mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

BASIC ASSESSMENT REPORT

And

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: ORION EXPLORATION NO. 5 (PTY) LTD.

TEL NO: 087 310 5468

FAX NO: NONE

POSTAL ADDRESS: 87 CENTRAL ROAD, HERLEAR, KIMBERLEY

PHYSICAL ADDRESS: 87 CENTRAL ROAD, HERLEAR, KIMBERLEY

FILE REFERENCE NUMBER SAMRAD: NC30/5/1/1/2/12258PR

FILE REFERENCE NUMBER SAMRAD: NC30/5/1/1/2/12258PR

1. IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

2. Objective of the basic assessment process

The objective of the basic assessment process is to, through a consultative process─

(a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;

(b) identify the alternatives considered, including the activity, location, and technology alternatives;

(c) describe the need and desirability of the proposed alternatives,

(d) through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage , and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on the these aspects to determine:

  (i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
  (ii) the degree to which these impacts—
    (aa) can be reversed;
    (bb) may cause irreplaceable loss of resources; and
    (cc) can be managed, avoided or mitigated;

(e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—
  (i) identify and motivate a preferred site, activity and technology alternative;
  (ii) identify suitable measures to manage, avoid or mitigate identified impacts; and
  (iii) identify residual risks that need to be managed and monitored.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF MAPS IN APPENDIX B

LIST OF ACRONYMS AND ABBREVIATIONS

AEM	Airborne Electromagnetic Survey
AQSR	Air Quality Sensitive Receptor
BAR	Basic Assessment Report
CBA	Critical Biodiversity Area
CRR	Comment and Response Register
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ESA	Ecological Support Area
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IWULA	Integrated Water Use Licence Application
IWWMP	Integrated Water and Waste Management Plan
Kl	Kilolitre
Ktpa	Kilotons per annum
Ktpm	Kilotons per month
L	Litre
M	Metre
mamsl	Metres above mean sea level
Mm	Millimetre
MPRDA	Minerals and Petroleum Resources Development Act
MR	Mining Right
MRA	Mining Right Application
Mtpa	Million tons per annum
NEMA	National Environmental Management Act
NEM:AQA	National Environmental Management: Air Quality Act
NEM:BA	National Environmental Management: Biodiversity Act
NEM:WA	National Environmental Management: Waste Act
NHRA	National Heritage Resources Act
NWA	National Water Act
p.a.	Per annum
PR	Prospecting Right
PRA	Prospecting Right Application
SAHRA	South African Heritage Resource Agency
SDF	Spatial Development Framework
SLM	Siyathemba Local Municipality
TDEM	Time-Domain Electromagnetic
TEM	Transient Electromagnetic Survey
VHMS	Volcanic Hosted Massive Sulphide

PART A
BASIC ASSESSMENT REPORT

1 CONTACT PERSON AND CORRESPONDENCE ADDRESS

1.1 DETAILS OF THE EAP WHO PREPARED THE REPORT

Name of the Practitioner:	ABS Africa (Pty) Ltd.
Tel No.:	+27 11 805 0061
E-mail address:	paul@abs-africa.com

1.2 EXPERTISE OF THE EAP

1.2.1 THE QUALIFICATIONS OF THE EAP

Name: Mr. Paul Furniss

Academic Qualifications:

- Bachelor of Agricultural Science in Animal Science: University of Pretoria, 1998
- Bachelor of Science (Honours) in Wildlife Management: University of Pretoria, 1999
- Master of Science in Environmental Science (Water Resource Management): University of Pretoria, 2000

Professional Registration:

- Pr.Sci.Nat. Professional Natural Scientist (Environmental Science): The South African Council for Natural Scientific Professions, 2007.
- Certified Environmental Assessment Practitioner: Environmental Assessment Practitioners Association of South Africa.

Name: Ms. Chané Pretorius

Academic Qualifications:

- Bachelor of Science in Tourism: North West University, 2010
- Bachelor of Science (Honours) in Geography: University of Johannesburg, 2011

1.2.2 SUMMARY OF THE EAPS PAST EXPERIENCE

ABS Africa (Pty) Ltd is a professional environmental advisory company with a focus on the mining industry. The ABS Africa personnel included in the project team structure for the independent environmental assessment have collectively completed more than 100 EIAs across the African continent.

