice Guidelines for the mining sector, DWAF 2006, 2008 dealing with general water management strategies, techniques and tools which could be applied cross – sectorial and deals with storm water management, water and salt balances, water monitoring systems, impact prediction.
- Best Practice Guidelines for the mining sector, DWAF 2006-2008 dealing with specific mining activities and addresses the prevention and management of impacts from small scale mining, water management for Mine Residue Deposits, pollution control dams, water management for surface mines, and water management for underground mines.

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3 HYDROLOGICAL SETTING AND BASELINE HYDROLOGY

3.1 Climate

Climate, amongst other factors, influences soil-water processes and water availability in open to air systems in a water balance. The most influential climatic parameter is rainfall and evaporation. Rainfall intensity, duration, evaporative demand, and runoff were considered in this study to indicate rainfall partitioning within the project area.

In Middelburg, the monthly distribution of average daily maximum temperatures (Figure 2) shows that the average midday temperatures range from 19°C in June to 32°C in January. The region is the coldest during June and July when the mercury drops to -1°C on average during the night. The area receives approximate an average 52mm of rain per year, with most rainfall only occurring during summer months.

Figure 3 shows the average rainfall values for the general area per month. This area receives its lowest rainfall during July (2mm) and the most rainfall during December (109mm). The Köppen Climate Classification suggests that the site is situated in a subtropical highland climate with dry winter that receives rainfall in the summer months (Kottek, et al., 2006).

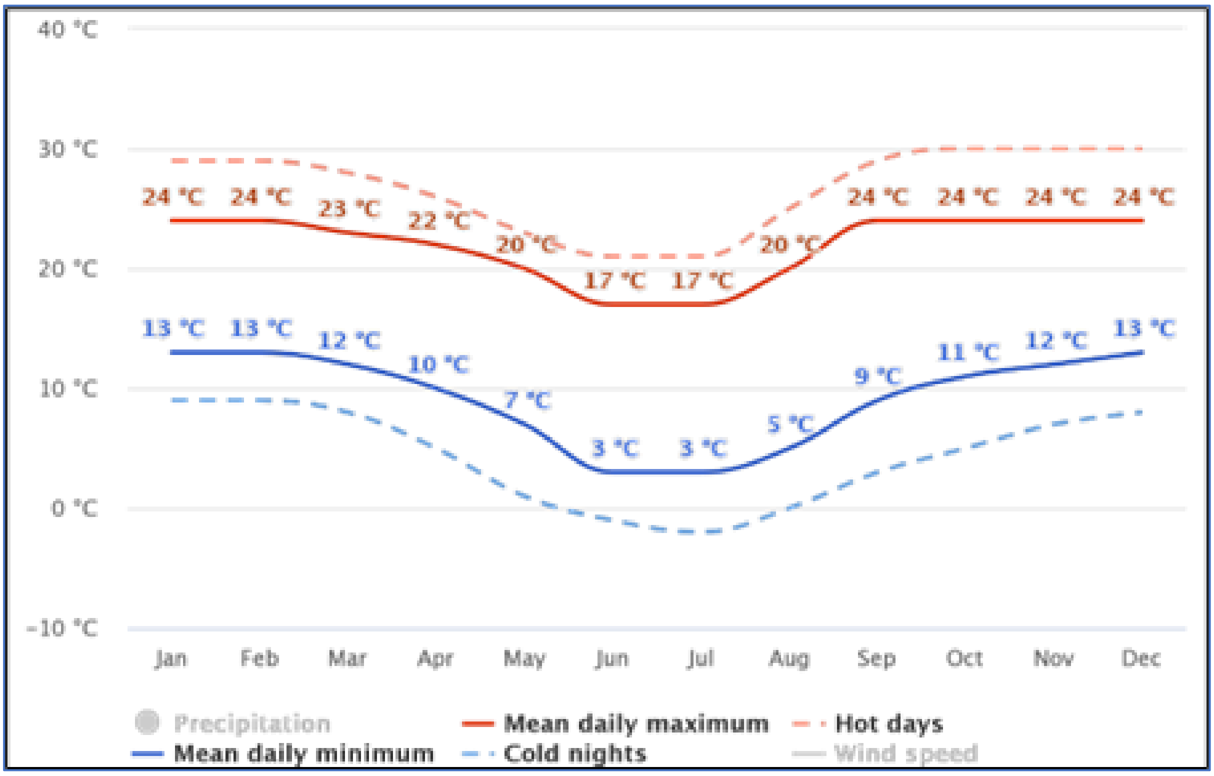

Figure 2: Average monthly temperature map

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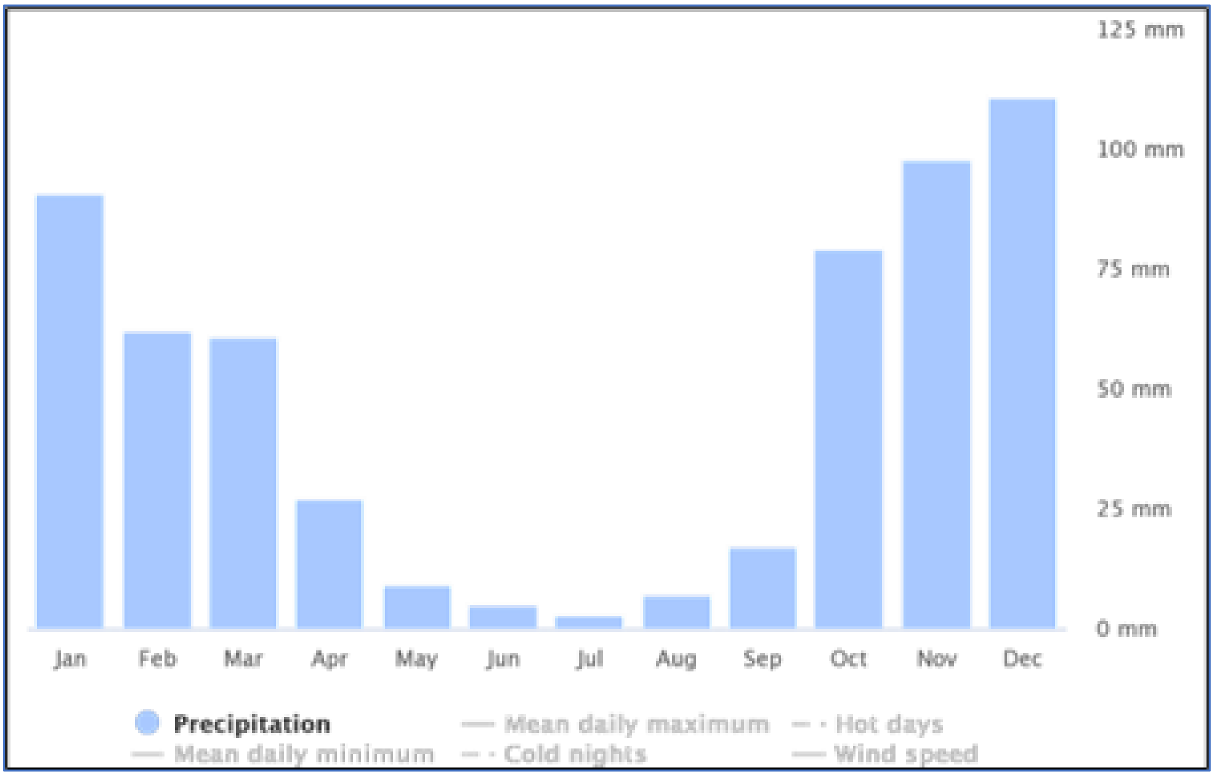

Figure 3: Average monthly rainfall map

3.2 Drainage and Topography

Topography is a field of geoscience and planetary science and is concerned with local detail in general, including not only relief but also natural and artificial features, and even local history and culture. The flow of water during rainy seasons flows from the area of high elevation to the area of low elevation. The topography of the proposed prospecting area has approximately an elevation varying from 1600 mamsl to 1618 mamsl with an overall estimated slope of 2.1%. The Figure 4 below indicates that the following waterbodies exists within and nearby the prospecting right area:

- Dam.
- Non-perennial river.
- Depression.
- Channelled valley bottom wetland.
- Seep wetland.

The site is located on a B12C quaternary catchment, B12A forms part of the Upper Olifants Sub-Water Management Area, which is part of the Olifants Water Management Area. The site lies in the Upper Olifants sub-catchment which forms part of the Olifants River Catchment.

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Locally drainage is towards the Klein-Olifants tributary, it flows towards northern-east direction which then drains to Klein-Olifants River. The Klein-Olifants River is a tributary of the Main Olifant River. The Klein-Olifants River system feeds into the Middelburg Dam. Sustained flow of high-quality water to this dam is important. On larger scale, drainage occurs towards the generalised flow of the Olifants River of B1 Tertiary catchment.

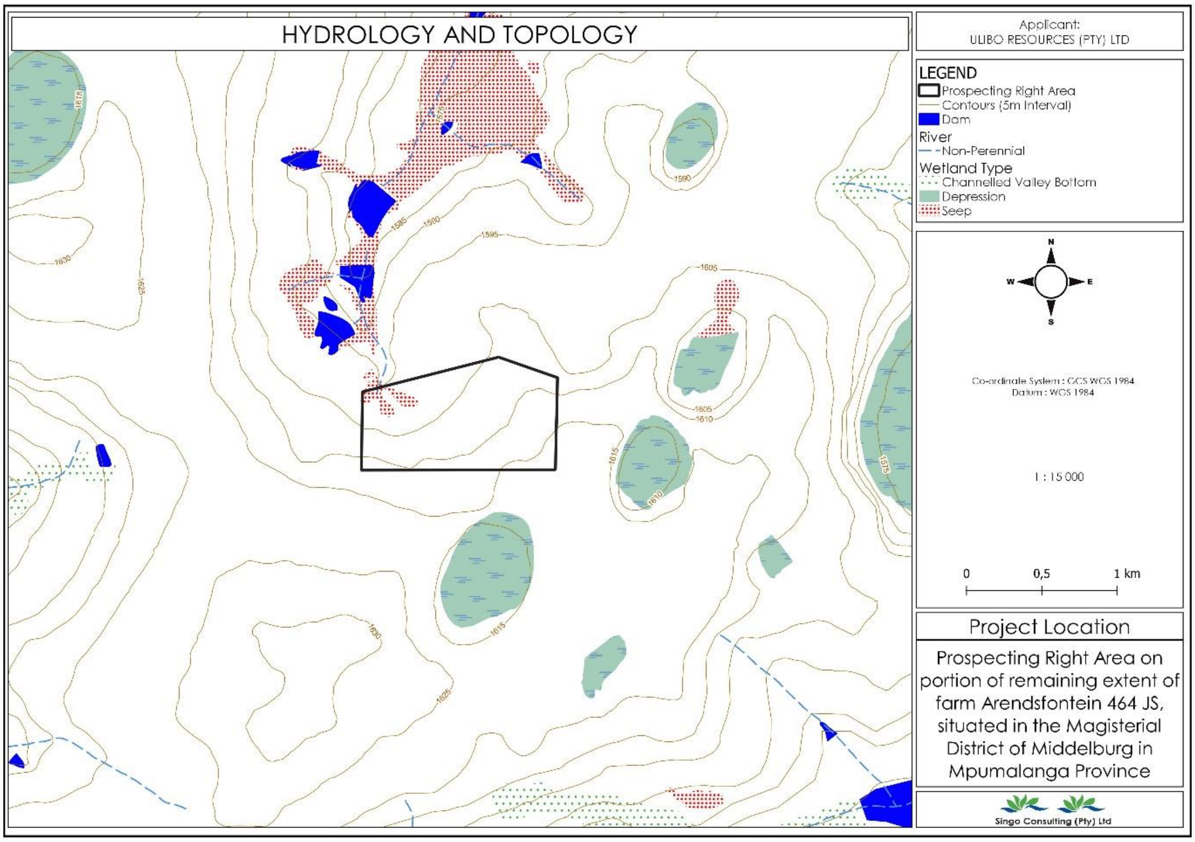

Figure 4: Hydrology and Topology map

3.3 Catchment Description

South Africa's water resources are divided into quaternary catchments, which are the country's primary water management units (DWAF 2011). In a hierarchical classification system, a quaternary catchment is a fourth order catchment below the primary catchments. The primary drainages are further classified as Water Management Areas (WMA) and Catchment Management Agencies (CMA). In accordance with Section 5 subsection 5(1) of the National Water Act, 1998, the Department of Water and Sanitation (DWS) has established nine WMAs and nine CMAs as outlined in the National Water Resource Strategy 2 (2013). (Act No. 36 of 1998). The purpose of establishing these WMAs and CMAs is to improve water governance in various regions of the country, ensuring a fair and equal distribution of the Nation's water resources while ensuring resource quality is maintained.

The prospecting area falls within the Inkomati-Usuthu Water Management Area (WMA). The quaternary catchment is B12C. The WRC 2012 study, presents hydrological parameters for each quaternary catchment including area and mean annual precipitation (MAP).

Table 2: Quaternary Information data

Quaternary Catchment	Water Management Area	S-Pan Evaporation		Rainfall		Catchment Area
		Evaporation Zone	MAE (mm)	Rainfall Zone	MAP (mm)	
B12C	Olifants water management	4A	1550	B1B	707	529

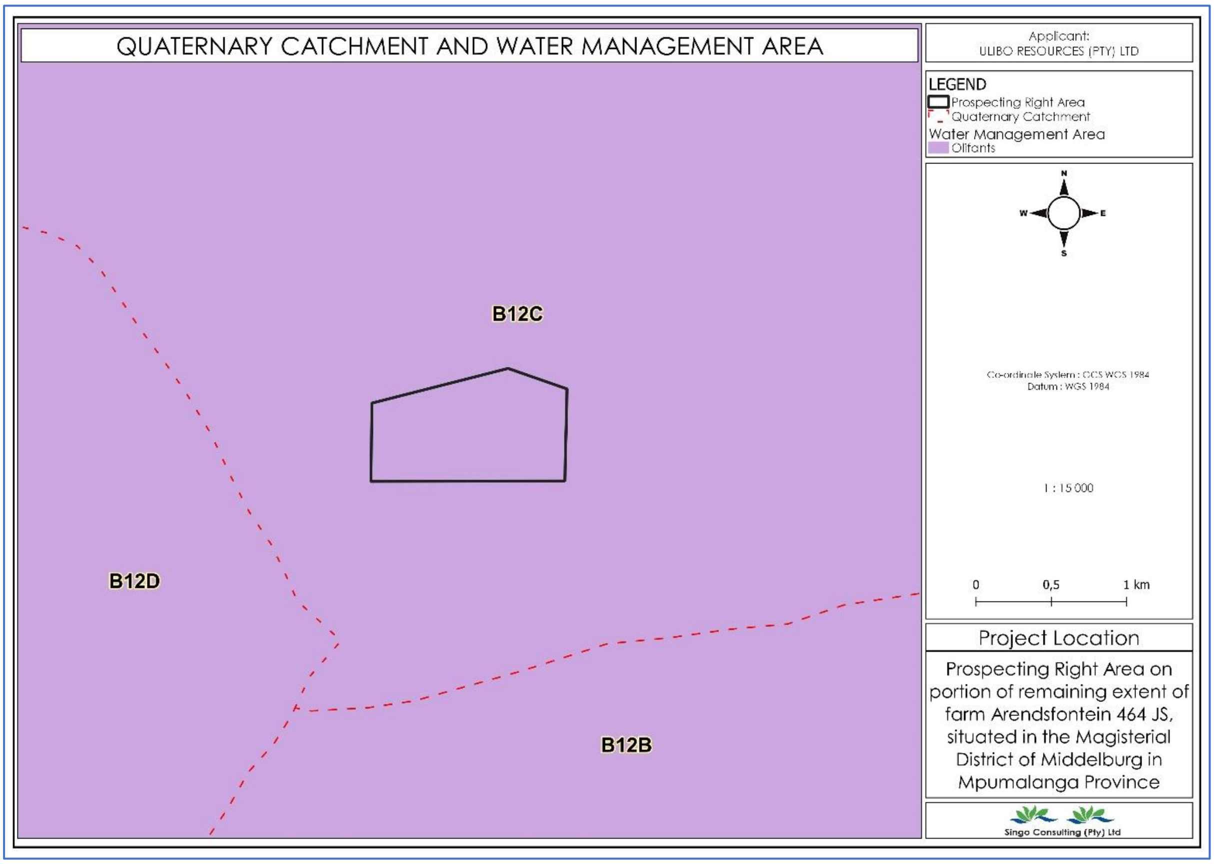

Figure 5: Quaternary Catchment and Water Management Area Map

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3.4 Wetlands Delineation

According to National water Act 36 of 1998, a wetland is defined as Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil. Wetland delineation is the process of identifying outer edge of the temporary zone of the wetland.

Whilst the identification of a wetland is useful, normally the requirement (specifically for EIA and WULA applications) is for the wetland to be delineated – for its boundaries to be precisely determined so that it can be mapped out and indicated as a sensitive area. This edge marks the boundary between the wetland (water resource) and the adjacent terrestrial areas. This process is aided by using the various indicators which are used to identify a wetland, the indicators are as follows:

- The **position in the landscape**, which will help identify those parts of the landscape where wetlands are more likely to occur.
- The **type of soil form** (i.e., the type of soil according to a standard soil classification system), since wetlands are associated with certain soil types.
- The presence of wetland **vegetation species.**
- The presence of **redoxymorphic soil features,** which are morphological signatures that appear in soils with prolonged periods of saturation (due to the anaerobic conditions which result).

To this study, redoxymorphic indicator will be used to delineate a wetland, this is because it is the most reliable, diagnostic indicator of wetland. These features develop due to prolonged saturation (and associated anaerobic conditions) and can be used to indicate zones of a permanently, seasonally, or temporarily high-water table, as described in the characteristics of the permanent, seasonal, and temporary wetland zones in the national water Act 36 of 1998.

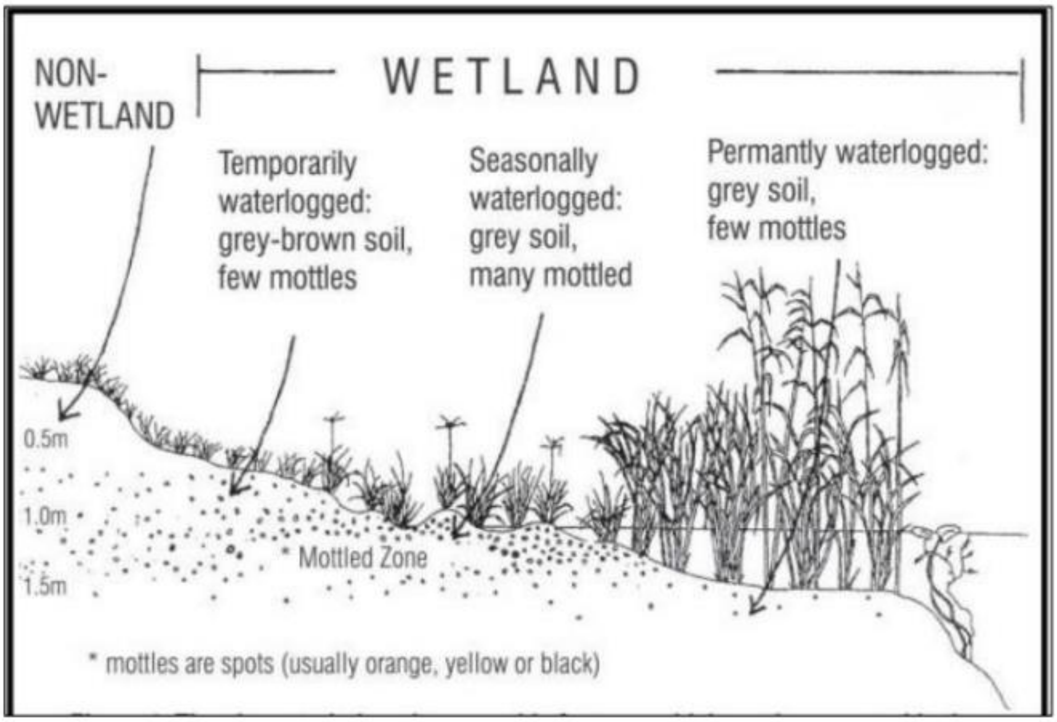

Figure 6: The characteristics of redoxymorphic indicator (DWAF, 2008)

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<u>Redoxymorphic features as an indicator of a wetland presence.</u>

Water is the most important criterion for defining land as a wetland, with "the water table at or near the surface, or the ground is occasionally covered with shallow water" being the most important. Unfortunately, due to southern Africa's very fluctuating climate, the water table may not always remain at or near the surface in a consistent, predictable manner year after year, or even seasonally predictable. The existence of the water table (or the extent of flooding) will not always be a highly useful criteria for detecting wetlands due to intra- and inter-annual fluctuations in the extent of saturation/inundation of wetlands. As a result, the fundamental wetlands classification criterion – a high water table and/or frequent flooding – cannot be accurately measured.

Roots and microorganisms eventually deplete the oxygen contained in pore spaces in soil that has been saturated for an extended period. The oxygen consumed in this fashion would be replaced by diffusion from the air at the soil surface in an unsaturated soil. However, because oxygen diffuses 10 000 times slower via water than it does through air, restoring depleted soil oxygen in a saturated soil takes much longer. As a result, once the oxygen in a saturated soil is gone, the soil becomes practically anaerobic. Long-term anaerobic soil conditions cause changes in the chemical properties of the soil's mineral constituents, which are visible as colour changes in the soil. As a result, even a high-water table. Although the frequency of flooding cannot be directly assessed, it is possible to analyse soil parameters for signs of saturation by looking for redoxymorphic traits that come from prolonged anaerobic conditions. The two important redoxymorphic features are mottling and gleying Figure 9; both features caused by prolonged saturated conditions in the soil and the subsequent development of anaerobic conditions.

Gleying: is characterised by the development of grey or blueish-grey colours in the mineral soil component. Certain soil components, such as iron and manganese, are insoluble under aerobic conditions. Iron is one of the most abundant elements in soils, and the iron oxide (rust) coatings over soil particles is responsible for the red and brown colours of many soils. However, under prolonged anaerobic conditions iron becomes soluble and can thus be dissolved out of the soil profile. Once most of the iron has been dissolved out of a soil, the soil matrix is left a greyish, greenish, or bluish colour, and is said to be Gleyed.

Mottling: follows the same initial process as gleying, in that the iron becomes soluble and dissolved under anaerobic conditions. A fluctuating water table, common in wetlands that are seasonally or temporarily saturated, results in alternation between aerobic and anaerobic

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conditions in the soil. Lowering of the water table results in a switch from anaerobic to aerobic soil conditions, causing dissolved iron to return to an insoluble state and be deposited in the form of patches, or mottles, in the soil. Recurrence of this cycle of wetting and drying over many decades concentrates these bright (orange or red) insoluble iron compounds. Thus, soil that is Gleyed but has many mottles may be interpreted as indicating a zone that is seasonally or temporarily saturated.

Table 3: Greying and Mottling

Red colour spots indicate mottles on the soil	
Greying	

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Using redoxymorphic features to identify a wetland.

The outer edge of the temporary zone of the wetland should be determined. This should be done using a transect-based approach in the field. Starting from the wettest (central or lowest lying) part of the wetland, move perpendicularly upslope towards the surrounding terrestrial areas, sampling (with the aid of an auger or through other excavation means) the soil to a depth of at least 50cm. Note the presence of any gleying or mottling (Rountree et al., 2008). Ensure that the indicators observed meet the requirements prescribed for the redoxymorphic indicators of wetland soils. Continue moving outwards from the wetland until the redoxymorphic indicators of wetland soils can no longer be found within the top 50cm of the soil. This will be the outer edge of the temporary wetland zone. At this stage the boundary indicated by redoxymorphic features should be verified using the vegetation indicators.