Much of this experience has been gained in undertaking complex and challenging EIAs involving the management of specialist teams, conducting public participation processes, aligning international standards with in-country legislation and interfacing with project engineering teams.

Please refer to Appendix A for a record of the experience of the EAP.

2 LOCATION OF OVERALL ACTIVITY

2.1 OVERVIEW

Orion Exploration No. 5 (Pty) Ltd is applying for a Prospecting Right for various minerals within the Copperton Subvolcanic area. The location and extent of the proposed prospecting right areas are shown in Table 2-1.

TABLE 2-1: DESCRIPTION OF THE PROPERTIES

<table>
<tr><td>FARM NAMES:</td><td>The following farms relate to the prospecting right application:

<table>
<tr><th>Farm Name</th><th>Farm Number</th><th>Subdivision Number</th><th>Extent (Ha)</th></tr>
<tr><td>Klipgats Pan</td><td>117</td><td>5</td><td>1330,53</td></tr>
<tr><td>Kaffirs Kolk</td><td>118</td><td>1</td><td>2855,04</td></tr>
<tr><td>Kaffirs Kolk</td><td>118</td><td>4</td><td>861,45</td></tr>
<tr><td>Klipgats Pan</td><td>117</td><td>4</td><td>2621,92</td></tr>
<tr><td>Hoekplaas</td><td>146</td><td>RE</td><td>5016,31</td></tr>
<tr><td>Kaffirs Kolk</td><td>118</td><td>RE</td><td>1984,02</td></tr>
<tr><td>Humansrus</td><td>147</td><td>RE</td><td>2344,50</td></tr>
<tr><td>Klipgats Pan</td><td>117</td><td>3</td><td>2661,44</td></tr>
</table>

Please see Map 1 - Locality Map in Appendix B.</td></tr>
<tr><td>APPLICATION AREA (HA):</td><td>The extent of the area that will be required for prospecting is approximately 19 666 Hectares. Please see Map 1 - Locality Map in Appendix B.</td></tr>
<tr><td>MAGISTERIAL DISTRICT:</td><td>Siyathemba Local Municipality

Pixley ka Seme District Municipality</td></tr>
<tr><td>DISTANCE AND DIRECTION TO NEAREST TOWNS</td><td>The proposed prospecting right area is located approximately 15 km South and 60 km South-West of Copperton and Prieska respectively in the Northern Cape Province.</td></tr>
</table>

TABLE 2-2: DIGIT SURVEYOR-GENERAL CODE FOR EACH FARM PORTION

Farm Name	Farm Number	Subdivision Number	SG Code
Klipgats Pan	117	5	C06000000000011700005
Kaffirs Kolk	118	1	C06000000000011800001
Kaffirs Kolk	118	4	C06000000000011800004
Klipgats Pan	117	4	C06000000000011700004
Hoekplaas	146	RE	C06000000000014600000
Kaffirs Kolk	118	RE	C06000000000011800000
Humansrus	147	RE	C06000000000014700000
Klipgats Pan	117	3	C06000000000011700003

2.2 LOCALITY MAP

Please refer to Appendix B Map 1.

3 DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

The region of interest, the Copperton Subvolcanic area, is situated in the Northern Cape Province and is part of the geological Areachap Group. The nearest town to the proposed prospecting area is Copperton (15 km north). Prieska is situated approximately 60 m north-east of the proposed prospecting area.

Orion Exploration No. 5 intends to undertake prospecting activities for a variety of minerals by means of the following non-invasive and invasive prospecting methods:

3.1.1 NON-INVASIVE PROSPECTING METHODS

- Compile a working plan on a scale of 1: 10 000, which would integrate all geological, geophysical and geochemical data, as well as farm tracks, fences and drainages, to cover the relevant portion of the prospect area.
- Geological mapping of a zone covering the approximate position of the old "sea floor".
- Geophysical Surveys.
- Reconnaissance soil sampling traverses followed by more detailed and systematic soil sampling and trenches.
- Geochemical Surveys- It is expected that more than 1 000 soil samples may be collected on traverse lines and analysed using a hand-held XRF.

3.1.2 INVASIVE PROSPECTING METHODS

- Diamond-core drilling to test the conductors and soil geochemical anomalies at depth (20 m to 400 m).
- If economic grades of base metals are intersected, follow-up diamond-core boreholes will be drilled to delineate the economic zones.
- An initial 15 holes are planned to a depth of 400 m for the exploration phase.
- If the drilling determines an economic deposit, it will be modelled, and a pre-feasibility study will be done resulting in a resource statement and feasibility study.
- Minor trenching may be conducted in areas of limited outcrop to determine geological contacts and continuity.
- No bulk sampling or testing will be carried out for the duration of the prospecting right applied for.

Diamond core drilling is used to retrieve a large piece of relatively intact cylindrical rock. This technique is so named for industrial strength diamonds that are placed into the hollow end of the drill bit and they are used to cut away at almost any strength of rock or other material. Diamond drilling is a hydraulic assisted method that produces no dust. The cutting edge is constantly water flushed and all rock chips and fine particles are transported up the hole as a sludge.

Diamond drilling is appropriate where more detailed geological information needs to be obtained and for accurate ore sampling. The process involves the use of light and easy to transport equipment and it can be used in just about all locations, including underwater. Another advantage is that diamond drilling produces less noise pollution and little or no dust.

The eventual extent of an orebody, if one exists, will determine the number of diamond-core boreholes to be drilled. For an orebody of 10 million tons, assuming a strike extent of 1 km and a dip extent of 800 m, 30 to 40 diamond-core boreholes will need to be drilled to a depth of approximately 800 m. The drilling program will be confirmed through the surface work plan.

If, at the end of this prospecting period, an orebody of economic tonnage and grade is proven, an extension of the prospecting right will be applied for, for the purpose of bulk sampling and testing. In the event of an economic orebody being proven or indicated well before the end of the prospecting period, an amended work program will be submitted to the DMR for approval.

FIGURE 3-1: TYPICAL DIAMOND-CORE DRILLING RIG

TABLE 3-1: DETAILED PROSPECTING WORKS PROGRAM

PHASE	ACTIVITY (WHAT ARE THE ACTIVITIES THAT ARE PLANNED TO ACHIEVE OPTIMAL PROSPECTING)	SKILL(S) REQUIRED (REFERS TO THE COMPETENT PERSONNEL THAT WILL BE EMPLOYED TO ACHIEVE THE REQUIRED RESULTS)	TIMEFRAME (IN MONTHS) FOR THE ACTIVITY)	OUTCOME (WHAT IS THE EXPECTED DELIVERABLE, E.G. GEOLOGICAL REPORT, ANALYTICAL RESULTS, FEASIBILITY STUDY, ETC.)	TIMEFRAME FOR OUTCOME (DEADLINE FOR THE EXPECTED OUTCOME TO BE DELIVERED)	WHAT TECHNICAL EXPERT WILL SIGN OFF ON THE OUTCOME? (E.G. GEOLOGIST, MINING ENGINEER, SURVEYOR, ECONOMIST, ETC)
1	Non-Invasive Prospecting Literature Survey Geological Mapping	Geologist Geologist	3 Months 3 Months	Maps and detail reports. Maps and geological repos	3 Months 3 Months	Geologist Geologist
1	Non-Invasive Prospecting Airborne Geophysical Survey Ground Geophysical Survey	Geophysicist Geophysicist	3 Months 3 Months	Regional targets Drilling targets	3 Months 3 Months	Geophysicist Geophysicist
2	Non-Invasive Prospecting Soil sampling Invasive Prospecting Trenches	Geologist Geologist	3 Months 3 Months	Maps and detail reports. Geological contacts	3 Months 3 Months	Geologist Geologist
3	Invasive Prospecting Drilling	Geologist	18 Months	Borehole core data	18 Months	Geologist
4	Invasive Prospecting Resource drilling	Geologist	24 Months	Borehole core data	18 Months	Geologist
5	Non-Invasive Prospecting Analytical desktop studies	Geologist / Mine Economist	3 Months 3 Months	Pre-feasibility reports. Resource Statement	3 Months 3 Months	Geologist Geologist

3.2 LISTED AND SPECIFIED ACTIVITIES

(The layout for activities described below will only be established once non-invasive prospecting has been completed).