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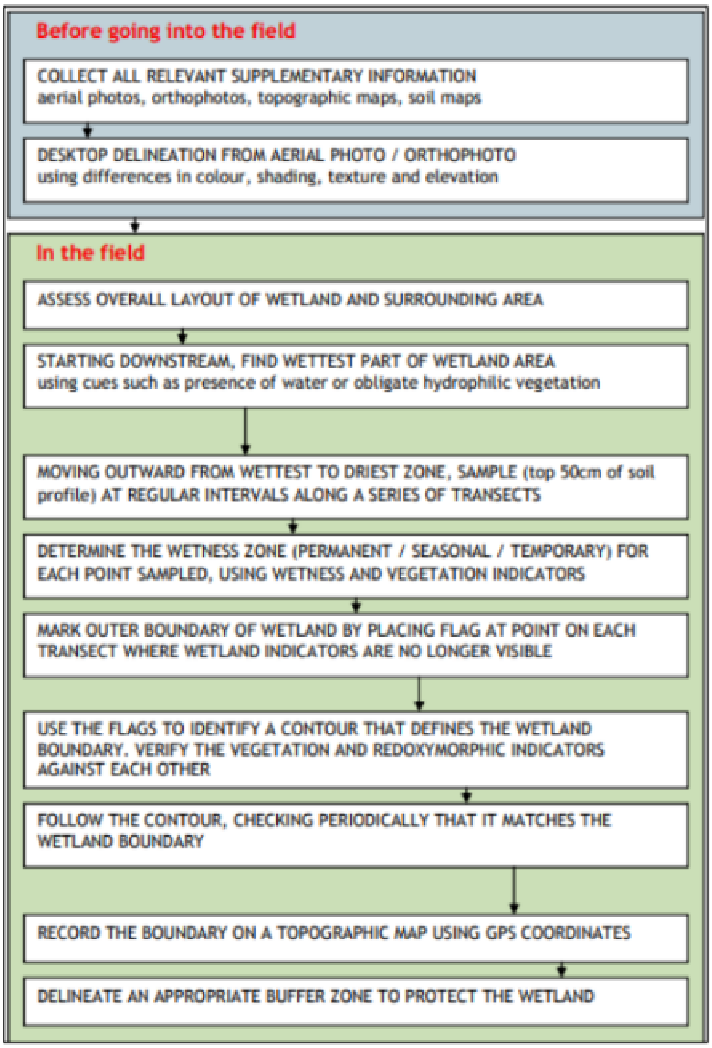

Figure 7: Wetland delineation process (DWAF, 2008)

3.5 Buffer Zones

During the prospecting right activities which will include, logging, sampling, mapping, and drilling. Caution must be taken with regards to the water bodies existing within and surrounding the proposed project area. This includes the implementation of buffer zones. Buffer zones as depicted by the map will be the areas where the prospecting team will be notified not to conduct any activities within the depicted 100m radius from the water bodies. No washing of any mechanical equipment's or vehicles will be allowed near the water resources, and all the water bodies will be buffered, a 100m buffer will apply.

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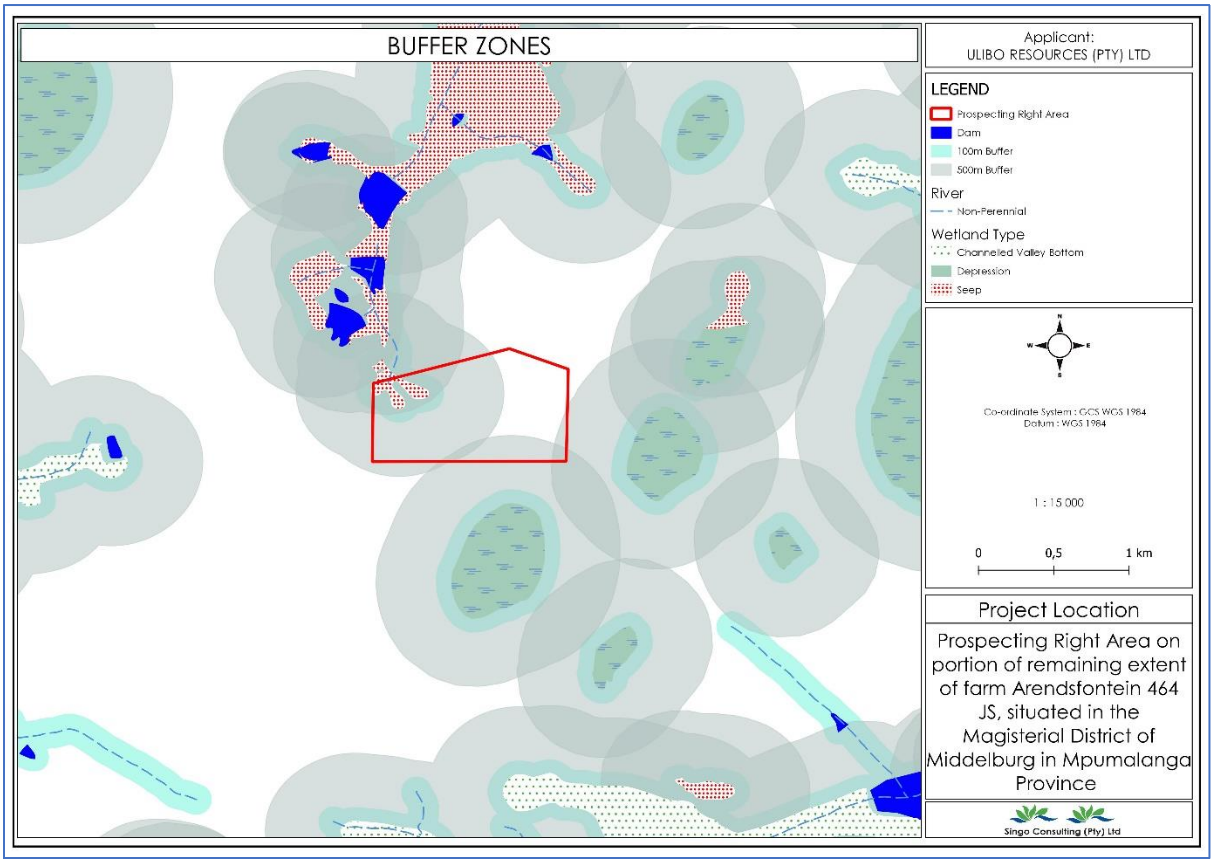

Figure 8: Buffer zone map of the study area

3.6 Soil

The prospecting right area is covered by Freely drained structureless soils.

Soil drainage

The Freely drained, structureless soils can be defined based on their soil depth, Soil Drainage, erodibility, and natural fertility.

Soil depth

Depth of the soil profile is from the top to the parent material or bedrock. This type of soil can be classified as a restricted soil depth. A restricted soil depth is a nearly continuous layer that has one or more physical, chemical, or thermal properties.

Soil Drainage

Soil drainage is a natural process by which water moves across, through, and out of the soil because of the force of gravity. The soils in the proposed area have an excessive drainage due to the soils having very coarse texture. Their typical water table is less than 150.

Erodibility

Erodibility is the inherent yielding or non-resistance of soils and rocks to erosion. The freely drained structureless soils have high erodibility. A high erodibility implies that the same amount of work exerted by the erosion processes lead to a larger removal of material.

Natural Fertility

Soil fertility refers to the ability of soil to sustain agricultural plant growth, i.e., to provide plant habitat and result in sustained and consistent yields of high quality. The soil, as a nature of them, contains some nutrients which is known as 'inherent fertility'. Among the plant nutrients, nitrogen, phosphorus, and potassium is essential for the normal growth and yield of crop. The proposed area has a low natural fertility soil.

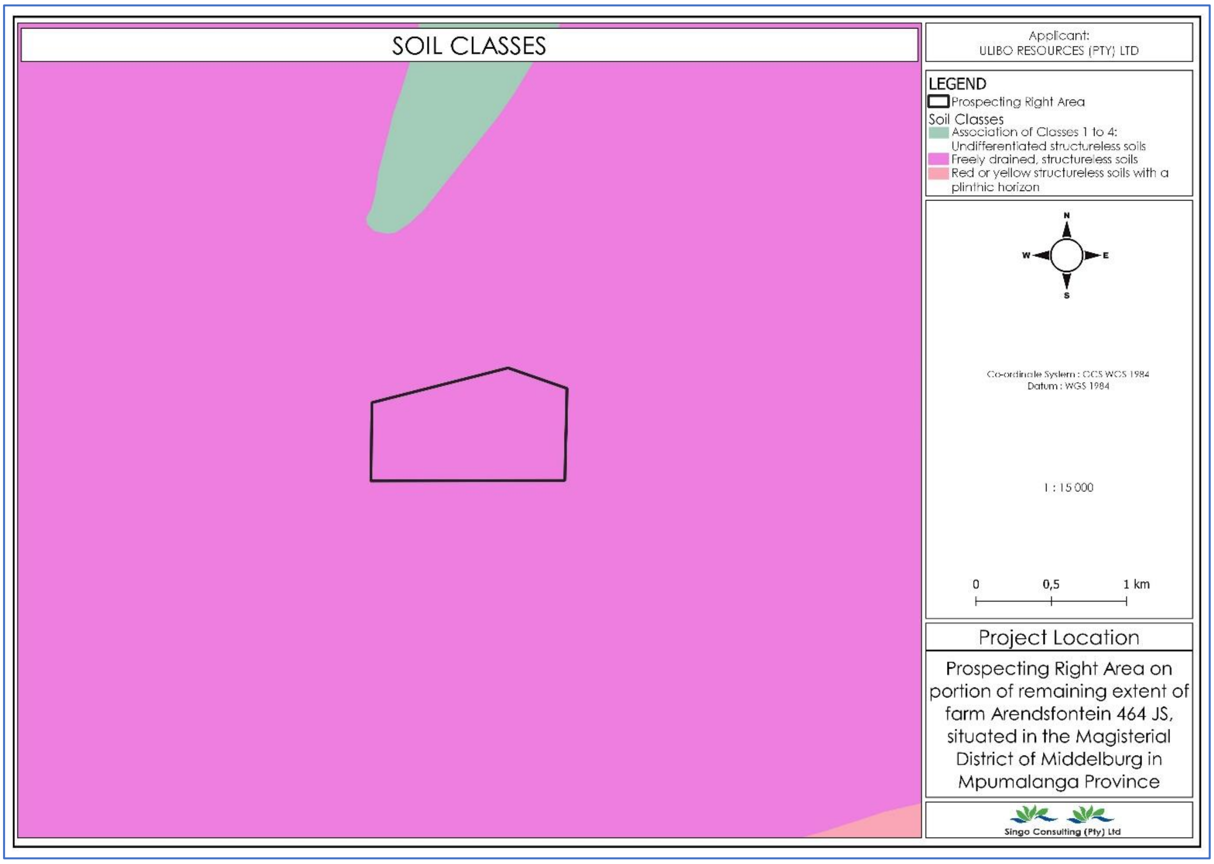

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Figure 9: Soil class map

3.7 Geological setting

Regional Geology

Karoo Supergroup

The main Karoo Supergroup basin covers over 50% of South Africa's surface and consists of five age-based groups, which show a change of depositional environment in time. These groups are the Dwyka (glacial), Ecca (shallow marine and coastal plain), Beaufort (non-marine fluvial), Stormberg (aeolian) and the volcanic Lebombo or Drakensberg groups (Johnson et al., 2006). The proposed project area falls within the Ermelo Coalfield which hosts thinner seams that are more sedimentological and structurally complex. Sediments of Vryheid and Dwyka formations underlay the area which was deposited on a glaciated Pre-Karoo basement consisting of Rooiberg felsites. The deposit is preserved as an outlier underlying the small hill known as Vlooikop, surrounded by strata of the Dwyka Group (mainly tillites and varved mudstones/shales).

The Vryheid formation is essentially an interbedded succession of sandstone with lesser gritstone, siltstone, and mudstone, which contains five coal seams of the Ermelo coalfield, as shown in Figure 12 below.

Dwyka Group

The rocks of the Dwyka Group in South Africa are amongst the most important glaciogenic deposits from Gondwana. This Group is named for exposures along the Dwyka River east of Laingsburg and forms the basal succession of the Karoo Supergroup. Dwyka Group strata are mostly contained within bedrock valleys incised into Archean to lower Palaeozoic bedrock (Visser, 1990; Visser and Kingsley, 1982; Von Brunn, 1996). The lithologies in the areas underlying the coalfields of South Africa consist of a heterolithic arrangement of massive and stratified polymictic diamictites, conglomerates, sandstones, and dropstone-bearing varved mudstones. The easily identifiable lithologies form a good marker below the coal bearing Ecca Group. In the distal sector of the MKB these sedimentary strata accumulated largely as ground moraine associated with continental ice sheets and is generally composed of basal lodgement and supraglacial tills. These deposits are generally massive, but crude horizontal bedding occurs in places towards the top (Tankard et al., 1982).

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Ecca Group

In the 1970s several studies (Cadle, 1974; Hobday, 1973, 1978; Mathew, 1974; Van Vuuren and Cole, 1979) showed that the Ecca Group could be subdivided into several informal units based on the cyclic nature of the sedimentary fills. In 1980 the South African Committee for Stratigraphy (SACS, 1980) introduced a formal lithostratigraphic nomenclature for the Ecca Group in the northern, distal sector of the MKB, which replaced the previously used informal Lower, Middle and Upper subdivisions with the Pietermaritzburg Shale Formation, the Vryheid Formation, and the Volksrust Shale Formation.

In general, the coal deposits in South Africa are hosted in the Karoo Supergroup, which was deposited in the Gondwana basin that covered parts of Africa, Antarctica, South America, and Australia. The basal stratigraphy of the Karoo Supergroup comprises the Dwyka Group, which is a Late Carboniferous to Early Permian (~320 Ma) sequence of glacial and periglacial sediments, including diamictite, till moraine, conglomerate, sandstone, mudstone and varved shale. This is overlain by the Ecca Group, which is an Early to Late Permian (~260 Ma) sequence comprising sandstone, siltstone, mudstone and significant coal seams deposited in a terrestrial basin on a gently subsiding shelf platform.

In South Africa, based on the literature; only 19 coalfields are generally accepted which cover an area of approximately 9.7 million hectares (ha). The distinction between coalfields is based on geographic considerations and variations in the mode of sedimentation, origin, formation, distribution, and quality of the coals. (Hancox & Annette, 2014).

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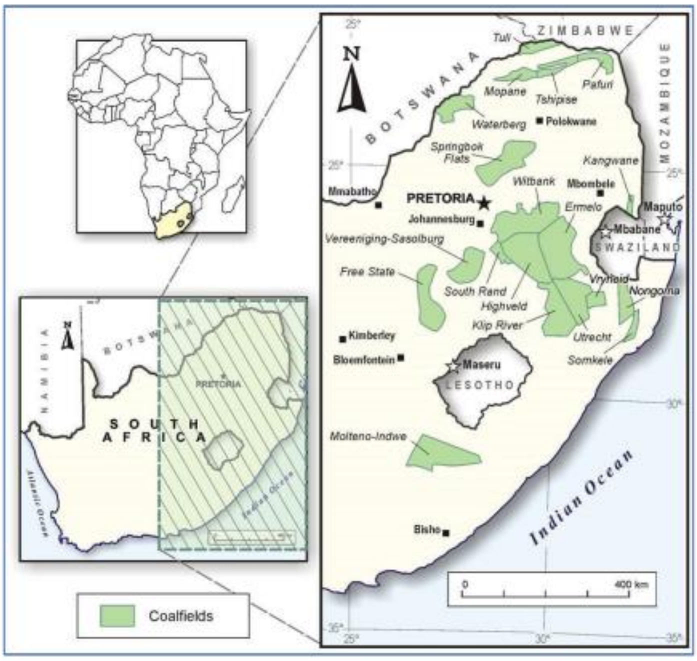

Figure 10: South Africa's Coalfields, Snyman (1998).

Ermelo Coalfield

The Ermelo Coalfield is located in the districts of Carolina, Dirkiesdorp, Hendrina, Breyten, Davel, Ermelo and Morgenzon in the southeast Mpumalanga Province. It extends approximately 75 km east-west, and 150 km north-south, covering an area of about 11,250,000 ha. The northern and eastern boundaries of the Ermelo Coalfield are defined by the sub-outcrop of the coal-bearing strata against pre-Karoo basement. In the west, the Ermelo Coalfield shares a boundary with the Witbank and Highveld coalfields, and to the south with the Klip River and Utrecht coalfields of KZN (Greenshields, 1986).

Rocks of the Permian Vryheid Formation and Jurassic aged dolerites dominate the surface exposures of the coalfield. As in the Witbank and Highveld coalfields the Vryheid Formation is the coal bearing horizon in the Ermelo Coalfield and five coal seams are also recognised within an 80-90 m thick sedimentary succession. Unlike in the Witbank and Highveld coalfields, the seams are given letters as codes and are named from the top to bottom the A to E seams (Wyburgh, 1928).

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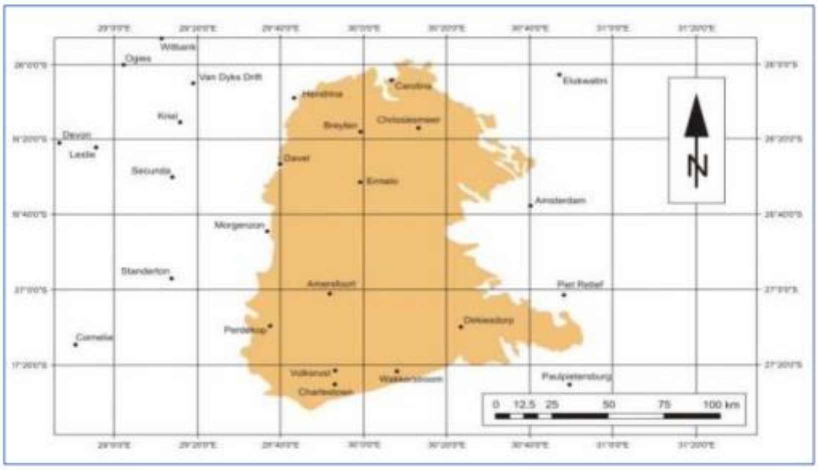

Figure 11: Geological extent of the Ermelo Coalfield

The coal seams in the Ermelo Coalfield are generally flat-lying to slightly undulating and as for the Witbank and Highveld coalfields, are separated by fine- to coarse-grained sandstones, siltstones and mudstones. The A, D and E seams are usually too important in the Carolina–Breyton area, and the B Seam group in the Ermelo area. Rapid seam thickness variations characterise the coalfield.

The E Seam may reach a thickness of up to 3m but is of economic importance only in isolated patches in the north of the Ermelo Coalfield (Greenshields, 1986). The coal is mostly bright and banded, has a competent sandstone roof and floor and is sometimes split by a thin sandstone or carbonaceous fines parting (Greenshields, 1986). In the central and southern part of the coalfield, it is developed as a torbanite or as a carbonaceous siltstone or mudstone unit, and locally becomes too thin for mining (Greenshields, 1986).

The coal of the D Seam is of good quality, but in general is too thin (0.1–0.4 m) to be of economic importance (Greenshields, 1986). The coal is not split by partings and consists of large amounts of vitrain and occasional durain bands (Greenshields, 1986; Jeffrey, 2005a). The C Seam group has been one of the main seam packages of economic importance throughout the Ermelo Coalfield. It is usually split by several partings which can lead to miscorrelation of the seams (Greenshields, 1986). In general, the C Seam is subdivided into the C Upper (CU) and C Lower (CL) seams. The CU Seam is well-developed over the entire coalfield and is often split by partings of different lithologies, such as sandstone, siltstone or mudstone, reaching a composite thickness of 0.7–4 m. It has historically been mined in several

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collieries of the Ermelo Coalfield, including the Golfview, Usutu, Goedehoop, Union, and Kobar collieries (Greenshields, 1986), as well as more recently at the Ferreira opencast mine.

The CL Seam is not developed throughout the entire coalfield, but where developed is between 0.5 and 2 m thick. It locally grades into carbonaceous siltstone and mudstone, which often form the roof of the seam, whereas the floor mostly consists of sandstone. It has historically been mined at the Savmore, Anthra, Ermelo, Golfview, and Wesselton mines (Greenshields, 1986; Paulson and Stone, 2002). Several other mines in and around the towns of Ermelo and Breyten have at times extracted coal from this seam including the Spitzkop, Bellevue, Grenfell, Usutu, Consolidated Marsfield, and Union collieries. The CL was also the main target seam at CCL's Ferreira opencast mine, and it is also currently being mined underground at their Penumbra mine, where it occurs at an average depth of around 100 m. It is the thickest of all the coal seams intersected here, reaching a thickness of more than 1.5 m over large parts of the project area. Locally seam floor rolls may negatively influence the thickness of the CL Seam in the Ermelo Coalfield.

The B Seam group varies in thickness from 1 to 2.7 m and may be split into three units. Greenshields (1986) terms these the B1, B and BX seams, but they are more commonly referred to as the B Lower.

Marsfield collieries, and was the seam mined at CoAL's Mooiplaats Colliery, where it is between 0.6 and 2.87 m thick. The BU was mined at the end of the mine life at the old Usutu Colliery, and the BL at the Ferreira mine. At Mooiplaats the BU Seam occurs at depths of between 90 and 140m and ranges in thickness between 0.15 m in the southeast to over 3 m in the north.

The A Seam occurs only in the northern and central parts of the coalfield, where it varies in thickness from 0 to 1.5 m (Greenshields, 1986). Wakerman (2003) provides a weighted average thickness of 0.94 m for the seam thin to be of economic interest and historically the C Seam group was the most in the Sheepmoor exploration area. Over most of the Ermelo Coalfield however this seam has been removed by erosion. Like in the Witbank and Highveld coalfields for the No. 5 Seam, the A Seam is overlain by a green glauconitic sandstone that forms a useful


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marker horizon and denotes the transition from a fluvio-deltaic to a marine depositional environment.

Dykes are common throughout the coalfield and the frequency of sills increases southwards. Dolerite sills displace the coal seams causing structural complications and also cause devolatilization of the coal (destruction of quality).

The coal of the Ermelo Coalfield, while variable in quality, is generally bituminous with the following airdried raw quality parameters of; calorific value 24MJ/kg, 23% ash, volatiles 26 %, inherent moisture 3 %, fixed carbon of 48% and 1.2 sulphur. Table 1 summarises the average thickness and quality of the various coal seams within certain areas of the Ermelo Coalfield.

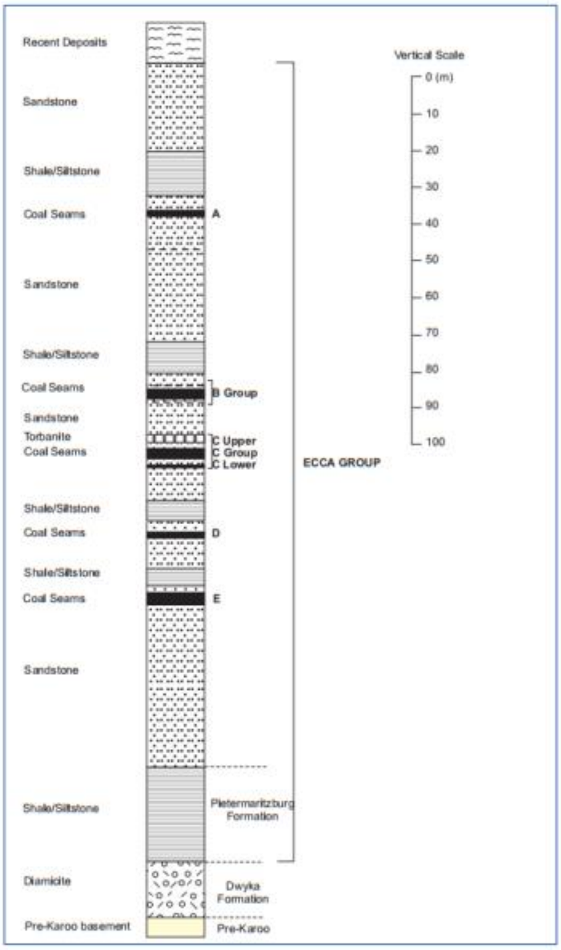

Figure 12: A typical representation of coal seams in the Ermelo Coalfield.