NAME OF ACTIVITY (ALL ACTIVITIES INCLUDING ACTIVITIES NOT LISTED) (E.G. EXCAVATIONS, BLASTING, STOCKPILES, DISCARD DUMPS OR DAMS, LOADING, HAULING AND TRANSPORT, WATER SUPPLY DAMS AND BOREHOLES, ACCOMMODATION, OFFICES, ABLUTION, STORES, WORKSHOPS, PROCESSING PLANT, STORM WATER CONTROL, BERMS, ROADS, PIPELINES, POWER LINES, CONVEYORS, ETC…ETC…ETC.)	AERIAL EXTENT OF THE ACTIVITY HA OR M^2	LISTED ACTIVITY MARK WITH AN X WHERE APPLICABLE OR AFFECTED	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 OR GNR 546)/ NOT LISTED	WASTE MANAGEMENT AUTHORISATION (INDICATE WHETHER AN AUTHORISATION IS REQUIRED IN TERMS OF THE WASTE MANAGEMENT ACT). (MARK WITH AN X)
Drilling of diamond core boreholes	3375 m^2	X	GNR 983 (20) GNR 985 (12)	n/a
Establishment of access tracks for drilling equipment	4000m^2	n/a	n/a	n/a
Removal of vegetation for access tracks and drilling sites	7375 m^2	X	GNR 983 (20) GNR 985 (12)	n/a
Establishment of temporary topsoil stockpiles at drilling locations	0 – accommodated within the 15 m x 15 m footprint for each drilling site	n/a	n/a	n/a

All applicable listed activities from the Listing Notices in the EIA Regulations, 2014 (as amended) requiring Environmental Authorisation are specified in Table 4-2.

4 POLICY AND LEGISLATIVE CONTEXT

Table 4-1 provides a description of the legislation which has particular importance to the BAR process being undertaken for the development.

TABLE 4-1: POLICY AND LEGISLATIVE CONTEXT

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT (A DESCRIPTION OF THE POLICY AND LEGISLATIVE CONTEXT WITHIN WHICH THE DEVELOPMENT IS PROPOSED INCLUDING AN IDENTIFICATION OF ALL LEGISLATION, POLICIES, PLANS, GUIDELINES, SPATIAL TOOLS, MUNICIPAL DEVELOPMENT PLANNING FRAMEWORKS AND INSTRUMENTS THAT ARE APPLICABLE TO THIS ACTIVITY AND ARE TO BE CONSIDERED IN THE ASSESSMENT PROCESS)	REFERENCE WHERE APPLIED
ACTS	
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)	NEMA provides 18 specific principles relating to Environmental Management. Of key importance are the precautionary principle and the polluter pays principle. The 18 principles of NEMA are to be recognised during the undertaking of the Impact Assessment Process and play a key role during the decision-making process. Section 24 of NEMA requires environmental authorisation to be obtained for certain activities identified in three listing notices, published on 4 December 2014. The procedure for obtaining an environmental authorisation requires either a basic assessment (activities in Listing Notice 1 and 3) or scoping and Environmental Impact Assessment (activities in Listing Notice 2) process to be undertaken to inform the application for authorisation. **The proposed prospecting activities fall within the ambit of various listed activities in Listing Notice 1. Since activities in Listing Notice 1 apply to the proposed prospecting activities, a Basic Assessment process is being followed. The BAR process is being undertaken in compliance with the requirements of NEMA and the EIA Regulations, 2014.**
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)	The MPRDA regulates the acquisition, use and disposal of mineral and petroleum rights. **A Prospecting Right Application is applicable.**
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA)	The NEM: WA provides for the reform of waste management legislation and repeals or amends the legislation under which waste was previously regulated. Part 4 of the NEM: WA pertains to listed waste management activities. In accordance with section 19(2) of the NEM: WA, the Minister published a schedule of listed waste management activities in Government Notice (GN) 921 of 29 November 2013. These are considered activities that have or are likely to have a detrimental effect on the environment. According to regulation 2 of GN 921, no person may commence, undertake, or conduct a listed waste management activity unless a licence is issued in respect of that activity.

	No application in terms of NEM:WA is required for the intended prospecting activities.
Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA)	The objective of the Act is to cover all aspects relating to health and safety of employees and other persons on the mine property. The Act places the responsibility on the mine owner for ensuring that the mine is designed, constructed and equipped in a manner which allows for a safe and healthy working environment. **The safety precautions in Section 7 of the MHSA have been considered in the environmental sensitivity map.**
The National Water Act, 1998 (Act No. 36 of 1998) (NWA)	The National Water Act, 1998 (Act No. 36 of 1998), identifies 11 consumptive and non-consumptive water uses, which must be authorised under a tiered authorisation system, which include Scheduled uses, General Authorisations, or Licenses. In terms of the National Water Act, the following water uses are identified: (a) Taking water from a water resource; (b) Storing water; (c) Impeding or diverting the flow of water in a watercourse; (d) Engaging in a stream flow reduction activity contemplated in section 36; (e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1); (f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; (g) Disposing of waste in a manner which may detrimentally impact on a water resource; (h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process; (i) Altering the bed, banks, course or characteristics of a watercourse; (j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and (k) Using water for recreational purposes. **No WUL application has been identified as being necessary for the prospecting activities.**
National Environmental Management: Air Quality Act 2004 (Act No. 39 of 2004) (NEM:AQA)	The main objectives of the National Environmental Management: Air Quality Act 2004 (Act no. 39 of 2004) (NEM: AQA) are to protect the environment by providing reasonable legislative and other measures to: ➲ Prevent air pollution; and ➲ Promote conservation and secure ecologically sustainable development. **No AEL application has been identified as being necessary for the prospecting activities.**
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	The NHRA describes the importance of heritage in the South African context, and designates the South African Heritage Resource Agency (SAHRA) as guardian of the national estate which may include heritage resources of cultural significance that link to biodiversity, such as places to which oral traditions are attached or which are associated with living heritage, historical settlements, landscapes and natural features of cultural significance, archaeological and paleontological sites, graves and burial grounds, or movable objects associated with living heritage. Section 38 of the Act requires a Heritage Impact Assessment (HIA) to be undertaken for various types of development. If the HIA demonstrates that the development will have an impact on a heritage resource,

	approval from the South African Heritage Resource Agency, or the relevant provincial heritage authority is needed prior to proceeding with the development. **Based on research conducted in the area ESA, MSA and LSA scatters as well as sites can be expected in the larger study area. Heritage artefacts are common in the study area. A chance find procedure is incorporated in the EMPr to ensure that no significant archaeological sites or finds are disturbed or impacted upon.**
Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007)	Provides for the protection, preservation and maintenance, in respect of radio frequency interference or interference in any other way, of declared astronomy advantage areas. Three Central Astronomy Advantage Areas have been established to date, namely: ➲ The Northern Cape Province, excluding Sol Plaatje Municipality ➲ The Karoo Core AAA ➲ The Karoo Central AAA **The prospecting right area is located within the Northern Cape Province and the Karoo Central AAA. Restrictions may apply with respect to prospecting-related radio and electrical activities, if these are deemed to interfere with radio astronomy work.**
GUIDELINES	
Department of Environmental Affairs Guideline Series 7: Public Participation (2012)	The public participation guideline outlines the importance of public participation as well as the minimum legal requirements for the public participation process, the steps to be taken and the guideline for planning a public participation process. **The public participation process for this application has incorporated relevant requirements of the guideline.**
Department of Environmental Affairs Guideline Series 9: Need and Desirability (2012)	The need and desirability guideline highlights the importance of establishing and assessing the need and desirability for a project. The consideration of need and desirability in the EIA decision making process requires the consideration of the strategic importance of the development alongside the broader societal need and public interests. **The need and desirability description for the proposed development has taken cognisance of this guideline.**

4.1 LISTED ACTIVITIES IDENTIFIED IN TERMS OF NEMA, NEM:WA AND NWA

TABLE 4-2: NEMA LISTED ACTIVITIES APPLICABLE TO THE PROPOSED PROSPECTING ACTIVITIES

NEMA LISTED ACTIVITIES		
REGULATION	**ACTIVITY NUMBER**	**SUMMARY DESCRIPTION**
GN R.983, 8 December 2014 (as amended on 7 April 2017) **Listing Notice 1: Basic Assessment**	1(20)	Any activity including the operation of that activity which requires a prospecting right in terms of section 16 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including - (a) associated infrastructure, structures and earthworks, directly related to prospecting of a mineral resource; or (b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing; but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in Listing Notice 2 applies.
GN R.985, 8 December 2014 (as amended on 7 April 2017) **Listing Notice 3: Basic Assessment**	3 (12)	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. (g) Northern Cape i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within critical biodiversity areas identified in bioregional plans; iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuary, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; or iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning. **The proposed prospecting activities may fall within a CBA or ESA. However, it is anticipated that the prospecting can be planned to avoid these areas..**