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Local Geology

The geological formations in the project area includes Vryheid formation, Volksrust Formation and the Karoo Dolerite Suite.

Vryheid formation

This formation has been subdivided into three different lithofacies arrangements. They are dominated by fine-grained mudstone, carbonaceous shale with alternating layers of bituminous coal seams, and coarse-grained, bioturbated immature sandstones respectively. The rock sediments are predominantly arranged in upward-coarsening cycles, although some fining-upward cycles are found in this formation's easternmost deposits. The alternating rock types observed in the Vryheid Formation indicate seasonal variations of storms and fairer weather in a pro-delta setting. The carbonaceous shales were formed below the water surface in anoxic conditions and the coal formed from compacted plant matter deposited at the bottom of peat swamps. These swamps formed on abandoned alluvial plains where stagnant water accumulated. The Vryheid Formation reaches a maximum of 1030m in Nongoma, KwaZulu-Natal, within the Nongoma Graben.

The majority of the economically extracted coal in South Africa occurs in rocks of the Vryheid Formation, which ranges in thickness in the MKB from less than 70.0 m to over 500.0 m. It is thickest to the south of the towns of Newcastle and Vryheid, where maximum subsidence took place (Du Toit, 1918; Cadle, 1975; Whateley, 1980a; Stavrakis, 1989; Cadle et al., 1982) and where the basin was the deepest. The coal seams in the Ermelo Coalfield are generally flat-lying to slightly undulating and as for the Witbank and Highveld coalfields, are separated by fine- to coarse-grained sandstones, siltstones, and mudstones. The A, D and E seams are usually too thin to be of economic interest and historically the C Seam group was the most important in the Carolina–Breyton area, and the B Seam group in the Ermelo area. Coal qualities. The

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coal of the Ermelo Coalfield, whilst variable in quality, is generally of better quality than that of the Witbank and Highveld coalfields (Hancox and Gotz, 2014).

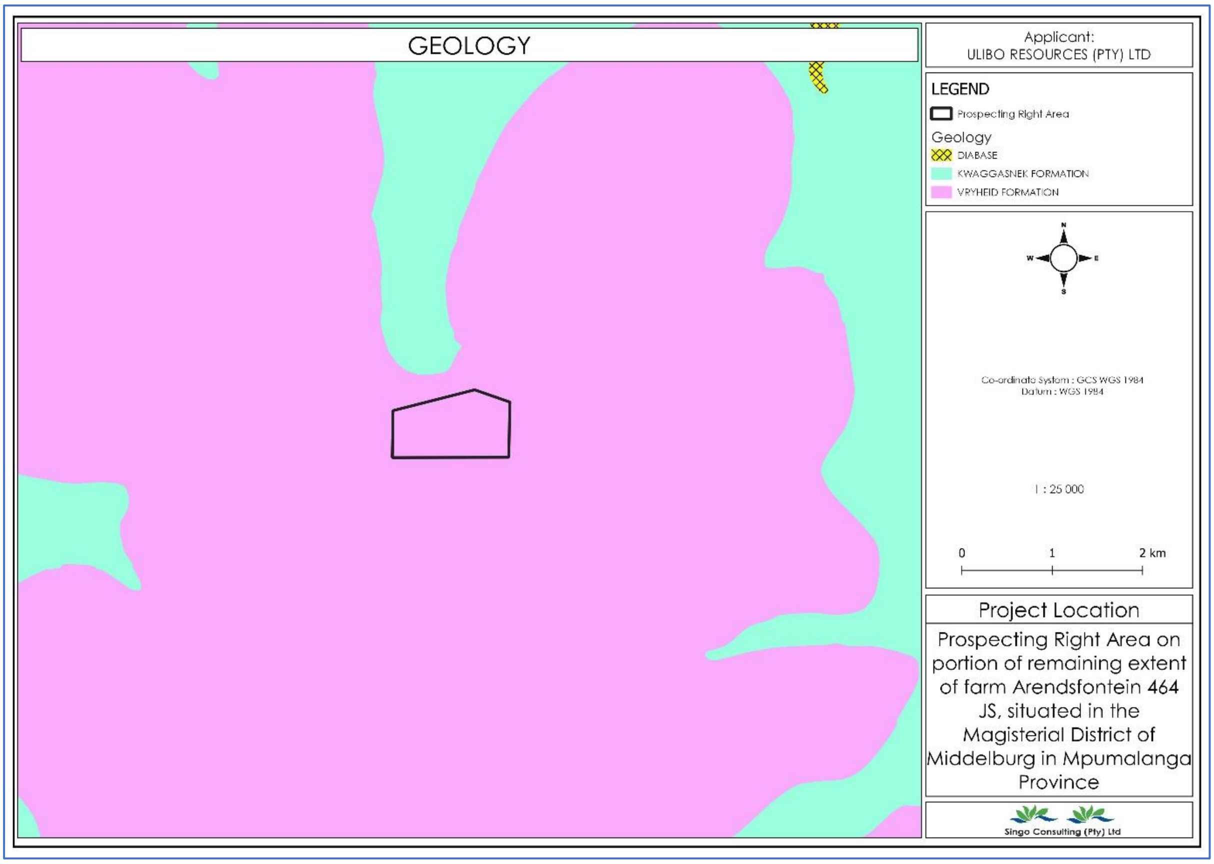

Figure 13: Geology map of the study area

4 SITE ASSESSMENT

4.1 Locality Setting

The locality map created by the QGIS illustrates detailed and comprehensive information regarding the surrounding settlements and infrastructure. The project area is situated on Portion of Portion of the Remaining Extent of the farm Arendsfontein 464 JS, situated in the Magisterial District of Middelburg Mpumalanga Province.

4.2 Water Sampling

The process of collecting a representative portion of water, as from the natural environment or from an industrial site, for the purpose of analysing it for constituents.

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Surface water sampling

Sampling using sampling Vessels:

Before sampling, the sampler must thoroughly clean the sampling vessel on site by rinsing it with water three to four times. Care must be taken to avoid contaminating the water used for sampling during rinsing. Gently submerge the collecting vessel, fill it with the water sample, and securely close it. If the obtained water sample can be frozen, leave some room for expansion equal to around 10% of the sampling vessel (Singh, 2015).

Groundwater sampling

Sampling using a Bailer:

A bailer is a hollow tube used to collect samples of groundwater from wells for monitoring. Bailers are tied to and lowered into the water column by a piece of rope or a piece of wire. When lowered, the bailer uses a simple ball check valve to seal a sample of the groundwater table at the bottom to raise it up. The bailers are made of polyethylene, PVC, FEP or stainless steel and can be disposable or reusable (Singh, 2015).

Bailers are easy and relatively inexpensive devices to use. In addition, bailers can be lowered to any depth although the depth of the well is sharply limited by pumps. Aeration of the water when the sample is collected, which could release volatile organic compounds that need to be tested, is the main downside to using bailers. This can also conflict with the proper seating of the ball check valve if there is a high volume of sediment or turbidity (Singh, 2015).

Table 4: Example of conducting borehole sampling

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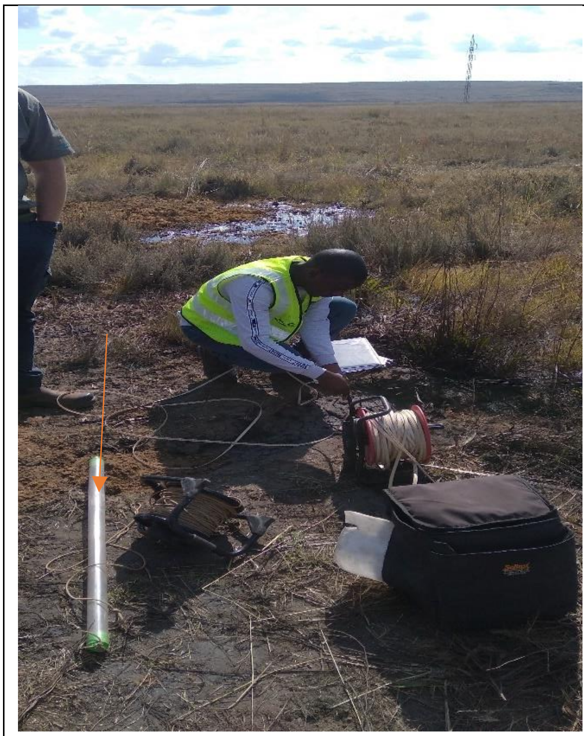

5 SURFACE WATER IMPACT ASSESSMENT

5.1 Methodology

This section evaluates the potential impact of the proposed development on watercourses present within and around the prospecting site. Watercourse is a term used in the National Water Act (Act No. 36 of 1998) (NWA) that includes various water resources, such as different types of wetlands (both natural and artificial), rivers, riparian habitat, dams and drainage lines (e.g., natural channels in which water flows regularly or intermittently). Results and discussions of delineated watercourses are used as part of the impact assessment that considers both corridor alternatives separately. Expected watercourse impacts associated with the proposed development is assessed in detail for the construction and operational phases of the project using the approach provided in the Impact Assessment methodology Section below, which includes the provision of recommended mitigation measures. An impact can be defined as any change in the physical-chemical, biological, cultural and/or socio-economic environmental system that can be attributed to human activities related to alternatives under study for meeting a project need.

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5.1.1 Impact Status

Status of Impact

The impacts are assessed as either having a:

- Negative effect (i.e., at a `cost' to the environment).
- Positive effect (i.e., a `benefit' to the environment).
- Neutral effect on the environment.

5.1.2 Impact Extent

Extent of the Impact

- Site (site only).
- Local (site boundary and immediate surrounds).
- Regional.
- National.
- International.

5.1.3 Impact Duration

Duration of the impact

The length that the impact will last for is described as either:

- Immediate (<1 year).
- Short term (1-5 years).
- Medium term (5-15 years).
- Long term (ceases after the operational life span of the project),
- Permanent.

5.1.4 Impact Probability

Probability of occurrence

The likelihood of the impact actually taking place is indicated as either:

- None (the impact will not occur).
- Improbable (probability very low due to design or experience).
- Low probability (unlikely to occur).

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- Medium probability (distinct probability that the impact will occur).
- High probability (most likely to occur).
- Definite

5.1.5 Impact Intensity

Magnitude of the Impact

The intensity or severity of the impacts is indicated as either:

- None.
- Minor.
- (4) Low.
- (6) Moderate (environmental functions altered but continue).
- (8) High (environmental functions temporarily cease).
- (10) Very high / unsure (environmental functions permanently cease)

5.1.6 Impact Significance

Based on the information contained in the points above, the potential impacts are assigned a significance rating (S). This rating is formulated by adding the sum of the numbers assigned to extent (E), duration (D) and magnitude (M) and multiplying this sum by the probability (P) of the impact.

S= (E+D+M) P

The significance ratings are given below:

- (<30) Low (i.e., where this impact would not have a direct influence on the decision to develop in the area),
- (30-60) Medium (i.e., where the impact could influence the decision to develop in the area unless it is effectively mitigated),
- (>60) High (i.e., where the impact must have an influence on the decision process to develop in the area).

5.2 Impact Assessment Ratings and Mitigation Measures

During the Coal prospecting period the following impacts are envisioned:

- Clearing of vegetation leading to increased runoff and less infiltration.

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- Diesel and oil spillages from the drill rig.
- Increase in volume of contaminated water that needs to be managed within the footprint.

Siltation on surface water

Footprint clearance will expose bare soil that could result in sheet wash into nearby watercourses during a precipitation event. In addition, dust can further be transported into watercourses or be deposited on infrastructure near watercourses thereby exacerbating the impact of siltation during rainfall events.

Table 5: Siltation mitigation measures

Issue	**Corrective measures**	**Impact rating criteria**					**Significance**
		Nature	**Extent**	**Duration**	**Magnitude**	**Probability**	
Siltation of surface water resources	No	Negative	1	1	6	8	64
	Yes	Negative	1	1	2	4	16
Corrective Measures		➢ Stripping of vegetation for prospecting must occur in a phased manner and must be restricted to the prospecting footprint to reduce the risk of erosion during times of precipitation. ➢ The contractor shall be responsible for rehabilitating all eroded areas in such a way that the erosion potential is minimised after prospecting has been completed					

<u>Surface water contamination</u>

Truck oils and fuel could leak and spill to water resources. All oils and fuels must be stored in bunded areas, and any spillages must be managed immediately in accordance with the Emergency Response plan. The emergency response plan must be provided by contractors. This will reduce the risks from high to medium.

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Table 6: Surface water contamination and mitigation measures

Issue	Corrective measures	Impact rating criteria					Significance
		Nature	Extent	Duration	Magnitude	Probability	
Surface water contamination (Truck oils and fuel could leak and spill)	No	Negative	1	1	6	8	64
	Yes	Negative	1	1	4	6	36
Corrective Measures	➢ In case of emergencies or unforeseen events, the problem must be remediated immediately and any spillage into any watercourses be reported to the Department of Water Affairs. ➢ Remove all project-related material / support equipment immediately on completion of any of the prospecting phases						

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6 STORMWATER MANAGEMENT PLAN

6.1 Terminology

Stormwater management involves the control of that surface runoff. The volume and rate of runoff both substantially increase as land development occurs. Construction of impervious surfaces, such as roofs, parking lots, and roadways, and the installation of storm sewer pipes which efficiently collect and discharge runoff, prevent the infiltration of rainfall into the soil. Management of stormwater runoff is necessary to compensate for possible impacts of impervious surfaces such as decreased groundwater recharge, increased frequency of flooding, stream channel instability, concentration of flow on adjacent properties, and damage to transportation and utility infrastructure.

6.2 Stormwater Management Principles

The following principles for stormwater management shall guide the planning, design and implementation of stormwater facilities (Centre for watershed, 2010).

- The ecosystems to be protected and a target ecological state should be explicitly identified.
- The post development balance of evapotranspiration, stream flow, and infiltration should mimic the predevelopment balance, which typically requires keeping significant runoff volume from reaching the stream.
- Stormwater control measures (SCMs) should deliver flow regimes that mimic the predevelopment regime in quality and quantity.
- SCMs should have capacity to store rain events for all storms that would not have produced widespread surface runoff in a predevelopment state, thereby avoiding increased frequency of disturbance to biota.
- SCMs should be applied to all impervious surfaces in the catchment of the target stream.

6.3 Current Stormwater Management

- No current stormwater management put in place.

6.4 Proposed Stormwater Measures

The proposed stormwater management during the drilling process are to ensure that the activity does not influence surface bodies contamination through stormwater. The following measures are proposed.

- The drilling area should be barricaded all around with plastic to ensure that the stormwater during drilling does not encounter wastewater from the drilling process.
- Around the drilling area, there should be an impervious surface made, this is to ensure that wastewater from drilling is efficiently channelled and collected. And, stormwater that may have entered the drilling segment area, is correctly harvested by the impervious material and channelled.

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7 MONITORING PLAN

The objective of the surface water management and monitoring measures is to minimise the impact on surface water dependent systems to be retained from disturbance within and adjacent to controlled sites; to maintain hydrological regimes of surface water so that the environmental values are protected and, to check compliance with license requirements and for reporting purposes.

Water dependent systems are parts of the environment in which the composition of species and natural ecological processes are determined by the permanent or temporary presence of flowing or standing surface water or groundwater. The in-stream areas of rivers, riparian vegetation, springs, wetlands, floodplains, groundwater-dependent terrestrial vegetation are all examples of water dependent systems (Department of Water, January 2013). The objectives of these systems will be achieved if there is no impact on the in-stream and downstream fitness for use criteria.

7.1 Surface Water Quality

Sampling Method

One litre plastic bottle with unlined plastic caps is required for most sampling exercises; however, in cases where organic constituents are to be tested for, glass bottles are required. Sample bottles must be marked clearly with the borehole name, date of sampling, water level depth and the sampler's name. Purging must be done on each surface waterbody that needs to be sampled, this is to ensure cross contamination is prevented. Metal samples must be filtered in the field to remove clay suspensions. The pH and EC meter used for field measurements will be calibrated daily using standard solutions obtained from the instrument supplier. Samples will be kept cool in a cooler box in the field and kept cool prior to being submitted to the laboratory to maintain proper preservation thereof.

Sampling Locations

The main objectives in positioning the monitoring surface bodies are to:

- Monitoring of surface water within the project area.
- To detect any change in chemistry of the surface water and reference it with the baseline information, to make recommendations.

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8 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusion and Summary

Singo Consulting (Pty) Ltd was appointed by Ulibo Resources (Pty) Ltd as an independent consulting company, to conduct a basic hydrological study. This study was conducted as a basic study aimed at assisting the EAP and interested parties involved to have a basic background about the project area and the surface water bodies that exist within and nearby the proposed project area. It can be concluded that the area is surrounded by various water bodies, however 100m buffers has been proposed for rivers and dams, 500m buffer proposed for wetlands, meaning no activities will take place within these radius from the water bodies.

- The study area is situated within the Olifants water management area (WMA), under the B12C quaternary catchment.
- The farm area is overlain by association of freely drained structureless soils.

8.2 Recommendations

- On site there should be regular maintenance of the mobile toilets.
- Once drilling, the team should rehabilitate the area and ensure the core is out of site
- Drilling within 100 meters of water resources should be avoided.
- Stormwater should be prioritised, and the management to prevent surface water contamination.
- Clearing of vast amount of vegetation should be avoided, this is to preserve infiltration.
- Stormwater measures which include the identified rivers and wetlands, should not be disrupted as they manage surface run off in an area.
- The drilling activity should also take into consideration the shallow and fractured aquifer in the area.
- No washing of vehicles on site should be allowed.
- Prohibition signs should be placed all around the prospecting area, such no ablution sign or site clearing.

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APPENDICES

Appendix A: Specialist's qualifications

Available upon request.

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BASIC SOIL, LAND USE AND LAND CAPABILITY

PROSPECTING RIGHT

Basic Soil, Land Use and Land Capability Study for the Proposed Prospecting Right Application of Coal on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.

2023

Prepared by:

Singo Consulting (Pty) Ltd

Prepared for:

ULIBO RESOURCES (Pty) Ltd
Reg Nr: 2013/099506/07

DMRE REF: MP 30/5/1/1/2/ 17258 PR

REPORT CREDENTIALS

Disclaimer	The opinion expressed in this and associated reports are based on the information provided by **Ulibo Resources (Pty) Ltd** to **Singo Consulting (Pty) Ltd ("Singo Consulting")** and is specific to the scope of work agreed with **Ulibo Resources (Pty) Ltd**. **Singo Consulting** acts as an advisor to the **Ulibo Resources (Pty) Ltd** and exercises all reasonable skill and care in the provision of its professional services in a manner consistent with the level of care and expertise exercised by members of the environmental profession. Except where expressly stated, **Singo Consulting** has not verified the validity, accuracy or comprehensiveness of any information supplied for its reports. **Singo Consulting** shall not be held liable for any errors or omissions in the information given or any consequential loss resulting from commercial decisions or acts arising from them. Where site inspections, testing or fieldwork have taken place, the report is based on the information made available by **Ulibo Resources (Pty) Ltd** or their nominees during the visit, visual observations and any subsequent discussions with regulatory authorities. The validity and comprehensiveness of supplied information has not been independently verified and, for the purposes of this report, it is assumed that the information provided to **Singo Consulting** is both complete and accurate. It is further assumed that normal activities were being undertaken at the site on the day of the site visit(s), unless explicitly stated otherwise. These views do not generally refer to circumstances and features that may occur after the date of this study, which were not previously known to **Singo Consulting (Pty) Ltd** or had the opportunity to assess.
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PROJECT DETAILS

Report type	**Basic Soil, Land Use and Land Capability Study for a Prospecting Right application**	
Project title	Basic Soil, Land Use and Land Capability Study for the Proposed Prospecting Right Application of Coal on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.	
Mineral (s)	Coal	
Client	Ulibo Resources (Pty) Ltd	
Site location	Portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.	
Version	01	
Date	April 2023	
		Electronic signatures
Compiled by	Dineo Makhubela (Environmental Specialist) Singo Consulting (Pty) Ltd (Candidate Natural Scientist, SACNASP Reg No: 158858)	
Reviewed by	Mutshidzi Munyai (Hydrogeologist) Singo Consulting (Pty) Ltd (Water Resources Science (Professional Natural Scientist), Environment Science (South African Council for Natural Scientific Professions) (SACNASP Registration Number 122464)	
Final review and approval	Dr. Kenneth Singo (Principal Consultant of Singo Consulting (Pty) Ltd)	

CRITICAL REPORT INFORMATION

Critical Information incorporated within the Basic Soil, Land Use and Land Capability Study:	Relevant section in report
Details of the specialist who prepared the report	Project details, P: 3
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix A, 28
Project Background Information, including the proposed activities description	Introduction, P: 7
An indication of the scope of, and the purpose for which, the report was prepared	Scope of work, P: 7
An indication of the quality and age of base data used for the specialist report	Project details, P: 3
A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Environmental impact assessment, P: 13
The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Project details, P: 3
A description of the methodology implemented in preparing the report or carrying out the specialised process comprehensive of equipment and modelling used;	Methodology, P: 9
Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Land use and cover 21-23
An identification of any areas to be avoided, including buffers	N/A
A map overlaying the proposed activity including the associated infrastructures on the environmental sensitivities of the site including containing buffer zones	N/A
A description of the findings and potential implications of such findings on the impact of the proposed activity or activities	Soil Management Plan, P:29
Any mitigation and conditions measures for inclusion in the EMPr	Soil management plan, P: 29
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Soil management plan, P: 29
An analytic opinion as to whether the proposed activity or portions thereof should be Authorised-i.e. specific recommendations	Recommendations, P: 31
Regarding the acceptability of the proposed activity or activities; and	Refer to the bar
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Soil management plan, P: 29
A description of any consultation process that was undertaken during carrying out the study	Refer to the Bar
Any other information requested by the competent authority.	N/A

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1. INTRODUCTION

1.1. Project Background Information

Singo Consulting (Pty) Ltd was appointed by Ulibo Holdings (Pty) Ltd to conduct a basic soil study for the prospecting right application which has been submitted for the prospecting of Coal and is situated on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.

This report is not planned to be an intensive description of the proposed project; however, it is conducted as a specialist basic soil study to evaluate the soil potential, current land use as well as land capability information required for the environmental authorizations for the proposed prospecting project.

1.2. Proposed Activities

Prospecting activities will be undertaken over a period of five (5) years and are designed in phases, each phase conditional on the success of the previous phase. Both Invasive and non-invasive methods will be implemented.

- Desktop study of the area has commenced, and this incorporates desktop geographical and geological mapping.
- This will be followed by geochemical and geotechnical surveys.
- Geotechnical surveys will be followed by detailed geophysical studies and later, a detailed drilling, sampling, assaying and mineralogical study.
- Diamond core drilling method will be utilized to prospect in situ ore deposits.
- To ensure or minimize impacts on the receiving environment, all the drilling activities will be guided by the project's EMPr.