5 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

Orion Minerals has several prospecting rights in the Northern Cape Province which it is investigating. The area identified for this prospecting right application forms part of the company's regional exploration strategy for the Areachap Group minerals belt. The latter represents a mid-Proterozoic fossil island arc environment consisting of amphibolite, hornblende gneiss, quartz-feldspathic gneiss, calc- silicates and pelitic schists. Chemical compositions of these highly deformed upper amphibolite/granulite grade metamorphosed rocks indicate protoliths ranging from rhyolite/rhyodacite, calc-alkaline basalt, tholeiite to ultramafic igneous rocks and sediments. This assemblage is typical of an island arc environment.

The 1: 250 000 Geological Sheets (Sheet 2922 Prieska and Sheet 3022 Britstown) demonstrate the Areachap Group in blue (Mv). It is, on average 10 km wide, striking southeast - northwest, flanked by granitic intrusives 3 km to the northeast and 6 km to the southeast of the prospect area (Figure 5-1).

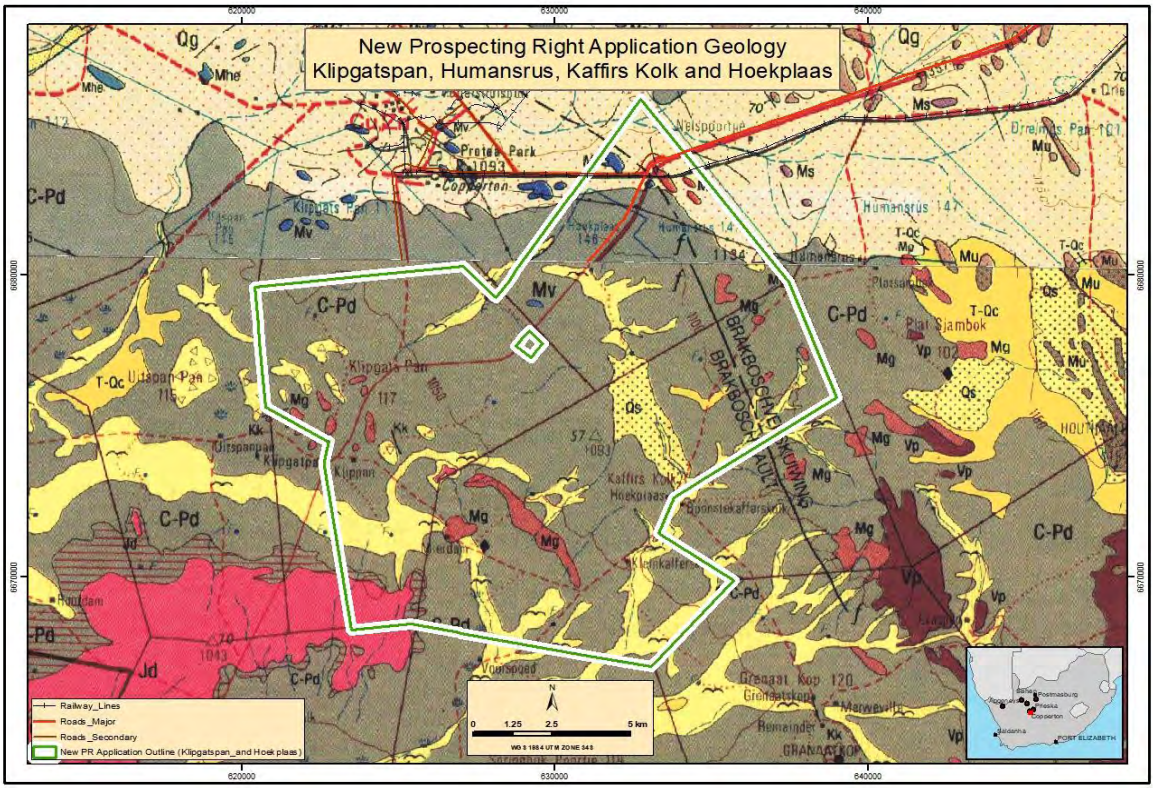


FIGURE 5-1: GEOLOGICAL MAP OF PROPOSED PROSPECTING RIGHT AREA

The Areachap Group presents a metallogenic province containing, at present, one economic deposit, namely the Prieska Copper Mine, as well as several sub-economic deposits, including the Areachap Mine and other lesser prospects at Boksputs, Kantienpan, Jacomynspan and Rokoptel. The Prieska Copper Mine is the most significant VHMS deposit of the Areachap Group and occurs within the Copperton volcanic centre. This abandoned mine delivered 47 Mt sulphide ore at 1,7 % Cu and 3,8 % Zn with traces of Ag and Au. Orion has applied for a mining right for re-developing this mine and the Final EIR and EMPr has been submitted to the DMR.

The new Prospecting Right Application on the farms, Klipgatspan, Humansrus, Kaffirs Kolk and Hoekplaas will be explored using time-domain electromagnetic (TDEM) ground and airborne surveys. These deposits occur below the surface and thus cannot be identified without these surveys.

Drilling on other properties with similar geological characteristics to that defining the proposed prospecting right area has confirmed mineralisation from 30 m - 1300 m below surface along 800 m of strike in some of the deposits. The TDEM surveys on these properties has proven the presence of targets along strike.

Several desktop studies have been undertaken and the availablee geological information for the area indicate that mineral resources of interest to the applicant may be present on the properties included in the prospecting right application.

The data and core logs gathered during prospecting activities will add valuable input to establish the presence of mineral resources and to determine the type, extent and locality of such resources. This will aid in quantifying the resources and assist in determining an economically effective manner to extract resources.

In addition to the export market need for minerals like copper, zinc, nickel, cobalt and others, there is a significant need in the Northern Cape for developments which facilitate economic growth and provide employment opportunities at a local and regional scale.

Although this application relates only to prospecting, if quality minerals are found, it may lead to mining of the resource and the associated benefits thereof including local economic development, regional economic growth and royalties arising from the mineral extraction, payable to the South African Government.

6 MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE

6.1 DETAILS OF THE DEVELOPMENT FOOTPRINT ALTERNATIVES CONSIDERED

6.1.1 THE PROPERTY ON WHICH OR LOCATION WHERE IT IS PROPOSED TO UNDERTAKE THE ACTIVITY

The properties included in the prospecting right application represent the cadastral units relating to the geological formation of interest, namely a portion of the Areachap Group. The proposed location of the prospecting activities on each property is similarly determined by the location of the resource on that property.

The location of the invasive prospecting activities (drilling and trenching) will be informed by the information obtained through the non-invasive prospecting activities, particularly the TDEM survey data. The invasive prospecting activities will avoid the areas identified in the environmental sensitivity map. .

6.1.2 THE TYPE OF ACTIVITY TO BE UNDERTAKEN

Prospecting activities (invasive and non-invasive) will be undertaken for several minerals on the properties under application. A full description of the planned prospecting activities is provided in section 3 of this report. Invasive prospecting activities will be limited to core drilling and trenching.

6.1.3 THE DESIGN OR LAYOUT OF THE ACTIVITY

The site layout of the prospecting activities is largely determined by the orebody of interest. The proposed drilling programme will be refined based on the information derived from the non-invasive prospecting activities, including geological mapping and EM surveys. An environmental sensitivity map has been compiled and the location of drilling and access tracks to the drilling locations will be planned in a manner that, wherever practicable, avoids the identified sensitive environmental areas.

6.1.4 THE TECHNOLOGY TO BE USED IN THE ACTIVITY

6.1.4.1 Technical Data Detailing Prospecting Methods

Geological mapping of the area will be undertaken. This will include surveying of all reference points, geological features, linear distances, etc., with a GPS Receiver.