1.3. Scope of Work

The scope of work included the following:

- Conduct a basic soil assessment of the proposed prospecting right project.
- Determine impacts of the proposed prospecting activities of Coal on soil and provide associated mitigation measures.
- Classify and map soil forms according to the South African Taxonomic Soil Classification System, 1991.
- Derive and map land capability based on soil properties.
- Map all current land uses.

2. TERMS OF REFERENCE

The following tasks were undertaken in the compilation of the soil assessment, land use and land capability study:

2.1. Basic Soil Study

- A basic soil assessment of the proposed project development footprint areas associated within the proposed Coal prospecting site.
- The soil classification will be done according to the Taxonomic Soil Classification System for South Africa, 1991. The following attributes were included at each observation:

  - Soil form and family
  - Soil depth
  - Estimated soil texture
  - Soil structure
  - Underlying material
  - Current land use
  - Land capability

3. METHODOLOGY

3.1 Desktop study and literature review

The main purpose is to provide as much information on the probable ground (soil) conditions, and the likely problems that they will produce due to the proposed prospecting right application, the study will focus on the farm area and its surrounding environment. Once these surveys are complete, the results should be formally presented in a report which brings together the details of:

- Site topography.
- Geology.
- Geotechnical problems and parameters.
- Groundwater conditions.
- Previous land use.
- Expected construction risks.
- Proposed ground investigation methods.

3.2 Site Assessment

The soil of the proposed prospecting right area will be investigated by means of physical properties. The soil will be described and classified according to the South African Taxonomic Soil Classification System.

The following procedure is followed to record soil properties and classify soils accordingly:

- Identification of applicable diagnostic horizons by stating the physical properties such as:
  - Effective depth (depth of soil suitable for root development),
  - Colour (in accordance with Munsell colour chart),
  - Texture (refers to the particle size distribution),
  - Structure (aggregation of soil particles into structural units),
  - Mottling (alterations due to continued exposure to wetness),
  - Concretions (cohesion of minerals into hard fragments)

3.3 Environmental Impact Assessment

The impact rating process is designed to provide a numerical rating of the various environmental impacts identified using the Input-Output model. It must be emphasized that the purpose of this process is not to provide an incontrovertible rating of the significance of various aspects, but rather to provide a structured, traceable, and defendable methodology of rating the relative significance of impacts in a specific context. This provides the project proponent a greater understanding of the impacts of this project and the issues which need to be addressed by mitigation and give the regulators information on which to base their decisions on.

The significance rating process follows the established impact/risk assessment formula:

Significance= Consequence x Probability

Where:

Consequence = Severity + Spatial Scale + Duration

Probability = Likelihood of an impact occurring

The matrix calculates the rating out of 147, whereby Severity, Spatial Scale, Duration and Probability are each rated out of seven as indicated in Table 1. Weighting can be applied to the various parameters. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in the Environmental Management Plans (EMP).

The significance of an impact is then determined and categorized into one of four categories, as indicated in Table 2, which supports Table 3. Environmental management actions will be assigned for all identified impacts. A neutral impact implies that it causes the area to return to a pre-project state. This is not regarded as positive, as there would have been no need for this activity if the operation were not carried out.

Table 1: Impact rating assessment parameter

Rating	Severity		Spatial Scale	Duration	Probability
	Environmental	Social, Cultural and heritage			
7	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage	Very significant impact on the environment. Irreparable damage to highly valued species, habitat or eco system. Persistent severe damage	International The effect will occur across international borders	Permanent: No Mitigation No mitigation measures of natural process will reduce the impact after implementation	Certain/Definite. The impact will occur regardless of the implementation of any preventative or corrective actions.
6	Significant impact on highly valued species, habitat, or ecosystem	Irreparable damage to highly valued items of cultural significance or breakdown of social order.	National Will affect the entire country	Permanent: Mitigation measures of natural process will reduce the impact	Almost certain/Highly probable It is most likely that the impact will occur
5	Very serious, long term environmental impairment of ecosystem function that may take several years to rehabilitate	Very serious widespread social impacts. Irreparable damage to highly valued items	Province/ Region Will affect the entire province or region	Project Life The impact will cease after the operational life span of the project	Likely The impact may occur
4	Serious medium term environmental effects. Environmental damage can be reversed in less than a year	On-going serious social issues. Significant damage to structures / items of cultural significance	Municipal Area Will affect the whole municipal area	Long term 6-15 years	Probable Has occurred here or elsewhere and could therefore occur
3	derate, short-term effects but not affecting ecosystem function. Rehabilitation requires intervention of external specialists and can be done in	On-going social issues. Damage to items of cultural significance. Local	Local extending only as far as the development site area	Medium term 1-5 years	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur

	less than a month				
2	Minor effects on biological or physical environment. Environmental damage can be rehabilitated internally with/ without help of external consultants	Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Limited Limited to the site and its immediate surroundings	Short term Less than 1 year	Rare/ improbable Conceivable, but only in extreme circumstances and/ or has not happened during lifetime of the project but has happened elsewhere. The possibility of the impact materializing is very low as a result of design, historic experience or implementation of adequate mitigation measures
1	Limited damage to minimal area of low significance, (e.g., ad hoc spills within plant area). Will have no impact on the environment.	Low-level repairable damage to commonplace structures	Very limited Limited to specific isolated parts of the site.	Immediate Less than 1 month	Highly unlikely/None Expected never to happen

According to the Impact assessment parameter ratings in Table 1, the rating of the proposed area is classified as 3, since there will be a moderate, short-term effects on the environment but not affecting the ecosystem function. Rehabilitation will require intervention of external specialists and can be done in less than a month. The spatial scale of the impact is the Local area, the impact can extend only as far as the development site area. The Likelihood of an impact to occur is unlikely but there is a possibility that the impact will occur once the project has started. The duration of the impact can last between 1- 5 years.

Table 2: Probability Consequence Matrix

Significance

Probability / Likelihood	Consequence (severity + scale + duration)								
	1	3	5	7	9	11	15	18	21
1	1	3	5	7	9	11	15	18	21
2	2	6	10	14	18	22	30	36	42
3	3	9	15	21	27	33	45	54	63
4	4	12	20	28	36	44	60	72	84
5	5	15	25	35	45	55	75	90	105
6	6	18	30	42	54	66	90	108	126
7	7	21	35	49	63	77	105	126	147

Table 3: Impact Significance threshold limits

Significance		
Low	0 – 35	
Low-Medium	36 – 76	
Medium- High	73 – 107	
High	108 - 147	

4. PHYSIOGRAPHICAL AND SOIL SETTING

4.1. Project Location

The prospecting right application covers portion of Portion of the remaining extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg (Steve Tshwete), Mpumalanga Province. The project area is indicated by the red star symbol shown on Figure 1 below and be accessed using the N11 road. Figure 2 shows the closer version of the proposed project.

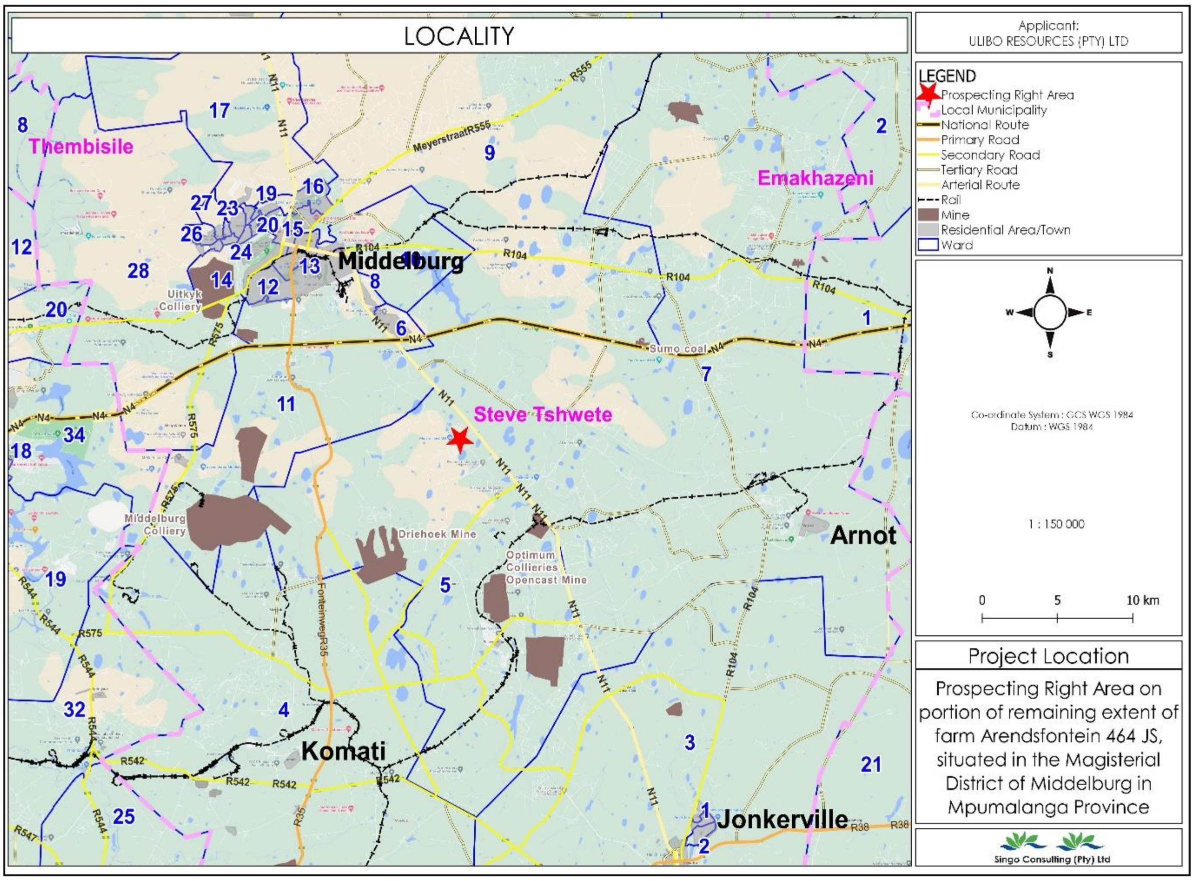


Figure 1: Locality map of the study area. (Singo Consulting (Pty) Ltd , 2023)

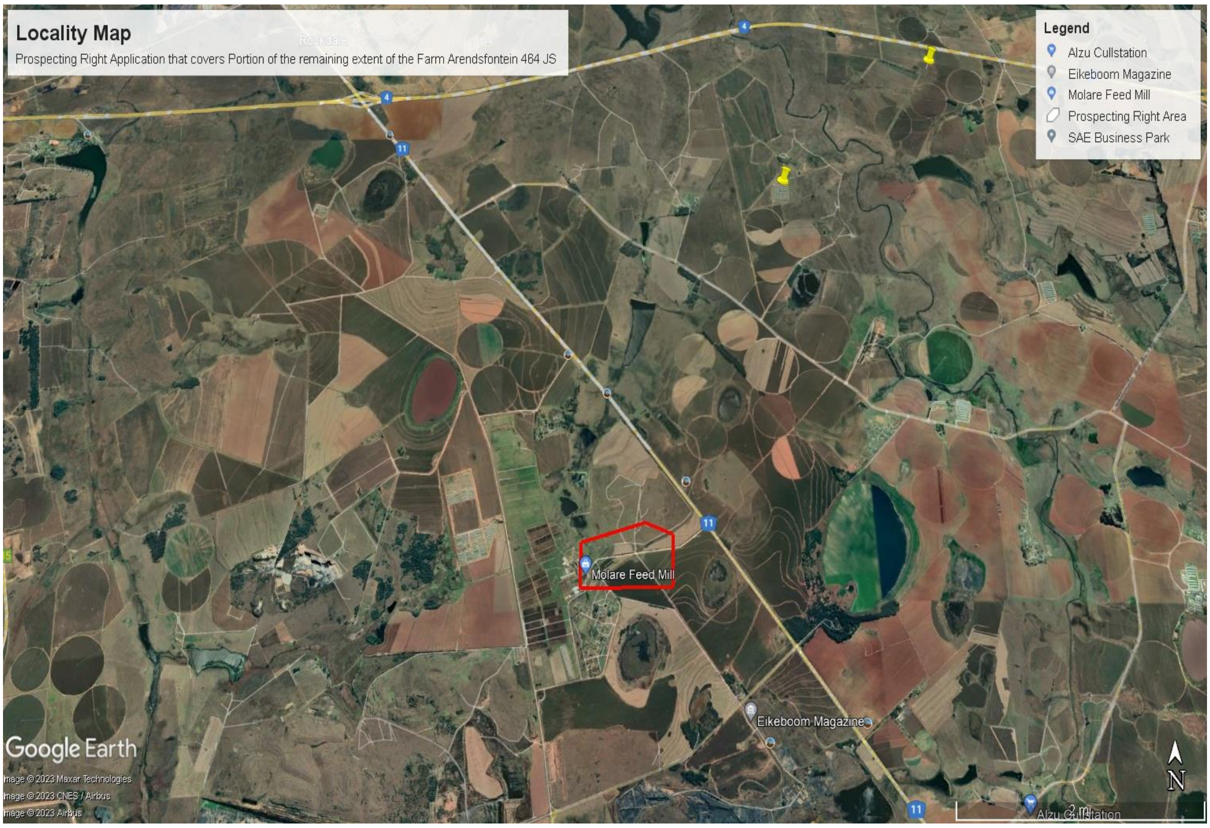


Figure 2: Google earth Map for the proposed prospecting right project. (Singo Consulting (Pty) Ltd , 2023)

4.2. Climate

Climate, amongst other factors (Humidity), influences soil-water processes and water availability in open to air systems in a water balance. The most influential factors on soil and climate are Temperature and Precipitation. Temperature and precipitation influence how fast parent materials weather and, thus, soil properties such as mineral composition and organic matter content (University of Minnesota, 2018).

In Middelburg, the summers are long, warm, and partly cloudy and the winters are short, cold, dry, and clear. Over the course of the year, the temperature typically varies from 2.2°C to 26°C and is rarely below *-0.1*°C or above 29°C (https://weatherspark.com/).

Temperature

Temperature directly influences the speed of chemical reactions. The warmer the temperature, the faster reactions occur. Temperature fluctuations increase physical weathering of rocks (University of Minnesota, 2018). Figure 3 below shows that the project area mean annual temperature is between 0.1-2 °C. With the information obtain by the in-house GIS Specialist and the weatherspark website it is safe to state that the project area's temperature is Cold which will make it harder for the soil reactions to occur.

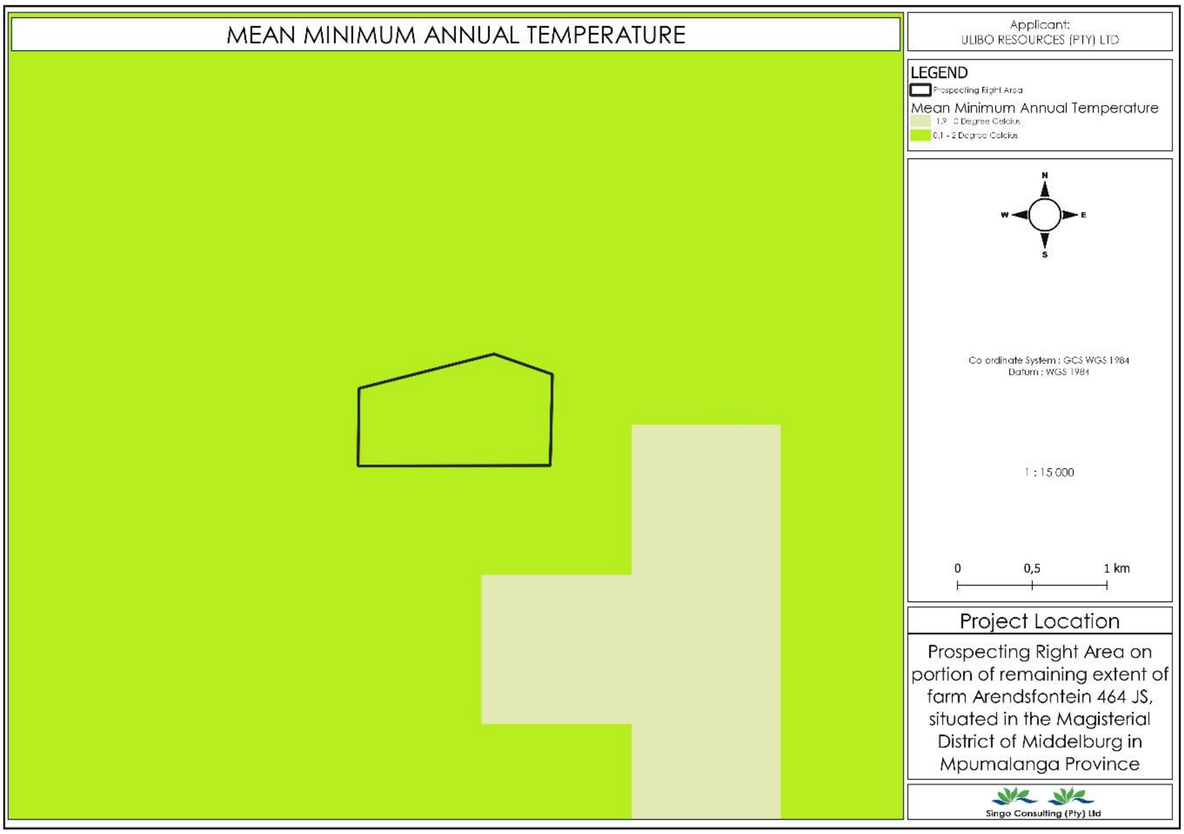


Figure 3: Mean Annual Temperature of the proposed prospecting right area. (Singo Consulting (Pty) Ltd , 2023)

Precipitation

Precipitation governs water movement in the soil. The amount of water the soil receives and the amount of evapotranspiration that occurs influence water movement. The month with the most wet days in Middelburg is December, with an average of 16.1 days with at least 0.04 inches of precipitation. The drier season lasts 6.5 months, from March 30 to October 13. The month with the fewest wet days in Middelburg is July, with an average of 0.6 days with at least 0.04 inches of precipitation (See figure 4 below).

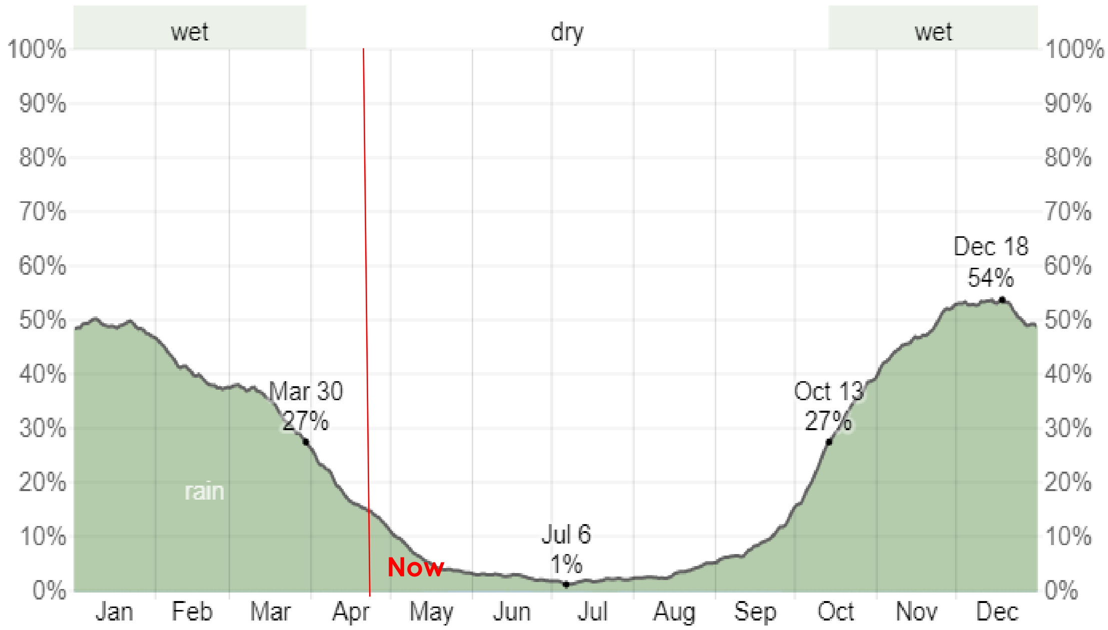


Figure 4: Daily Chance of Precipitation in Middleburg. (https://weatherspark.com/)

Among wet days, we distinguish between those that experience rain alone, snow alone, or a mixture of the two. Based on this categorization, the most common form of precipitation throughout the year is rain alone, with a peak probability of 54% (https://weatherspark.com/). Normal annual rainfall in Middleburg is the least 12.7 mm of a sliding 31-days. The rainy period of the year lasts for 8 months, from September 7 to May 8, at least 12.7 mm. The month with the most rain in Middelburg is January, with an average rainfall of 99.06 mm. The rainless period of the year lasts for 4 months, from May 8 to September 7. The month with the least rain in Middelburg is July, with an average rainfall of 2.54 *mm* (See Figure below) (https://weatherspark.com/).

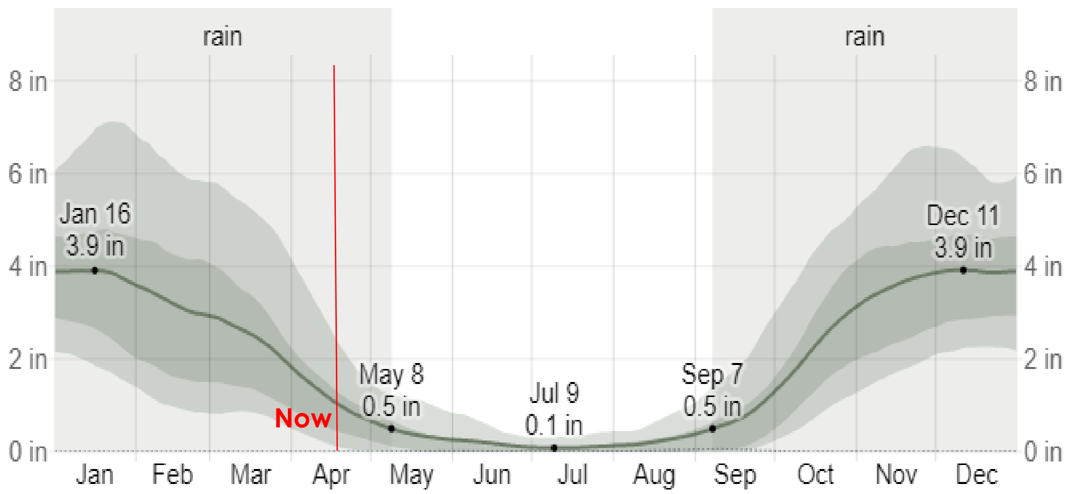


Figure 5: Average Monthly Rainfall in Middleburg. (https://weatherspark.com/)

The proposed prospecting right application has the mean annual rainfall that ranges from 601 mm to 800 m as shown on Figure 6 below, which means the project area consist of high rainfall and has a cold temperature.

This influence of soil temperature on plant growth is related to the fact that warmth promotes crop development through increased water and nutrient uptake, while cold inhibits water uptake due to lower water viscosity and slows down the process of photosynthesis (ESO data Analytics). Which indicates that the soil consist of low natural fertility status.

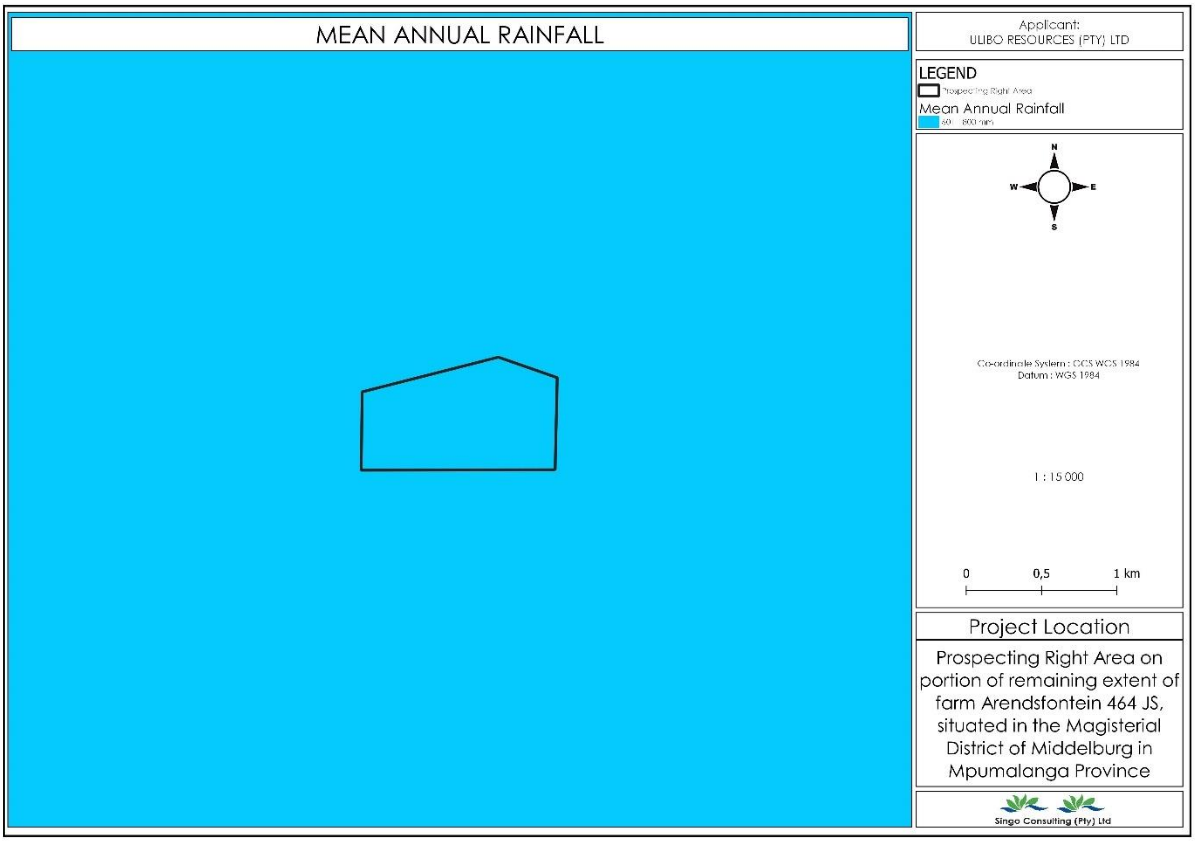


Figure 6: Mean Annual Rainfall Map for the proposed project. (Singo Consulting (Pty) Ltd , 2023)

4.3. Soil Classes present in the study area.

The soils can be defined based on their soil depth, Soil Drainage, erodibility, and natural fertility.

Soil depth

Depth of the soil profile is from the top to the parent material or bedrock. This type of soil can be classified as a restricted soil depth. A restricted soil depth is a nearly continuous layer that has one or more physical, chemical, or thermal properties.

Soil Drainage

Soil drainage is a natural process by which water moves across, though, and out of the soil because of the force of gravity. The soils in the proposed area have an excessive drainage due to the soils having very coarse texture. Their typical water table is less than 150.

Erodibility

Erodibility factor (K-factor) is the inherent yielding or non-resistance of soils and rocks to erosion by runoff and rainfall impact. The freely drained structureless soils have high erodibility. A high erodibility implies that the same amount of work exerted by the erosion processes lead to a larger removal of material.

Natural Fertility

Soil fertility refers to the ability of soil to sustain agricultural plant growth, i.e., to provide plant habitat and result in sustained and consistent yields of high quality. The soil, as a nature of them, contains some nutrients which is known as 'inherent fertility'. Among the plant nutrients, nitrogen, phosphorus, and potassium is essential for the normal growth and yield of crop. The proposed area has a low natural fertility soil.

The soil classes map in Figure 7 below shows that the prospecting right area is largely covered with the freely drained structureless soils. Which are defined as soils that when drainage occurs, it occurs gradually by piston displacement in the unsaturated phase with no observable aggregation and no definite arrangement of the soil particles. The wetting front moves to depth at rates of a few metres a year depending on drainage volumes and the pore volume of the soil and base rock (AEDA). They can be defined as structureless soils and have favourable physical properties such as **restricted soil depth**, **excessive drainage**, and **high erodibility potential** as well as a **low natural fertility status (SANBI BGIS).**

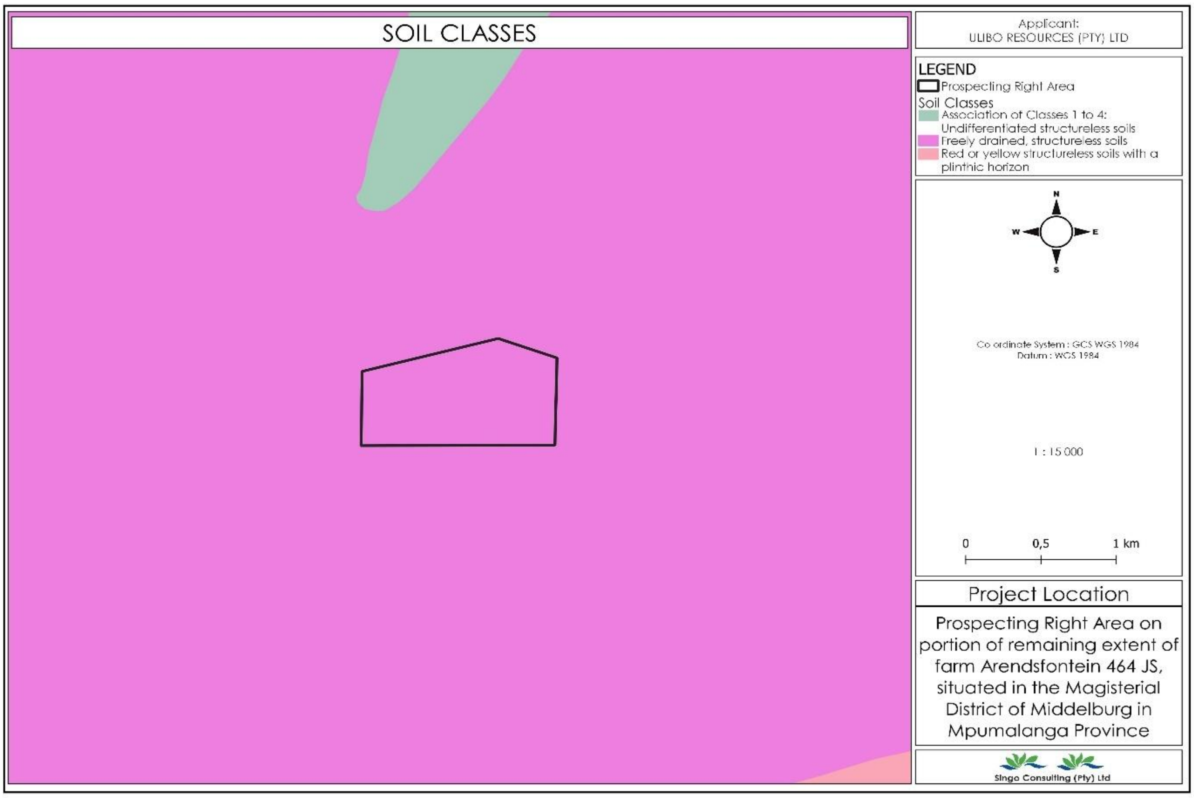


Figure 7: Soil class map of the study area. (Singo Consulting (Pty) Ltd , 2023)

During the site visit on the proposed prospecting right farm, the soil was assessed, and the results were co-referenced with the SANBI Soil Classes Legend. As shown on Table 4 below, the soil is indeed a Freely drained, structureless soil as confirmed by Desktop Studies.

Table 4: Soil Class of the proposed project.

Home > services > National_soils (MapServer) > Legend

JSON

Legend (National_soils)

Soil classes (0)

- Association of Classes 1 to 4: Undifferentiated structureless soils
- Association of Classes 13 and 16: Undifferentiated shallow soils and land classes
- Association of Classes 17 and 18:Structurelss soils and clays
- Association of Classes 17 and 19: Structureless and textural contrast soils
- Association of Classes 17 and 20: Structureless and poorly drained soils
- Association of Classes 17 and 21: Structureless soils, shallow soils and land classes
- Association of Classes 17 and 9: Structureless soils and podzols
- Association of Classes 5, 6, 10, 11, 12: Undifferentiated clays
- Association of Classes 7 and14: Undifferentiated texture contrast soils
- Association of Classes 8 and 15: Undifferentiated poorly drained soils
- Dark clay soils which are not strongly swelling
- Dark clay soils, often shallow, on hard or weathering rock
- Freely drained, structureless soils
- Imperfectly drained sandy soils
- Imperfectly drained soils, often shallow and often with a plinthic horizon
- Lithosols (shallow soils on hard or weathering rock)
- No dominance

5. LAND USE AND COVER

The proposed prospecting right area is covered with natural vegetation, bare land, cultivated land, plantations and mines as seen on Figure 8 & 9 below. Table 5 shows the description of the aforementioned land used and land cover of the proposed area.

Table 5: Land use and land cover (LULC) classes used in the classification scheme.

Plantations	Land that is used for planting or it is under cultivation using the single crop (e.g., Pine Trees)
Cultivated land	Characterized by high percentages of herbaceous vegetation and crops; including lands that are regularly tilled and covered with planted cropland
Natural Vegetation	Any non-agricultural, native, or naturalized plant species that grows at a site
Bare land	Areas of sparse vegetation cover; including clear cuts and barren rock or sand along river/stream beaches

Inappropriate land use and land cover change like deforestation, overgrazing, and expansion of agricultural lands has left the land barren, which reduces the biomass (vegetation cover) and results in a decline in soil organic matter content, availability of nutrients and soil moisture (Mao & Zeng 2010).

Soil degradation is one of the major factors that hinder agricultural land productivity. It is the result of past land use changes and intensive agricultural practices (Hurni 1985). Due to the vegetation cover change which reduces organic matter and nutrients available to plants the productivity of the land will decrease. This reduction in vegetation cover may increase erosion of the fine and top layer soil, which may reduce effective soil depth. Soil properties are varying and complex, particularly from a fertility standpoint. Information about this plays an important role in managing the resources in a sustainable manner. To minimize the effect of land use and land cover change, understanding the major factors that govern the process is important (Gebrehiwet 2004).

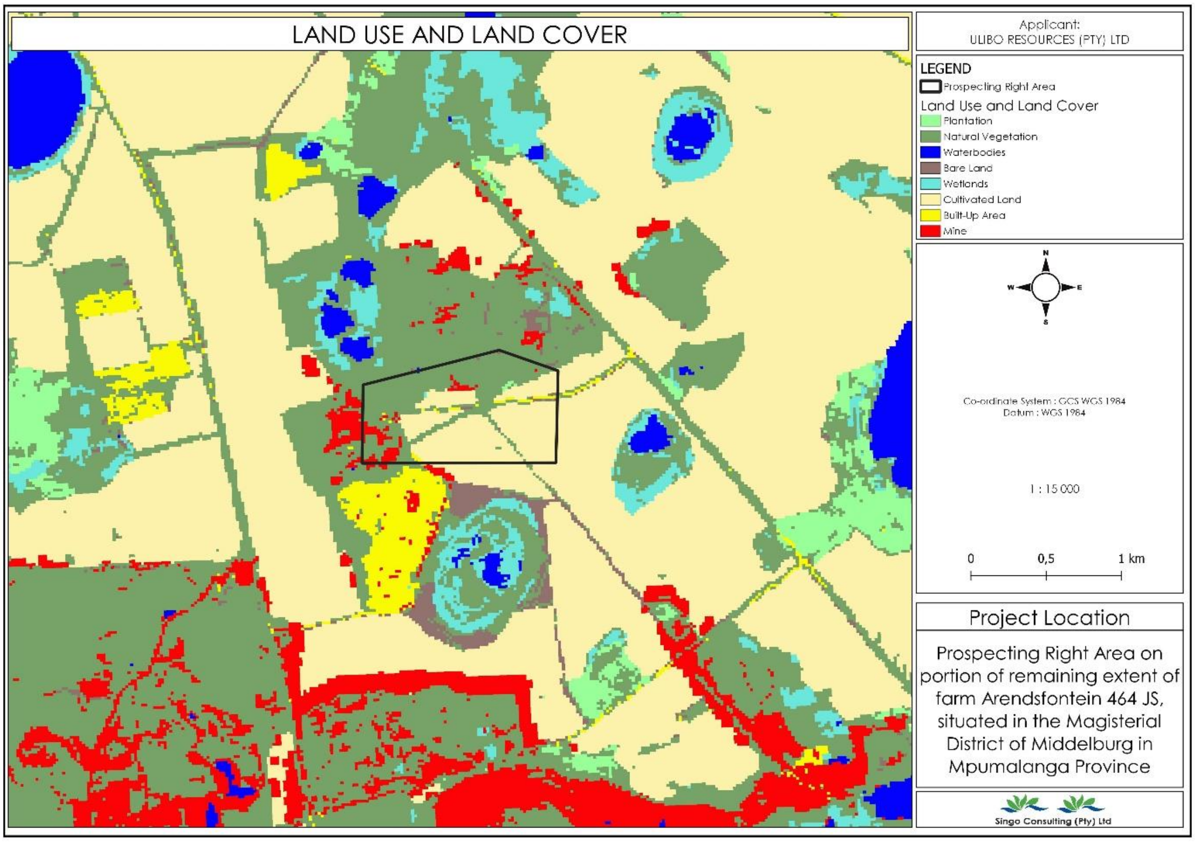
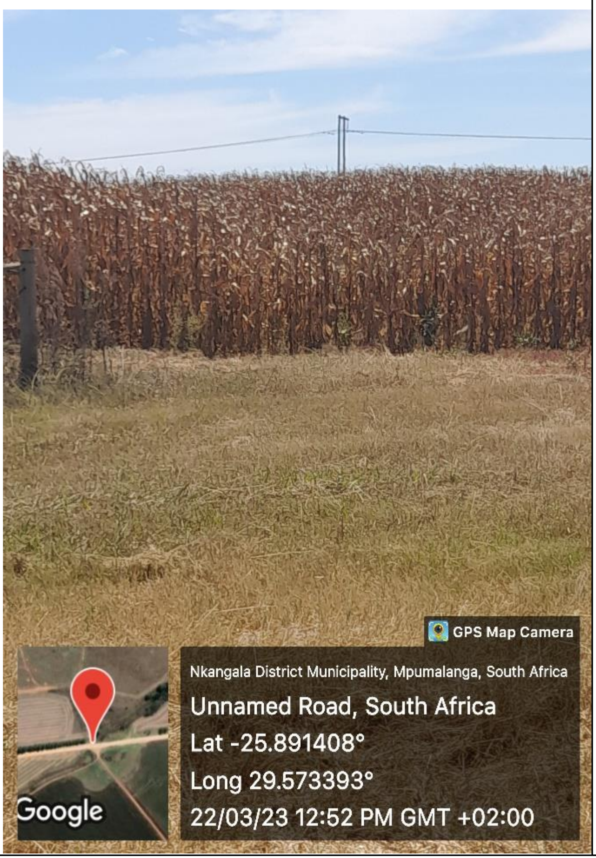
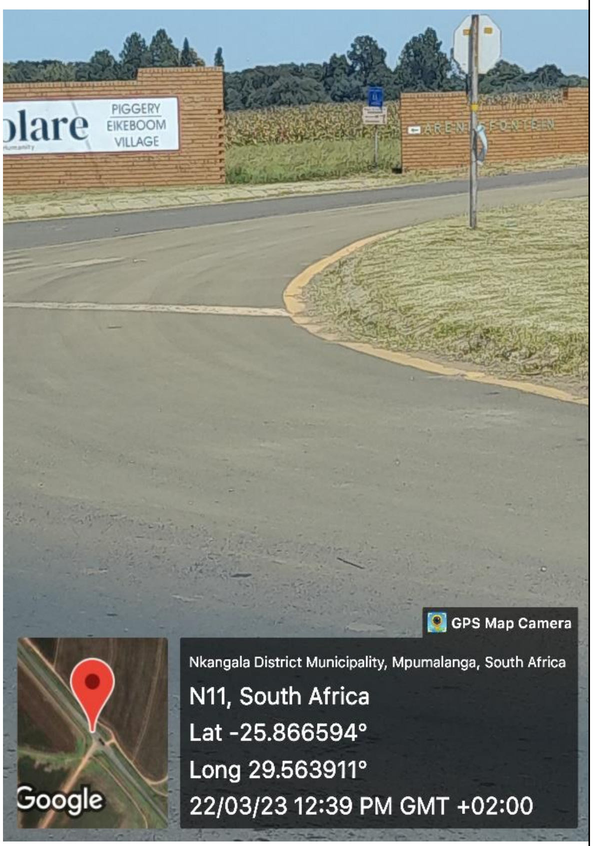
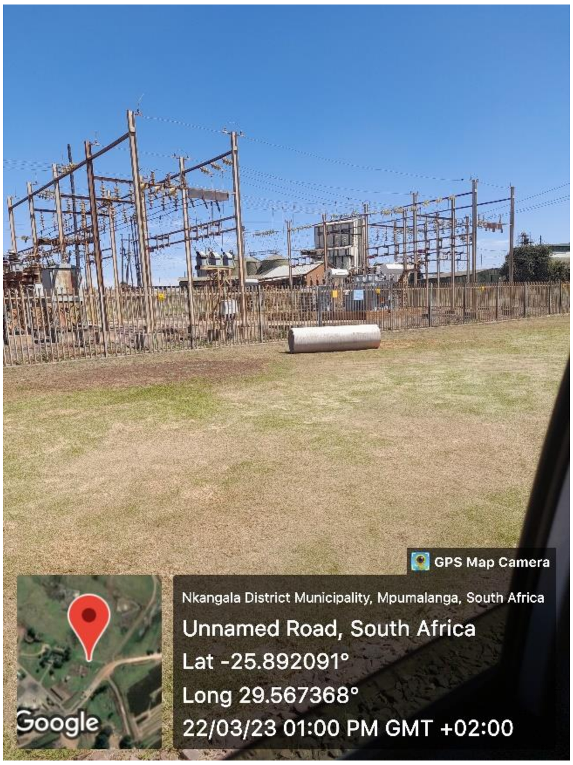


Figure 8: Land use and cover map. (Singo Consulting (Pty) Ltd , 2023)







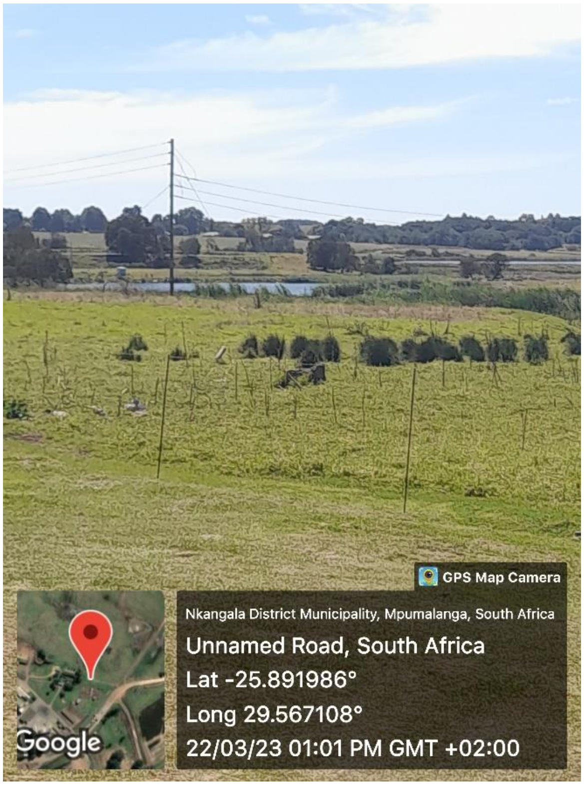


Figure 9: Land use and cover of the proposed prospecting right area. (Singo Consulting (Pty) Ltd , 2023)

6. Land capability

The Land capability classification is one of several interpretation groups that was made for agricultural purposes. As with all the interpretation groups, the land capability classification starts with one soil-mapping unit, which is the building block of the system.

The land capability of the proposed project is classified as arable land in Figure 10 below. In this classification the arable soils in the project area are grouped according to their potentialities and limitations for sustained production of the common cultivated crops that do not require specialized site conditioning or site treatment.

Nonarable soils (soils unsuitable for long time sustained use for cultivated crops) are grouped according to their potentialities and limitations to produce permanent vegetation and according to their risks of soil damage if mismanaged.

The prospecting area is suitable for growing crops as it is classified as arable, Figure 10.

The capability grouping of soils is designed:

0. To help landowners and others use and interpret the soil maps,
1. To introduce users to the detail of the soil map itself, and
2. To make possible broad generalizations based on soil potentialities, limitations in use, and management problems'

The capability classification provides three major categories of soil groupings:

0. Capability unit,
1. Capability subclass, and
2. Capability class.

The first category, capability unit, is a grouping of soils that have about the same responses to systems of management of common cultivated crops and pasture plants. Soils in any one capability unit are adapted to the same kinds of common cultivated and pasture plants and require similar alternative systems of management for these crops. Long-time estimated yields of adapted crops for individual soils within the unit under comparable management do not vary more than about 25 percent.

The second category, the subclass, is a grouping of capability units having similar kinds of limitations and hazards. Four general kinds of limitations or hazards are recognized: (1) Erosion hazard, (2) wetness, (3) rooting zone limitations, and (4) climate.

The third and broadest category in the capability classification places all the soils in eight capability classes. The risks of soil damage or limitations in use become progressively greater from class I to class VIII. Soils in the first four classes under good management can produce adapted plants, such as forest trees or range plants, and the common cultivated field crops ^ and pasture plants. Soils in classes V, VI, and VII are suited to the use of adapted native plants. Some soils in classes V and VI are also capable of producing specialized crops, such as certain fruits and ornamentals, and even field and vegetable crops under highly intensive management involving elaborate practices for soil and water conservation. Soils in class VIII do not return on-site benefits for inputs of management for crops, grasses, or trees without major reclamation.

The grouping of soils into capability units, subclasses, and classes is done primarily based on their capability to produce common cultivated crops and pasture plants without deterioration over a long period of time. To express suitability of the soils for range and woodland use, the soil mapping units are grouped into range sites and woodland-suitability group.

Table 6: Relationship of soil-mapping unit to capability classification (Source: Kellogo, 1961)

Soil-mapping unit	A soil mapping unit is the part of the landscape' that has the same qualities and characteristics and whose limits are static by accurate definitions. Within the cartographic limitations and considering the purpose for which the map is made, the soil mapping unit is the unit at which the highest number of accurate statements and predictions can be done. The soil mapping units gives more information about the details of soils. The basis for all the interpretation is the basic mapping units. They provide the information required for the development of capability units, forest site groups, crop suitability groups, range site groups, engineering groups, and other interpretation groups. The most specific management ways and estimated yields relates to the individual mapping unit.
Capability unit	A group of one or more individual soil mapping units having similar potentials and continuing limitations or hazards is termed as capability unit. The soils in a capability unit are sufficiently uniform to 1) produce similar kinds of cultivated crops and pasture plants with similar management practices, 2) require similar conservation treatment and management under the same kind and condition of vegetative cover, 3) have comparable potential productivity. The capability unit condenses and simplifies soils information for planning individual tracts of land, field by field. Capability units with the class and subclass furnish information about the degree of limitation, kind of conservation problems and the management practices needed.

Capability subclass	Are the groupings of capability units that have the same major conservation problem are called Subclasses. The problems include— 1.E>Erosion and runoff. 2.W>Excess water. 3.S>Root-zone limitations. 4.C>Climatic limitations. The information about the involved limitations and the kind of problems related to conservation are provided by capability Subclass. The information about the map user relating to the limitation degree and the kind of problems involved in broad program planning, conservation need studies, and similar purposes are provided by the class and sub class
Capability class	Capability classes are groups of capability subclasses or capability units that have the same relative degree of hazard or limitation. The limitation and risks of soil damage in use become more from class I to class VIII. The capability classes are useful as a means of introducing the map user to the more detailed information on the soil map. The classes show the location, amount, and general suitability of the soils for agricultural use. Only information concerning general agricultural limitations in soil use are obtained at the capability class level.

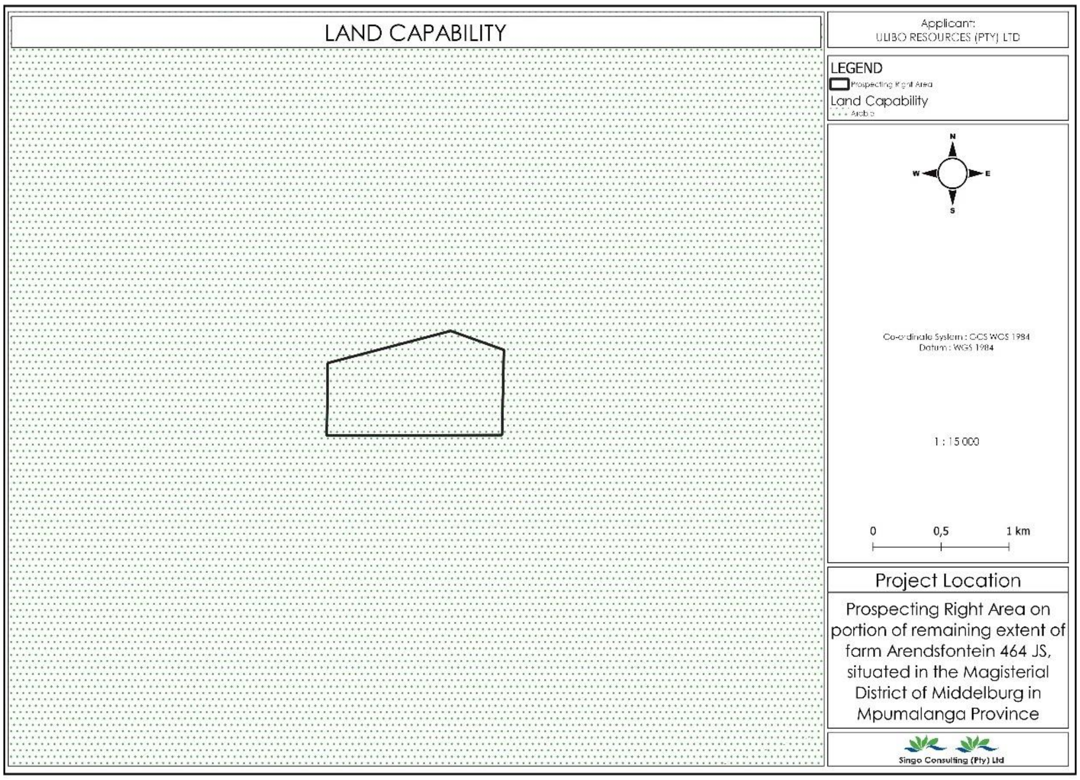


Figure 10: Land Capability Map. (Singo Consulting (Pty) Ltd , 2023)

6.1. Land capability classification

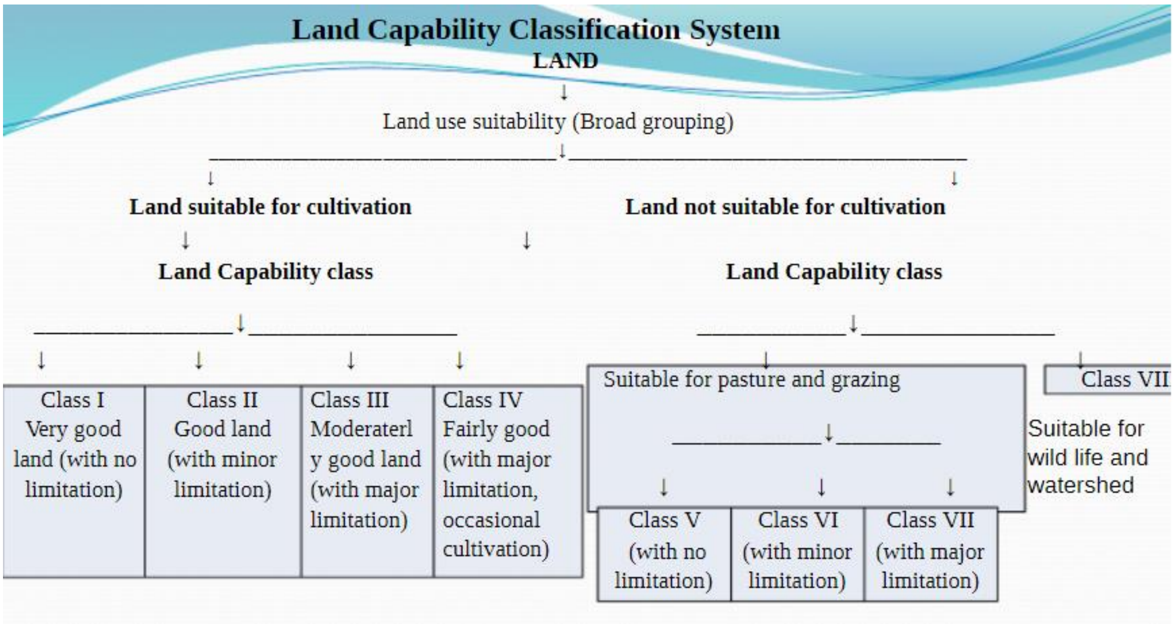
Soils are grouped based on their capability to produce crops and pasture plants without deterioration over a long period of time. The criteria used in assessing a land are the physical properties of the land and the degree of limitation as a function of the severity with which crop growth is inhibited. It is mainly based on:

- The soil properties.
- The external land features.
- The environmental factor that limits land use.

Different factors that determine the capability of a soil are:

- Depth of soil.
- Drainage condition of soil.
- Relief (slope)
- Intensity of soil erosion.
- Susceptibility to overflow and flooding and degree of saturation.
- Climate variation.

<u>Table 7: Land Capability Classification System</u>



In conclusion the land capability of the area can be classified ad Class III (Moderately good land with major limitation. Due to the factors mentioned above, namely:

- **Climate:** The project area consists of high rainfall and has a cold temperature. This influence of soil temperature on plant growth is related to the fact that warmth promotes crop development through increased water and nutrient uptake, while cold inhibits water uptake due to lower water viscosity and slows down the process of photosynthesis.

- **Soil:** They can be defined as structureless soils and have favourable physical properties, but have restricted soil depth, excessive drainage, and high erodibility potential as well as a low natural fertility status**.**
- **Intensity of soil erosion**: rainfall is the major driver of soil erosion which has direct impact on separation of soil particles, decomposition of soil aggregates and migration of eroded sediment, the amount of soil erosion caused by erosive rainfall accounts for most of the total erosion

7. SOIL MANAGEMENT PLAN

7.1. Soil management during the prospecting phase

More important than chemical imbalances which can be easily restored at cost, is soil compaction and volumes of replacement during soil reclamation. Heavy drill rigs equipment to be used during prospecting may lead to areas of decreased soil and land capabilities. Such areas have limited land use options and specialized management needs. However, this impact will be minimal.

7.2. Soil management during the prospecting phase

7.1.1. Terrain stability to minimise erosion potential.

Contour Cultivation reduces surface flow velocity and delays soil erosion, this process involves sowing crops through the slope instead of climbing and descending from slope. Contour trimming is more effective on slopes between 2% and 10% (Suresh 2012; Meena et al. 2018a). Contour crops protects the precious upper soil by reducing the velocity of the flow of water and inducing more infiltration. The contour cultivation reduces the outflow by increasing the rough-ness of the surface perpendicular to the slope. The increased surface roughness reduces the speed of any flowing water, providing more time for infiltration and reducing erosion rate.

Contour Cultivation is a sustainable way of farming where farmers plant crops across or perpendicular to slopes to follow the contours of a slope of a field. This arrangement of plants breaks up the flow of water and makes it harder for soil erosion to occur.

7.1.2. Management of access and haulage roads

For the proposed prospecting right, they will not be any developments of roads infrastructure on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province, existing path on the farm will be used. Dust suppression must be done on a regular basis.

7.1.3. Prevention of soil contamination

Toxic chemical compounds, salts, radioactive agents, toxins, and other waste contribute to soil contamination/pollution, and these results in severe negative impact on plant and animal health.

- To avoid soil pollution, it is important, that along with fertilizers, farmers should shift to bio pesticides and fungicides, also known as herbicides.
- deforestation measures must be undertaken at rapid pace.

- Ensure reduction of the use of chemical fertilizers and pesticides.
- Recycling paper, plastics, and other materials.
- Ban the use of plastic bags, which are a major cause of pollution.
- Avoiding deforestation and promoting forestation.

8. CONCLUSION AND RECOMMENDATIONS

8.1. Conclusion and Summary

A soil, land use and land capability investigation were conducted for the proposed prospecting right application. The topographical, land use and soil type data available for the site were compiled using both desktop and field assessment data to determine the potential impacts of the prospecting activities.

The following conclusions are made in this study:

- The proposed area is covered with the fairly modified structureless soils.
- The study area is an arable land and has the capability of being ploughed and used to grow crops.
- The prospecting right area is mostly covered with natural vegetation.

8.2. Recommendations

- Pathways will be stripped when the soil is dry (as far as practical possible), as to reduce compaction; and
- The pathways will be stripped according to the stripping guideline and management plan, and further recommendations contained within the rehabilitation plan.
- The period of exposure of soil disturbances will be minimized through a planning schedule.
- Absorbent kits will be made available near the drill rigs during drilling activities to prevent oil spills from contaminating the surrounding soil.
- Drilling on steep slopes will be avoided, to prevent soil erosion.
- The exploration geologist will be advised to drill and sample more than 100m away from the waterbody on site.
- The proposed prospecting land should be returned to its origin as before prospecting activities and the rehabilitation performance assessment in the proposed land must be done progressively (annually) during the operational phase by a soil specialist.
- Dust suppression should be conducted regularly.

9. REFERENCES

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9. SANBI BGIS (Map Viewers - Biodiversity BGIS (sanbi.org)
10. University of Minnesota (https://extension.umn.edu/)

10. APPENDICES

Appendix 1: Specialist's qualifications

Available upon request

PROSPECTING RIGHT APPLICATION

BASIC

REHABILITATION AND CLOSURE PLAN

Basic Rehabilitation and Closure Plan for the proposed Prospecting Right application for Ulibo Resources (Pty) Ltd on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.

ULIBO RESOURCES (Pty) Ltd
Reg Nr: 2013/099506/07

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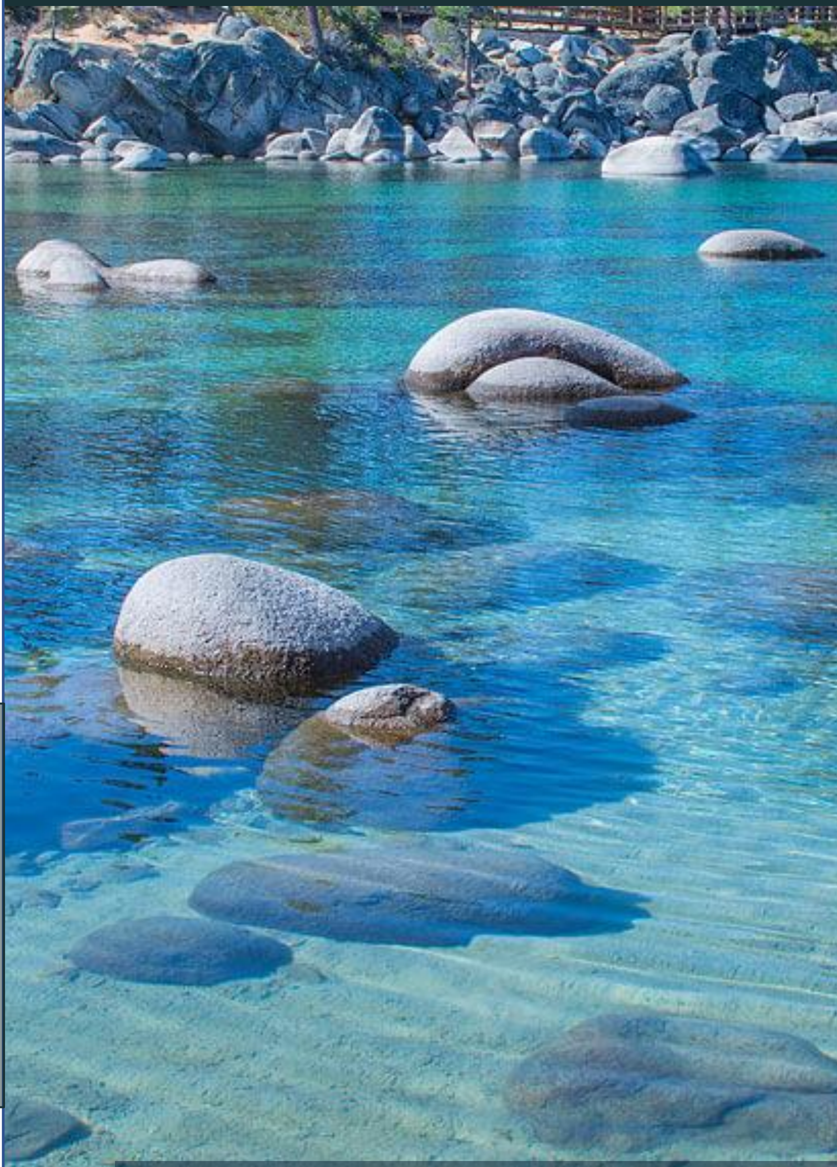

DMRE REF: MP 30/5/1/1/2/17258 PR

Report Credentials.

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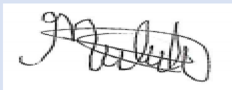
Copyright	

Project details

Report type	**Basic Hydrological Study for a prospecting right application**
Project title	Basic Hydrological study for prospecting right application for Ulibo Resources (Pty) Ltd of Coal on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.
Mineral (s)	Coal
Client	Ulibo Resources (Pty) Ltd
Site location	on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.
Version	01
Date	05 April 2023

		Electronic signatures
Compiled by	Mutali Guduvheni (Hydrogeologist) Singo Consulting (Pty) Ltd, South African Council for Natural Scientific Professions (SACNASP: Earth Science (Candidate Natural Scientist) Reg. No: 141174)	
Reviewed by	Mutshidzi Munyai (Hydrogeologist) Singo Consulting (Pty) Ltd (Water Resources Science (Professional Natural Scientist), (SACNASP Registration Number 122464)	
Final review and approval	Dr. Kenneth Singo (Principal Consultant of Singo Consulting (Pty) Ltd)	

Executive summary

Ulibo Resources (Pty) Ltd appointed Singo Consulting (Pty) Ltd as the independent Environmental Assessment Practitioner (EAP) to compile a Rehabilitation and Closure Plan, as well as financial provisions for its proposed prospecting activities. The prospecting activity will be undertaken in within on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.

This document supplies the Department of Mineral Resources (DMR) with information pertaining to closure planning for the proposed prospecting as required in terms of the National Environmental Management Act 107 of 1998 (NEMA) and the Mineral and Petroleum Resources Development Act 28 of 2002.

The contents of this Rehabilitation and Closure Plan have been prepared as per the requirements of Appendix 5 of the NEMA EIA Regulations of 2014 (GNR 982 and GNR 327) and as stipulated under Appendix 4 of GNR 1147.

The proposed prospecting activities will be conducted in the following phases:

- Site Preparation
- Invasive drilling, trenching, pitting, bulk sampling, and concurrent rehabilitation
- Final decommissioning, rehabilitation, and closure

The proposed area is a typical farmsteads and rural settlement characterized by subsistence farming, an array of livestock farming. The soil agricultural potential of the area varies but may fall within six main ratings, ranging from high potential to very low potential land. However, the larger percentage of land, about 70% can be considered as moderate agricultural land, particularly with regards to crop production.

The aim for closure will be to return the disturbed prospecting target areas to their natural state. It is important to rehabilitate disturbed areas to ensure a safe and stable land use after prospecting for humans, wild animals and livestock.

Summary of rehabilitation and closure actions

Rehabilitation actions for the proposed prospecting activities would be undertaken in two phases namely concurrent rehabilitation and afterwards final decommissioning and rehabilitation. Concurrent rehabilitation would include:

- Sealing of drill holes
- Backfilling of sumps, pits and trenches
- Clean up of surrounding areas, pollution and waste materials

- Spread overburden and topsoil evenly and re-vegetate disturbed areas to finalise the rehabilitation
- Inspect rehabilitated areas to monitor re-vegetation rate and remove alien invader species that may establish in the area;

Final decommissioning and rehabilitation:

- Remove all temporary infrastructure from the site camp and at prospecting sites
- Rip and seed disturbed areas
- Inspect rehabilitated areas to monitor re-vegetation rate as well as to remove alien invader species

It is recommended that concurrent rehabilitation is undertaken to improve the success of rehabilitation. The rehabilitated areas must be monitored to ensure that the objectives of rehabilitation are met, and the correct rehabilitation process is followed.

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1. Introduction

1.1 Background information

Mine rehabilitation is a long-term process, which should ideally begin during the planning phase of a mine development. Mine closure should aim to achieve long-term site stability and the establishment of a self-sustaining ecosystem. The objective of the rehabilitation plan is to ensure activities associated with the Prospecting activities will be designed to prevent, minimise or mitigate adverse long-term environmental and social impacts and create a self-sustaining ecosystem.

Ulibo Resources (Pty) Ltd appointed Singo Consulting (Pty) Ltd as the independent Environmental Assessment Practitioner (EAP) to compile a Rehabilitation and Closure Plan, as well as financial provision for its proposed prospecting activities. The prospecting activity will be undertaken on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.

1.2. Project description

The coal prospecting right application on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province as shown on **Figure 1**. located approximately 31,85km North of Hendrina, 14,64km South of Middleburg and 13,82km North of Optimum coal mine. It can be accessed via the N11 and farm access (gravelly) roads.

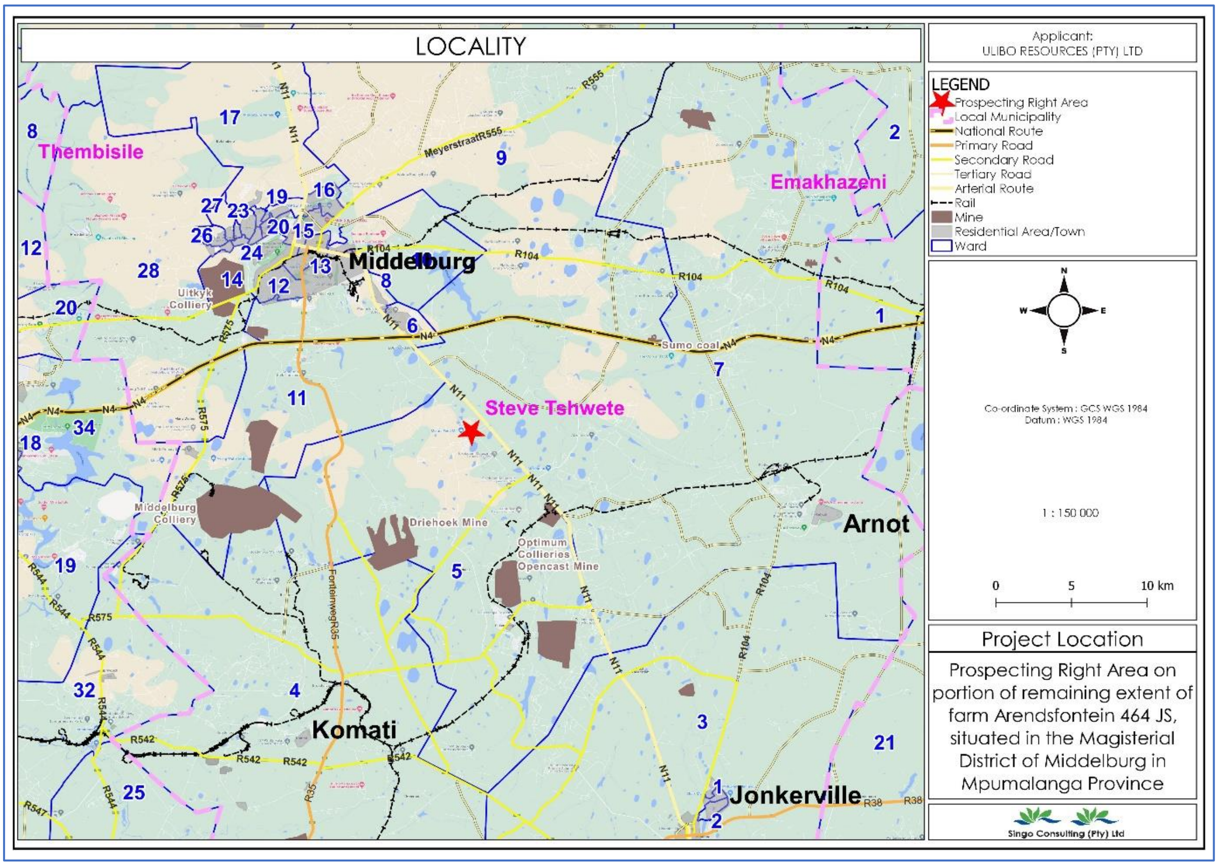

Figure 1: Locality map of the Prospecting area

Prospecting activities will include establishing a main prospecting site for drilling, sample storage, camping site etc. Prospecting at the area will include:

- drill holes (drill pads, excavation, lining of drill water sump)
- Site camp, ablution facilities, site office, equipment storage

More details of the project are entailed in the BAR & EMP report.

2 BASELINE ENIRONMENT

2.1 Soils and Land Capability

Land capability is the ability of land to support a given land use without causing damage. It depends on soil capability in combination with climate. The land capability depends on soil depth which was determined at soil survey positions. Survey positions were recorded as waypoints using a handheld (Global Positioning System (GPS).

2.2 Soil profiles Interpretation

The Freely drained, structureless soils can be defined based on their soil depth, Soil Drainage, erodibility, and natural fertility.

Soil forms

The soil classes map in **Figure 2** below, shows that the Prospecting right area is largely covered with Freely drained, structureless soils.

Soil depth

Depth of the soil profile is from the top to the parent material or bedrock. This type of soil can be classified as a restricted soil depth. A restricted soil depth is a nearly continuous layer that has one or more physical, chemical, or thermal properties.

Soil Drainage

Soil drainage is a natural process by which water moves across, through, and out of the soil because of the force of gravity. The soils in the proposed area have an excessive drainage due to the soils having very coarse texture. Their typical water table is less than 150.

Erodibility

Erodibility is the inherent yielding or non-resistance of soils and rocks to erosion. The freely drained structureless soils have high erodibility. A high erodibility implies that the same amount of work exerted by the erosion processes lead to a larger removal of material.

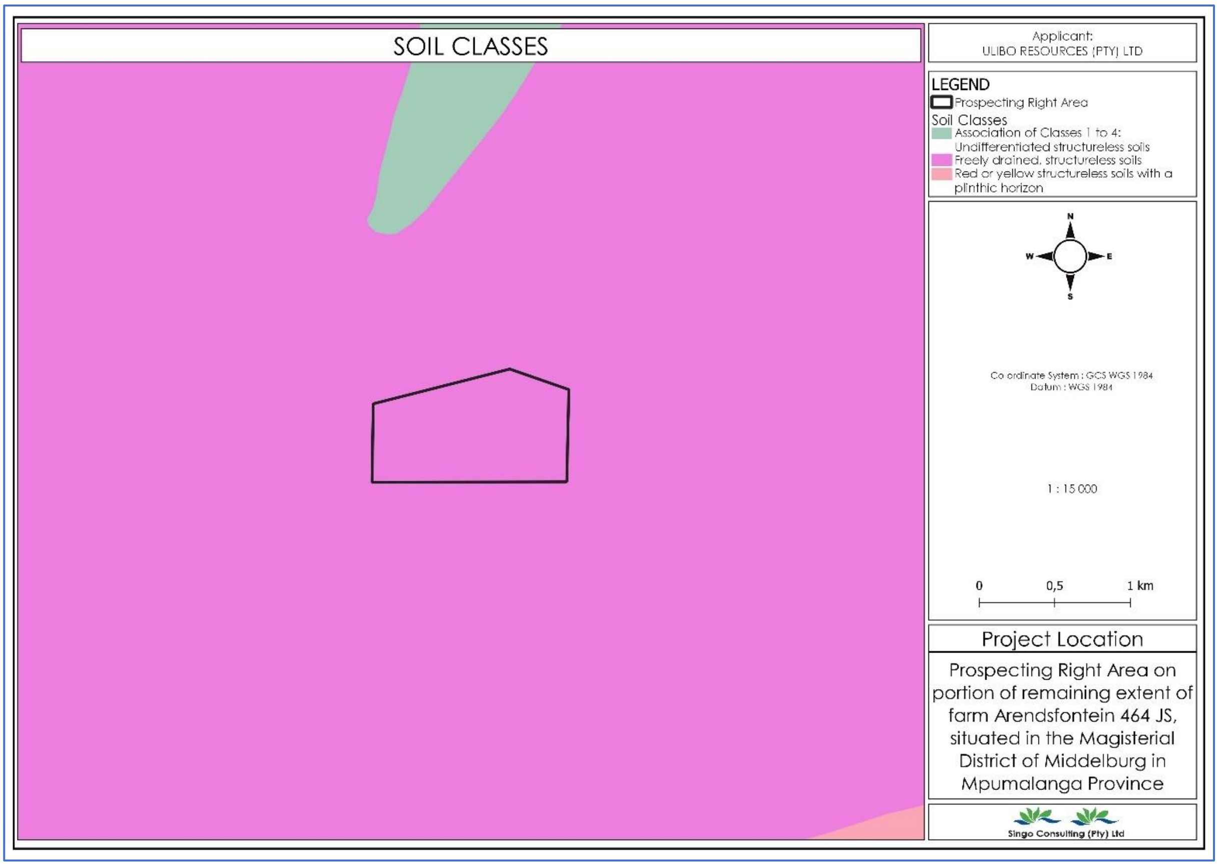

Figure 2: Soil classes map

Photo 1: Pictures on site

2.3 Land Capability and Land Use

The proposed project area is an arable land this type of land it is the land that is used for livestock grazing, as shown in **Figure 3**.

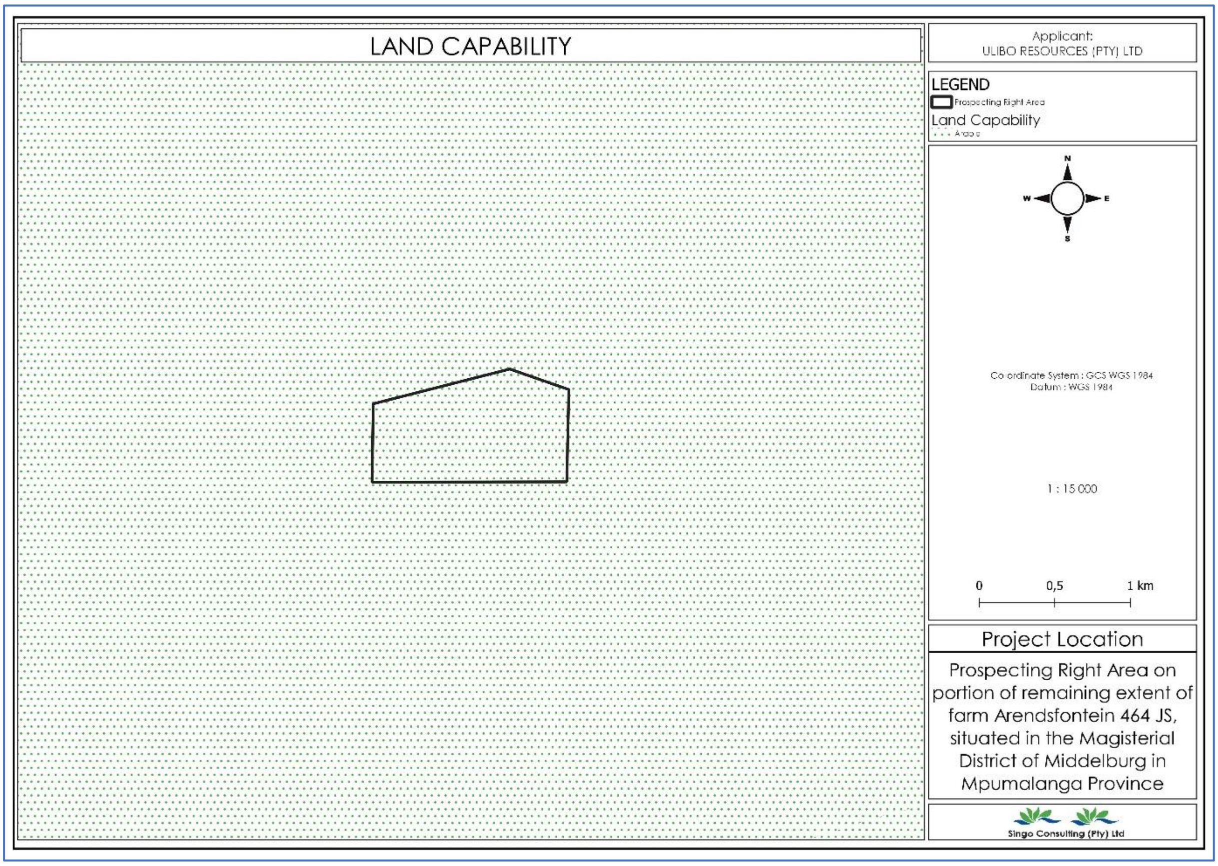

Figure 3: Land capability map of the area

2.4 Fauna and Flora

2.4.1 Flora

According to the Magisterial District of Middelburg in Mpumalanga Province, the most important environmental factors influencing the distribution of plant communities (flora) within the municipal boundary are terrain morphology and soil wetness. The vegetation types found in the municipal area include Moist Sandy Highveld Grassland, The study area is situated within an area vegetated by the Moist Sandy Highveld Grassland vegetation type according to Low & Rebelo (1998) with the most recent vegetation classification, classifying it as Eastern Highveld Grassland (Mucina & Rutherford 2006). The vegetation type is considered to be endangered nationally with none conserved and 55% altered, primarily by cultivation. The conservation status of this vegetation type is very poor, with large parts that are either currently cultivated or have been previously ploughed, and the remaining untransformed vegetation that occurs as patchy remnants that are often heavily grazed.

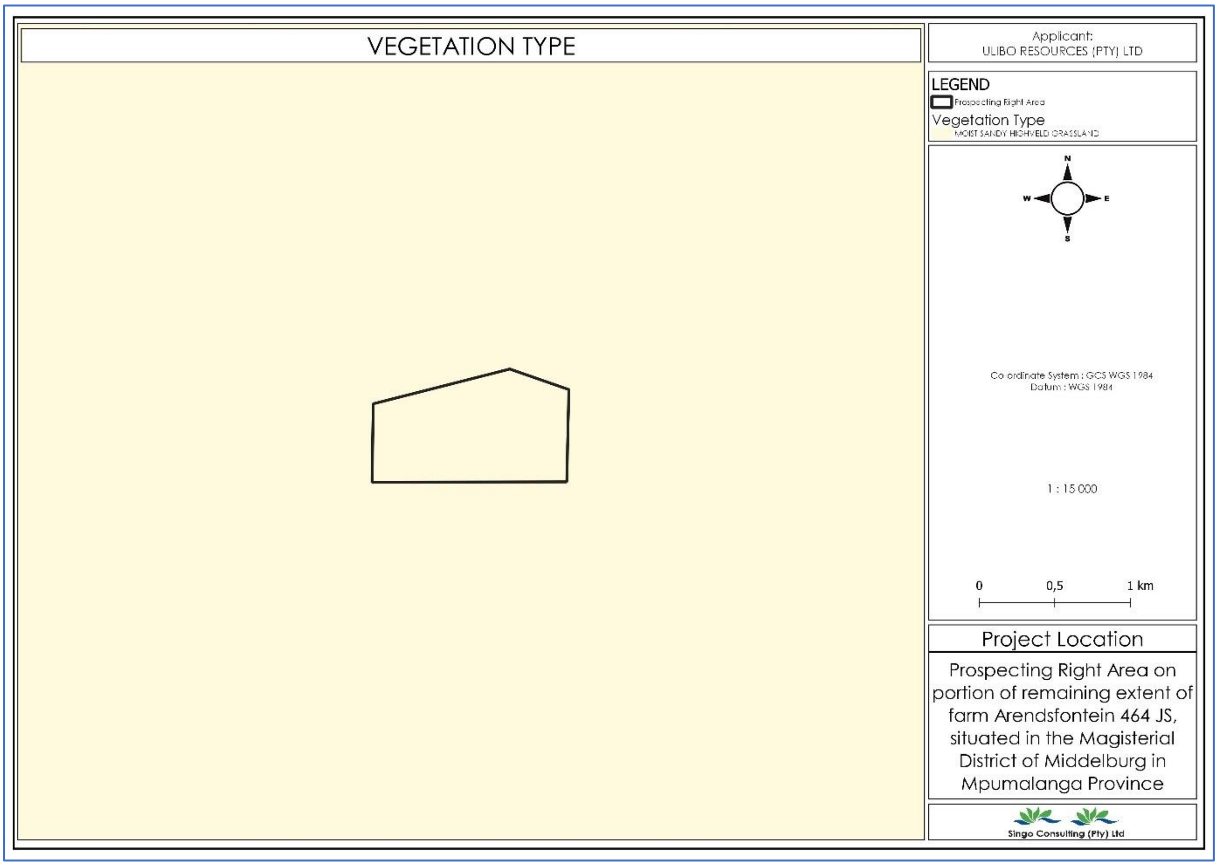

Figure 4: Vegetation map of the mine area

Photo 2: Type of vegetation observed during site assessment.

2.4.2 Fauna

The biome of Grassland is characterized by a high diversity of fauna (animals), including many endangered taxa. The following fauna is likely to occur in the proposed mining/ Prospecting right area: -

- Mammals
- Birds
- Reptiles and,

- Amphibians

Mammals: No Species of Conservation Concern (SCC) were observed during site assessment. However, there are three SCC known to frequent the area from time to time. These include *Crycteropus afer (aardvark NE), Poecilogale albinucha (African Stripped Weasel NE) and Pronolagus crassicaudatus ruddi (Natal Red Rock Rabbit, NE).* Common species expected to frequent the area include *Yellow Mangoose, Vervet Monkey and Meerkat.*

Birds: Habitats are typically associated with grasslands, but the loss of habitat has affected diversity due to site clearing (historical and current). The proposed prospecting area showed intermediate diversity of bird species which included seed eaters and insectivores.

No SCC was observed during site assessment. SCC likely to occur in the area include *emimacronyc chloris (Yellowbreasted Pipit (Vulnerable) Balearica reguloru (Grey Crowned Crane (vulnerable), Eupodotis senegalensis (white Bellied Bustard (vulnerable)*.

Possibility of common bird species to occur in the project area include *axicola torquatus (African Stonechat, Upupa africana (African Hoopoe), Threskiornis aethiopicus (African Sacred Ibis), Elanus caeruleus (Blackshouldered Kite), Vanellus armatus (Blacksmith Lapwing), Passer melanurus (Cape Sparrow) and Motacilla capensis (Cape Wagtail)*.

Reptiles: Reptile faunal environment is called intermediate, reptiles are naturally adaptable, and can live in different environments. The inhabitant suits both the reptiles and their prey. No SCC were observed in the project site. The likelihood of SCC to occur in the area may be low due to the high level of human activity in the area.

No common reptile species were observed during field assessment. This may be due to the season in which the assessment was done.

Amphibians: Because of extreme salinization of the freshwater environment, the general habitat vulnerability for amphibians is considered relatively poor. There were no SCC observed during site assessment. However, the likelihood of the species to occur in the area include *Pyxicephalus adspersus (African Bullfrog) may utilise the ephemeral system.*

No common species were observed although there are common species which are likely to occur during rainy/wet season and these include *Bufo gutturalis (Guttural Toad) Bufo rangeri (Rangers Toad), Cacosternum boettgeri (Boettger's Dainty Frog), Hyperolius marmoratus (Marbled Reed Frog), Kassina senegalensis (Senegal Running Frog) Ptychadena porosissima (Grassland Ridged Frog), Afrana angolensis (Angola River Frog), Afrana fuscigula (Cape River Frog), Strongylopus fasciatus (Striped Stream Frog), Strongylopus grayii (Gray's Stream Frog), Tomopterna natalensis (Natal Sand Frog) and Xenopus laevis (African Clawed Frog)*.

2.5 Surface and Ground Water

The fractured aquifer. The pores of the geological units are generally well cemented, and the principle flow mechanism is fractured flow along secondary structures e.g. faults, bedding plane fractures etc. The intrusion of the fractured aquifer by dolerite dykes and sills has led to the formation of preferential flow paths along the contacts of these lithologies due to the formation of cooling joints. The dykes may act as permeable or semi-permeable features to impede flow across the dykes.

The flow mechanism is fracture flow as can be expected from the crystalline nature of the shale rocks. The water quality is generally characterized by high fluoride levels which limits exploitation of this aquifer in combination with the general low yields, deep (expensive) drilling and the low recharge (Grobbelaar et al, 2004). Prospecting of the Coal has resulted in the introduction of an artificial aquifer system which generally dominates the groundwater flow on a local and regional scale.

Below is a cross sectional figure of a typical fractured aquifer. Water exists in fractures in Karoo weathered aquifers. Two important characterizations that exist in the study area is the upper weathered aquifer system and the lower fractured aquifer system. If the purpose of drilling boreholes is for the supply of water, drillers will usually be directed to drill targeting the fault zones, however in the present study where the boreholes to be drilled are for Coal exploration, fault zones and contacts should be avoided at all costs, to minimize the impact to groundwater. The boreholes drilled must be cased to avoid clogging and contamination.

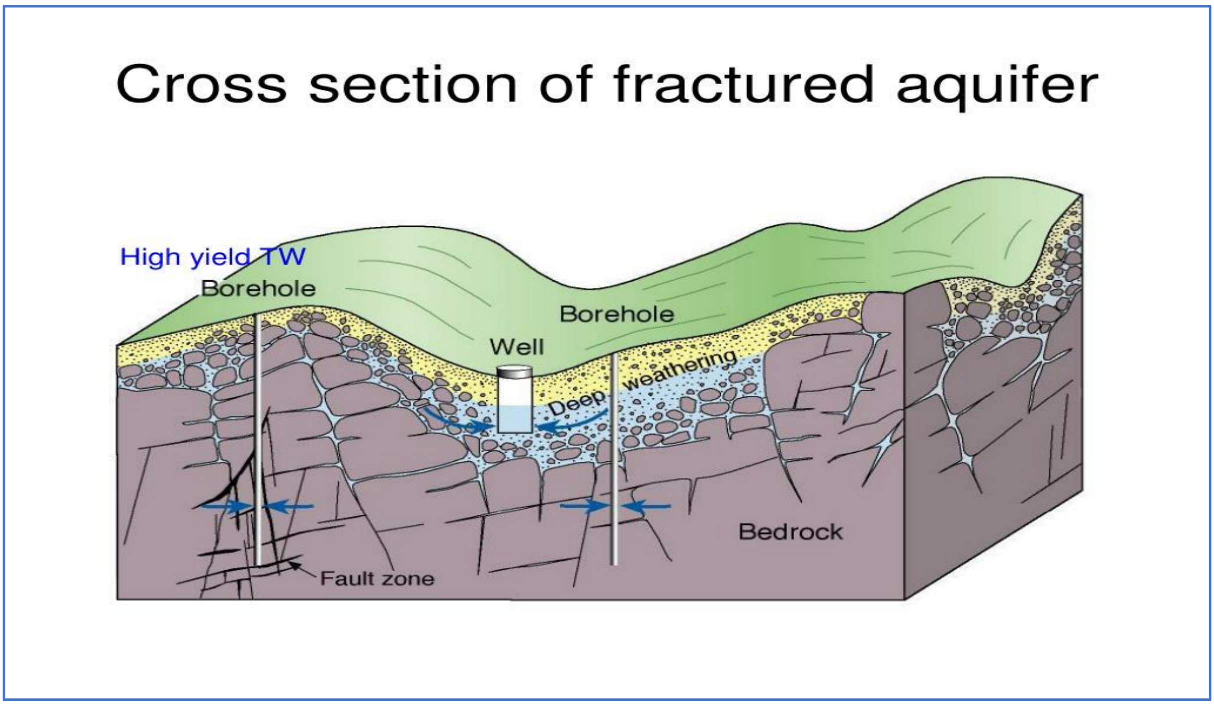

Figure 5: Cross section of a fractured aquifer

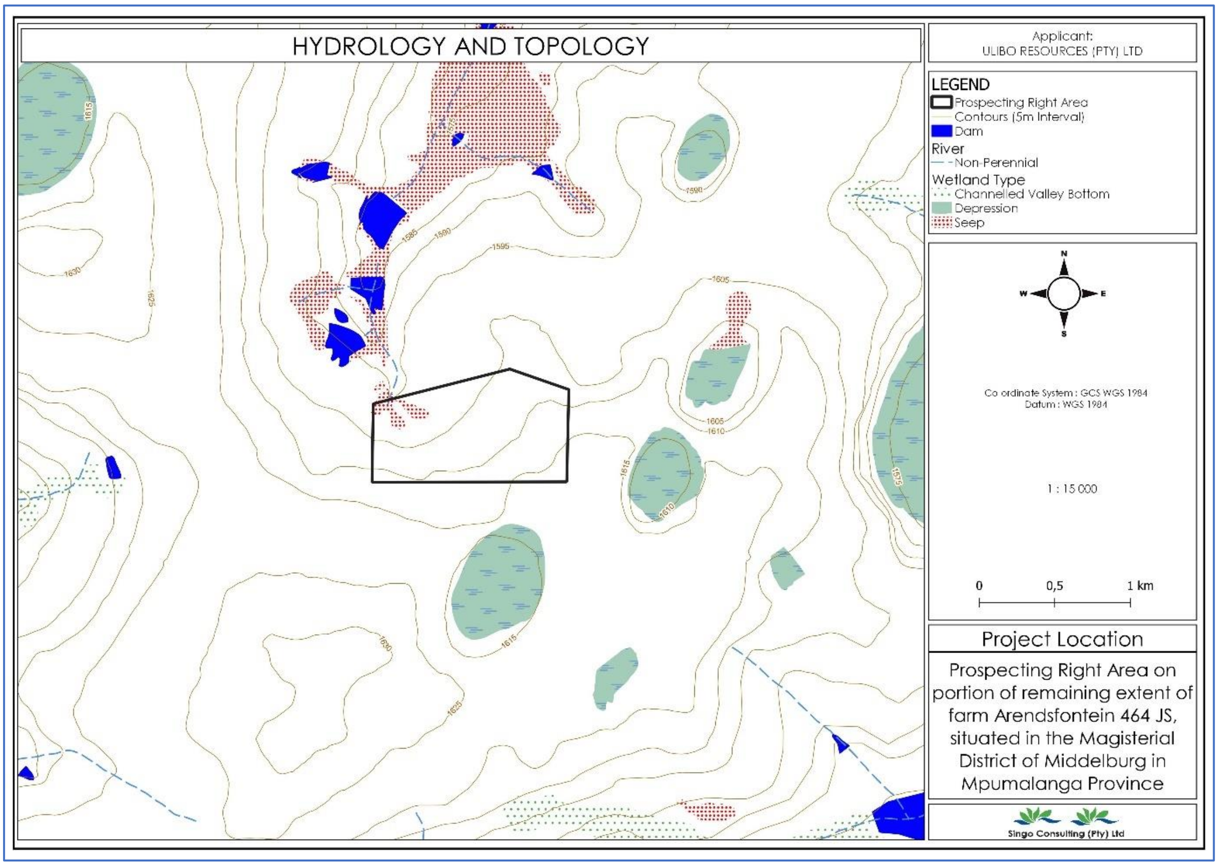

Figure 6: Hydrological map of the study area

3. Requirements for a Rehabilitation and Closure Plan

Mining/ Prospecting in South Africa is renowned as a key element of economic development. However, this significant economic development is shadowed by the environmental damage caused by the prospecting/ mining operations. The disturbance of the natural environment by the Prospecting/ mining industry has triggered the South African government to formulate laws that dictate that miners should pay to remediate the damage they cause.

4 LEGISLATIVE REQUIREMENTS

South Africa's legislation unambiguously places the responsibility of mitigating environmental damage because of prospecting/ Mining operations on prospecting/ mining companies. The liability exists throughout the life of the mine, and beyond in terms of residual impacts. It includes commitments for remediation and/or rehabilitation.

The key legislation governing the requirements for legislation for rehabilitation is contained in the following acts:

- The Constitution of the Republic of South Africa (Act 108 of 1996) ("The Constitution")

- The National Environmental Management Act (Act 107 of 1998, NEMA)
- The Mineral and Petroleum Resources Development Act (Act 28 of 2002, MPRDA)
- The National Water Act (Act of 1998, NWA)
- The National Environmental Management: Biodiversity Act (Act No. 10 of 2004, NEMBA)
- Conservation of Agricultural Resources Act (Act 43 of 1983, CARA)
- National Forests Act (Act 84 of 1998, NFA)
- Mine Health and Safety Act (Act 29 of 1996)
- National Heritage Resources Act (Act 25 of 1999)
- Occupational Health and Safety Act of 1994
- Atmospheric Pollution Prevention Act (Act 45 of 1965)
- Hazardous Substances Act (Act 15 of 1973)
- National Environmental Management: Air Quality (Act 39 of 2004, NEM: AQA)
- National Environmental Management: Waste Management (Act 50 of 2008);
- National Veld and Forest Fire Act (Act 101 of 1998)
- Promotion of Access to Information Act (Act 2 of 2000)

4.1 The Constitution

The Constitution, whilst it does not contain specific provisions for rehabilitation, does enshrine the right of every citizen to an environment that is not harmful to health or wellbeing (Section 24). The inclusion of environmental rights as part of fundamental human rights ensures that environmental considerations are recognised and respected during the administrative and legal processes implemented during the closure and rehabilitation of mined land.

The Bill of Rights, which is an aspect of the Constitution, also provides for rights pertaining to administrative justice, capacity or standing to institute legal proceedings and access to information. These all become relevant within the context of protection and management of the environment during all stages of the mine's life cycle.

4.2 The National Environmental Management Act (Act 107 of 1998)

NEMA aims to establish overarching general guidelines and principles to facilitate environmental management. It promotes Integrated Environmental Management (IEM) (Sections 23 and 24), which aims to integrate environmental management with development.

The concept of rehabilitation has become an imperative part of South African environmental law. Section 28 of NEMA imposes a duty of care to prevent, or where authorised, to minimise environmental degradation. It also provides examples of steps that should be taken to prevent environmental degradation, including the provision for rehabilitation in Section 28 (3) (f), which states that the measures may include measures to "remedy the effects of pollution and degradation. Section 2 of the Act lists a set of principles, with which environmental management must comply and to which Section 37 (1) of the MPRDA refers directly as follows: "The principles set out in Section 2 of the National Environmental Management Act, 1998 (Act No.107 of 1998)

(a) apply to all prospecting and mining operations, as the case may be, and any matter relating to such operation; and

(b) serve as guidelines for the interpretation, administration and implementation of the environmental requirements of this Act.

Section 2 (b) of NEMA states that they "serve as the general framework within which environmental management and implementation plans must be formulated.

The principles of Section 2 of NEMA that are particularly applicable to rehabilitation are:

- The precautionary principle (2 (4) (a) (vii)), which lays the onus on the developer or operator to take a risk averse and cautious approach during decision making, that recognised the "limits of current knowledge about the consequences of decisions and actions". Where uncertainty exists action must be taken to limit the risk.
- The cradle-to-grave (or lifecycle responsibility) principle (2 (4) (e)) states that "responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle
- The project must comply with the requirements for sustainable development (2 (3)), which requires consideration of all relevant factors (2 (4) (a)). A holistic, integrated approach must be followed and the "best practicable environmental option (defined as being "the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term") must be selected.
- The polluter-pays principle (2 (4) (p)) is generally regarded as an important guiding principle for environmental management. The White Paper A Minerals and Mining Policy for South Africa October 1998 state that mining must internalise its external costs. In Paragraph 4.4 (ii) it states that "The mining entrepreneur will be responsible for all costs pertaining to the impact of the operation on the environment.

4.3 The Minerals and Petroleum Resources Development Act (Act 28 of 2002)

The MPRDA is the principal legislation governing the mining industry and along with its regulations (GN R.517) has several provisions relating to rehabilitation. The objectives of the act in terms of rehabilitation are to give effect to environmental rights as outlined in the constitution. The cradle-to-grave principle (described above) is applied by means of the above-mentioned provisions, which cover the various stages of the project that apply from the period prior to prospecting through the construction, operation to closure and beyond.

4.4 Integrated Environmental Management and Responsibility to Remedy (Sections 38 and 39, Regulations 51 and 55 of GN R527)

The mining/ Prospecting right holder must give effect to the principles of IEM as laid down in Chapter 5 of NEMA. An annual review for financial provision and a biennial review (or as stipulated in the EMP, or as agreed to in writing by the Minister of Minerals and Energy) for auditing to ensure that the requirements of IEM are being met, are required (Regulation 55 (2) of GN R.517).

4.4.1 Rehabilitation

Furthermore, Section 38 (1) (d) states that the environment that has been affected by prospecting or mining operations must be rehabilitated to its natural or predetermined state or land use according to the principle of sustainable development (cf. Sections 2 (3) and 2 (4) (a) of NEMA as discussed above as well as Regulation 56, GN R.527 of the MPRDA).

4.4.2 Responsibility for and Management of Adverse Impacts

Section 38 (1) (e) of the MPRDA states that the holder of the mining/ Prospecting right is responsible for any adverse environmental impact resulting from the prospecting operations, "which may occur inside and outside the boundaries of the area to which such right, permit or permission relates." In addition, section 39 (3) (d) provides for a description in the EMPr of the manner whereby remediation of adverse environmental impacts and compliance with prescribed waste management standards are to be implemented.

This along with the provisions in Section 28 (1) of NEMA regarding care of duty and Regulation 56 of GN R527, which also provides for the land being rehabilitated, as far as is practicable, to its natural state, or to a predetermined and agreed standard of land use which conforms with the concept of sustainable development means that the land used by applicant as the permit holder must be restored to its previous state where appropriate, pending stakeholder approval.

4.5 Financial Provision (Sections 23 and 41 and Regulations 10, 52 – 54 of GN R527)

The applicant for a mining/ Prospecting right must make financial provision for the prevention, management or rehabilitation of adverse environmental impacts before prospecting commences. In terms of Section 23, a mining/ Prospecting right is granted only if a number of conditions are met including the requirement that prospecting will not result in unacceptable pollution, ecological degradation or damage to the environment. Regulation 10 requires that detailed documentary proof must be submitted to show that the applicant for a mining/ Prospecting right has the technical ability or access thereto to conduct the mining/ Prospecting activities and to mitigate and rehabilitate relevant environmental impacts.

Section 41 stipulates that approval of an EMPr can only be granted once financial provision for rehabilitation or management of negative environmental impacts has been made.

The obligation for financial provision encompasses the entire life cycle of the prospecting operation from the stage prior to prospecting and/or mining operations through the various phases to closure and beyond as per the cradle-to-grave principle of NEMA. It remains in force until the Minister issues a closure certificate in terms of Section 43. Once the closure certificate has been issued the Minister "may" return the remaining portion of the financial provision. In the event that rehabilitation and closure are not done properly, the Minister may seize assets of the mineral rights holder to defray costs. In the event that this cannot be done then the cost of fixing the problem has to be paid from the Government fund. As a result, this is why there is such a strong focus on rehabilitation and closure plans and the financial provision for closure.

Regulation 54 deals with the quantum of financial provision and stipulates that it must be updated and reviewed annually. It must include, amongst others, a detailed breakdown of the cost required for post-closure management of residual and latent environmental impacts.

This report must be submitted with the Environmental Impact Report (EIR) and Environmental Management Programme (EMPr) for authorisation of the prospecting right activity. This document has been prepared in line with Appendix 5 of the NEMA EIA Regulations of 2014 (GNR 982 and GNR 327) and as stipulated under Appendix 4 of the Financial Provision Regulations of 2015 (GNR 1147).

Exploration drilling

Exploration drilling methods considered include core drilling, reverse circulation or percussion drilling. Areas designated for drill holes, sumps and parking bays will be removed of vegetation and topsoil. The truck mounted drill rig will be placed on site. The drill unit is diesel powered and require storage a low volumes of diesel and oil next to the drill unit. Small sumps would be excavated and lined for the purposes of drilling water. Drill water will be trapped and stored in sumps for reuse in the drilling process. The target areas shall be fenced and temporary cooking and security facilities shall be established.

On completion, drill holes shall be capped by placing a steel casing to a suitable depth and concrete cap on top of the borehole.

Clearing and Stripping of Topsoil

No plants/trees of conservation importance were observed but conservation important birds, butterfly and baboon spiders may occur onsite. Qualified personnel shall observe the targeted areas for the presence/absence of protected trees. They should be demarcated and protected against damage or destruction. Removal of large individual large tree species must be avoided; where it cannot be avoided, a permit for removal will be obtained from the relevant authority.

Access Roads to be established

Existing access roads shall be used as far as possible. Single lane access tracks may be created for in and egress from the targeted areas. Minimal to no vegetation clearance shall be undertaken for these purposes. No access track shall be created through a wetland, stream or any riparian zone. Uphold a 50 metre buffer zone regarded a no-go area for prospecting to riparian areas and wetlands.

5. Rehabilitation and closure plan

Prospecting Rehabilitation Plan aims to inform on the actions required to rehabilitate the prospecting right target areas to ensure a socially and environmentally safe and sustainable area. The Rehabilitation Plan consists of direct activities that will be done where natural area has been disturbed during prospecting activity.

5.1. Aims and Objectives of Rehabilitation and Closure Plan

Rehabilitation and closure is an integral part of all prospecting and mining operations and having a plan serves as a roadmap to direct, refine and implement closure at the end of prospecting/mining. It ensures that the integrity of the environmental is sustained after prospecting/mining operations have ceased. The implementation of this concept also reduced the financial burden of rehabilitation and closure. The main objectives for rehabilitation and closure include:

- Make all areas safe for humans, wild animals and livestock;
- Prevent soil, surface and groundwater contamination by managing water on site; Minimise negative impacts;
- Establish a sustainable cover to prevent erosion and enhance ecological succession;
- Maintain and restore biodiversity levels to provide appropriate habitat for fauna utilisation;
- Protected drainage lines and watercourses
- Not leave any infrastructure onsite;
- Use approved sites for safe disposal of all wastes
- Maintain Traditional Owners access to areas of cultural & heritage significance
- Monitor key environmental variables (i.e. soils, erosion, vegetation) to demonstrate stability of rehabilitated areas

- Adhere to all statutory and other legal requirements

The closure aim would be to return the disturbed prospecting target areas to their natural state for conservation/grazing. It is important to rehabilitate disturbed areas to ensure a safe and stable land use after prospecting for humans, wild animals and livestock.

5.2. Closure Period and Post Closure Requirements

The closure period is the period between stopping of prospecting activities and the completion of active rehabilitation actions on the disturbed target areas. The nature of prospecting is of such that closure may be implemented for individual trenches and boreholes as and when analysis ends.

The closure options together with monitoring over a 2 year post closure period, will achieve the stipulated closure objective. This closure option is in line with the requirements of the MPRDA Regulations. Following successful completion of the closure actions it is suggested that a further post closure period of 2 years be assigned to monitor the success of closure. The post closure monitoring will include:

- Inspection of drill hole caps;
- Inspect and remedy any erosion around rehabilitated trench, drill sites
- Inspect rehabilitated areas re-vegetation rate
- Remove alien invader species

5.3. Rehabilitation and Closure

The clearing of soil surface areas would be restricted to what is really necessary for prospecting and construction/estalishment of infrastructure. During rehabilitation and closure of these sites, or where vegetation is lacking or compacted, the areas would be ripped or ploughed and levelled in order to reestablish a growth medium and if necessary fertilise to ensure the regrowth of vegetation and the soil ameliorated based on a fertiliser recommendation (soil sample analysed).

As the project progresses there will be an increase in topsoil surface area disturbed initially but also concurrent rehabilitation will take place which involves the replacement of topsoil on backfilled pits and trench areas. All drill holes and trenches will be rehabilitated after drilling and sampling activities have been completed to avoid risk of fauna, livestock falling into open drill holes and trenches.

The disturbed sites shall be returned as closely as possible to the original state.

5.4. Rehabilitation of access roads

- Existing roads will be used as far as possible;
- Whenever the prospecting right is suspended/cancelled or lapses such access road shall be rehabilitated to the satisfaction of the Regional Manager;
- Any gate or fence set up by the holder shall be removed and situation restored to the preprospecting state;
- Any temporary roads created, single track or formal shall be ripped or ploughed, and where necessary fertiliser (based on soil analysis) applied to ensure the regrowth of vegetation;
- If reasonable assessment indicates that re-establishment of vegetation is unacceptably slow the Regional Manager may require that the soil be analysed and any deleterious effects on the soil arising from the prospecting operation, be correct and the area be seeded with seed mix to Regional Managers specification;

5.5. Rehabilitation of surface trenches/pits and drill holes

On completion of operations, all structures or objects at the site camp shall be dealt with in accordance with Section 44 of the MPRDA. After all foreign matter has been removed from site; excavations shall be backfilled with subsoil, compacted and levelled with previously stored topsoil. No foreign matter such as cement or other rubble shall be introduced into such backfilling.

On completion of the prospecting operation, the areas shall be cleared of any contaminated soil. The surface shall then be ripped or ploughed to a depth of at least 300mm (Mispha soils limited in depth to 300mm) and the topsoil previously stored adjacent to excavations, shall be spread evenly to its original depth over the whole area. The area shall then be fertilised if necessary. The site shall be seeded with a vegetation seed mix adapted to reflect the local indigenous flora. Where sites have been rendered devoid of vegetation or where soils have been compacted by heavy machinery, the surface shall be scarified and ripped.

Drill holes shall be capped by placing a steel casing to a suitable depth and concrete cap on top of the borehole.

Photographs of the different prospecting target sites, before, during prospecting and after rehabilitation and closure, will be taken at selected fixed points and kept on record for regional manager"s information.

Rehabilitation of the new landscape would be done in such a manner to blend in with the surrounding landscape and allow normal surface drainage to continue. Water control systems must be implemented to prevent erosion.

The visual impact would be addressed by means of:

- Re-vegetation with grasses
- Removal of any infrastructure, scrap, waste that would contribute to a negative impact.

5.6. Fertilising of Areas to be rehabilitated

If a reasonable assessment indicates that the re-establishment of vegetation is unacceptably slow, it may be required that soil be analysed and any effects from prospecting be corrected and the area be seeded with a seed mix to his or her specification.

5.7. Seeding of Grass Seed Mixture and planting of Woody Species

The seed mix must therefore take into account the availability of indigenous grass seeds as per the above, different soil situations and the prevailing climatic conditions of the area. The herbaceous layer of the affected on portion of Portion of the Remaining Extent of the Farm Arendsfontein 464 JS, situated in the Magisterial District of Middleburg, Mpumalanga Province.

5.8. Demolition / Removal of infrastructure

On completion of operations all structures or other infrastructure on the prospecting terrain shall be dealt with in accordance with Section 44 of the MPRDA.

5.9. Monitoring and Maintenance

The post-monitoring period following decommissioning of prospecting activities must be implemented by a suitable qualified independent party for a minimum of 2 years unless otherwise specified by the DMR. The monitoring activities during this period would include:

- Inspection of drill hole caps
- Inspect and remedy of erosion around rehabilitated trench and drill sites
- Inspect rehabilitated areas re-vegetation rate
- Remove alien invader species

Provision must be made to monitor any unforeseen impact that may arise as a result of the proposed prospecting activities and incorporated into post closure monitoring and management.

5.10. Post Closure Monitoring and Maintenance

Prior to decommissioning and rehabilitation activities, a monitoring programme shall be developed and submitted to the DMR for approval, as part of the Final Rehabilitation Plan. The proramme is to include proposed monitoring during and after the closure of prospecting sites. It is recommended that post-closure monitoring include the following:

- Confirm all de-contaminated sites are free of latent pollution after decommissioning;
- Confirm all waste, wastewater or other pollutants generated as a result of decommissioning will be managed appropriately, as per requirements of the Final Rehabilitation Plan;
- Confirm acceptable cover has been achieved in areas where indigenous vegetation is re- established;
- Confirm that trench, pit and drill hole sites (all prospecting target areas) are safe and not a potential hazard for humans, wild animals or livestock.

Annual Environmental Report will be submitted to the DMR at least one year post decommissioning. The monitoring reports shall include a list of any remedial action required to ensure that the site remains safe and pollution free after infrastructure has been removed and alien invader species free.

6. Environmental Indicators

Table 1: Measures to rehabilitate the affected environment

Activities	**Phase**	**Size and scale of disturbance**	**Mitigation measures**	**Compliance with standard**	**Time period for implementation**
Drill hole closure	Decommissioning and closure	Short-term and localised	All prospecting drillholes should be plugged and sealed with cement. Cement and liquid concrete are hazardous to the natural environment on account of the very high pH of the material and the chemicals contained therein. As a result, the contractor shall ensure that Concrete shall not be mixed directly on the ground The visible remains of concrete either solid or from washings, shall be physically removed immediately and disposed of as waste. Washing of visible signs into the ground is not acceptable All excess aggregate shall also be removed	NWA DWF BPG	Throughout decommissioning and closure
Removal of surface infrastructure	Decommissioning	Short-term and localised	All infrastructure, equipment and other items used during prospecting will be removed from the site Compaction of soil must be avoided as far as possible. The use of heavy machinery must be restricted in areas outside of the proposed prospecting sites to reduce the compaction of soils	MPRDA Rehabilitation Plan	Decommissioning
Removal of waste (General and hazardous waste)	Decommissioning	Small scale and localised	Any excess or waste material or chemicals including drilling muds etc. must be removed from the site and must preferably be recycled (e.g. oil and other hydrocarbon waste products). Any waste materials or chemicals that cannot be recycled must be disposed of at a suitably licensed waste facility	NWA DWF BPG	Decommissioning

Activities	Phase	Size and scale of disturbance	Mitigation measures	Compliance with standard	Time period for implementation
Monitoring	Post-operation	All rehabilitation	The post-operational monitoring and management period following decommissioning of prospecting activities must be implemented by a suitable qualified independent party for a minimum of two (2) years unless otherwise specified by the competent authority The monitoring activities during this period will include but are not limited to: Biodiversity monitoring Re-vegetation of disturbed areas where required Provision must be made to monitor any unforeseen impact that may arise as a result of the proposed prospecting activities and incorporated into post closure monitoring and management	MPRDA Rehabilitation Plan	Post -operation

7. Managerial Capacity

The applicant will be responsible for ensuring compliance with all the provisions of the prospecting right and supporting plans. The Applicant must have the knowledge and understanding of the applicable legislation and guidelines. The applicant must where necessary appoint suitably qualified specialists, engineers and other internal and external resources to comply with the applicable commitments and requirements. The applicant must also ensure that suitable communication avenues are in place with local communities and relevant stakeholders.

An independent Environmental Assessment Practitioner shall be appointed to ensure compliance with requirements of the Final Rehabilitation, Decommissioning and Closure Plan and to undertake the following tasks:

- Conduct pre-closure environmental site assessment, risk assessment and landowner consultation
- Compile a site specific final closure and decommissioning plan;
- Conduct periodic compliance monitoring and reporting during closure.

Prospecting Contractor who has relevant experience in prospecting. The contractor must have experience in prospecting site closure as well as closure standards and guidelines. This contractor would be responsible for ensuring the closure plan is implemented and to ensure that environmental and social risks are prevented or minimised.

8. Relinquishment Criteria

The end land use is natural / grazing as the study site is covered in pristine indigenous vegetation and is a declared nature reserve.

The relinquishment criteria therefore include:

- No waste materials must have remained on site
- The vegetation cover of the disturbed target sites must be consistent with the surrounding vegetation cover, biodiversity levels restored and no faunal mortalities due to prospecting.
- All complaints registered during the prospecting and closure must have been addressed

9. Closure cost calculation

This Financial Provision Calculation has been undertaken as per the Department of Mineral Resource (DMR) "Guideline Document for Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine" published in January 2005. The DMR Guideline format makes use of a set template for which defined rates and multiplication factors are used. The multiplication and weighting factors which ultimately define the rate to be used are determined by amongst others the topography, classification of the mine according to the mineral mined, the risk class of the mine and its proximity to built-up or urban areas. The 2005 DMR Master Rates were updated and published by the DMR in 2012 however, due to inflation, these are no longer accurate. An average inflation of 6% was used to reflect 2018 costs.

9.1. DMR Classification

The DMR Guideline Document classifies a mine/activity according to a number of factors which allows one to determine the appropriate weighing factors to be used during the quantum calculation which include:

- Mineral mined/explored
- Risk class of mine/operation
- Environmental sensitivity of site
- Type of operation proposed
- Geographic location

Once the risk class (Class A, B or C) and the sensitivity of the area where the mine is located (, High Medium, Low) had been determined using the appropriate tables the unit rates for the applicable closure components were identified. The primary risk class is categorised as Class A (High Risk), Class B (Medium Risk) or Class C (Low Risk). Prospecting sampling can be considered as Class C – Low Risk operation. The study site sensitivity was determined by establishing the overall sensitivity of the area by accepting the most sensitive of the three (biophysical, social, and economic).

In terms of biophysical the site is of low sensitivity due to it being largely natural with a vibrant fauna and flora and as it forms part of an overall ecological regime of conservation value. From a social perspective, the site is of medium sensitivity due to local communities being within sighting distance of some of the target areas.The overall activity class is to be Class C.

7.3. Summary of financial provision

Table 1: Financial Provision Calculation

CALCULATION OF THE QUANTUM

Applicant: **ULIBO RESOURCES (PTY) LTD** — **DMRE REF: MP 30/5/ MP 30/5/1/1/2/16911 PR**
Evaluator: **Singo Consulting (Pty) Ltd** — **Date:17 M**

No.	Description	Unit	A Quantity	B Master Rate	C ltiplicati factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)
1	Dismantling of processing plant and related structures (including overland conveyors and powerlines)	m3	0	19	1	1	0
2 (A)	Demolition of steel buildings and structures	m2	0	271	1	1	0
2(B)	Demolition of reinforced concrete buildings and structures	m2	0	400	1	1	0
3	Rehabilitation of access roads	m2	5683	49	0,2	0,3	16708,02
4 (A)	Demolition and rehabilitation of electrified railway lines	m	0	471	1	1	0
4 (A)	Demolition and rehabilitation of non-electrified railway lines	m	0	257	1	1	0
5	Demolition of housing and/or administration facilities	m2	0	542	1	1	0
6	Opencast rehabilitation including final voids and ramps	ha	0	284292	1	1	0
7	Sealing of shafts adits and inclines	m3	0	146	1	1	0
8 (A)	Rehabilitation of overburden and spoils	ha	0	189528	1	1	0
8 (B)	Rehabilitation of processing waste deposits and evaporation ponds (non-polluting potential)	ha	0	236054	1	1	0
8 (C)	Rehabilitation of processing waste deposits and evaporation ponds (polluting potential)	ha	0	685612	1	1	0
9	Rehabilitation of subsided areas	ha	0	158701	1	1	0
10	General surface rehabilitation	ha	0,9	150138	0,4	0,3	16214,904
11	River diversions	ha	0	150138	1	1	0
12	Fencing	m	0	171	1	1	0
13	Water management	ha	0	57087	1	1	0
14	2 to 3 years of maintenance and aftercare	ha	0	19980	1	1	0
15 (A)	Specialist study	Sum	0			1	0
15 (B)	Specialist study	Sum				1	0
					Sub Total 1		32922,924

1	Preliminary and General	3950,75088	weighting factor 2 1	3950,75088
2	Contingencies		3292,2924	3292,2924
			Subtotal 2	40165,97
			VAT (15%)	
			Grand Total	**40166**

Sign THILIVHALI NDOU
Date 17/03/2023

8. Closure monitoring, auditing, and reporting

Monitoring is of ultimate importance as closure will only be obtained once evidence can be presented to the DMR that the closure objectives have been achieved and that closure plans have been effectively implemented and rehabilitation is sustained.

The mechanisms that will be applied to monitor the success of the EMPr include:

- Performance Assessment Report of the EMPr and Closure Plan
- Physical monitoring
- Compliance Audits
- Addressing external complaints, incident reporting

The Project Geologist, normally, will be responsible for daily monitoring. Internal monthly and annual performance assessment would be conducted of which records would be kept to inform an annual Performance Assessment Report of the EMPr and Closure Plan which will be submitted to the DMR. An external audit in the form of an EMPr Performance Assessment will be conducted every two years by an independent consultant and submitted to the DMR.

According to Regulation 34 of the NEMA EIA Regulations of 2014, the holder of an environmental authorisation must for the period during which the environmental authorisation, EMPR and Closure Plan remain valid:

- Ensure compliance with the conditions of the environmental authorisation and the EMPR and where applicable the closure plan, is audited and;
- Submit an environmental audit report to the relevant competent authority.

9. Recommendations

9.1. Compliance with Closure Plan

The closure objectives can only be achieved by fore filling the responsibilities as set out in the rehabilitation plan. Closure objectives cannot be achieved if the actions of the rehabilitation plan are not complied with resulting in an unsuccessful closure plan.

9.2. Annual update requirements of the plan

The closure plan must be reviewed annually and updated as and when major changes are effected to the Prospecting Works Programme.

9.3. On-site documents

The closure plan must be available onsite as per the requirements of Regulation 26 (h) of NEMA EIA Regulations of 2014.