Reconnaissance soil sampling, with follow-up stages and reconnaissance soil sampling traverses, followed by more detailed and systematic soil sampling will then proceed. Soil and stream sediment samples collected along traverses will be sieved to minus 80# or minus 200# (depending on the results of orientation studies) for analysis.

SkyTEM, a leading airborne electromagnetic (AEM) survey company headquartered in Denmark which offers state-of-the-art helicopter borne transient electromagnetic (TEM) and magnetic acquisition system, will be used to fly a TEM survey. This technique was used with great success on the other tenements which Orion operates on. The targets that are generated with the SkyTEM will be followed up with ground EM. These targets combined with the soil geochemistry will lead to the drilling targets.

Diamond-core drilling to test the more promising geophysical and soil geochemical anomalies will follow. If economic grades of base metals are intersected, follow-up diamond- core boreholes will be drilled for the purpose of delineating the economic zone. During the diamond-core drilling phase geological supervision and core processing can take place more or less simultaneously. The drilling program may be interrupted occasionally

to allow time for assaying, data processing and revision of the structural interpretation. Only zones with visible sulphides will be sampled for assay purposes. Mineralized core will be split with a core splitter. One half of the split core will be sent for assay, while the other half is kept for record purposes. All cores will be stored after processing is completed. Borehole collars will be surveyed by GPS Receiver on different days to enable average coordinates to be calculated. Down-hole surveys to detect deviation will only be carried out on holes deeper than 300 meters. Collars will be covered with numbered cement slabs until the end of the prospecting period.

Bore hole sites are GPS located and pegged with a steel dropper. The site is inspected and photographed prior to any disturbance. A drill pad is then cleared, keeping disturbance to the native vegetation to an absolute minimum. Any topsoil removed is stored separately for later reuse. These holes would be drilled in phases, with the first phase of holes being drilled on a wide 200 m grid on the target areas identified during Phase 1 and the balance being drilled on a tighter grid as the target becomes more resolved. Each hole would be started as an 8-inch diameter hole to allow for casing to be inserted for the first 9 m of drilling stabilizing overburden and thereafter progress to 60 m as a 6-inch diameter hole. Plastic lining to prevent oil spillage is used under the rig. After the drilling operation is complete, each borehole collar is surveyed, and the site is rehabilitated and photographed. The retained topsoil is used to fill any sumps and is reseeded if necessary. Any spoils or drilling material is transported off site and disposed often an approved area.

Phase 1 of the drilling would involve the completion of 200 m spaced diamond-core holes and would thereafter be further resolved with a second phase of diamond-core drilling on a 100 m by 100 m grid. This is contingent on the size and distribution of identified targets and may be adapted depending on results from previous phases. This should allow for a broad resource target area to be defined which 'would then be followed up with a third drilling phase on 50 m spacing.

Metallurgical work will be undertaken using the drill cores obtained during the first phase of drilling. At this stage only, bench scale test work is considered to define the likely upgrading and hydro-metallurgical process that would be applied to any ore grade material encountered.

6.1.5 THE OPTION OF NOT IMPLEMENTING THE ACTIVITY

Without prospecting, the presence of mineral resources which could be economically mined cannot be determined.

Although limited at this stage, the employment and procurement of local goods and services which would arise from the prospecting activities would not be realised.

No diamond-core drilling and/or trenching would be undertaken and the rehabilitation of these areas and any associated activities, including access roads, will not be necessary.

Should the feasibility study undertaken as part of the prospecting activities show economically beneficial outcomes in terms of extraction of the resources, a mine right application is likely to be undertaken. In turn mining will contribute positively to the local and regional socio-economic environment. This includes procurement of local goods and services, employment opportunities for local communities as well as other South African citizens, income generation, skills development and education opportunities, local economic development, GDP improvement and the distribution of revenue and wealth. These benefits cannot however be realised if the prospecting is not implemented.

7 DETAILS OF PUBLIC PARTICIPATION PROCESS FOLLOWED

The public participation process has been undertaken in accordance with Chapter 6 of the EIA Regulations, 2014 (as amended) and the DEA Public Participation Guidelines.

7.1 NOTIFICATION PHASE

All I&APs have been notified by the following means of the application for a prospecting right and environmental authorisation:

- Application notification letter;
- Placement of statutory advertisement in the local newspaper; and
- Placement of on-site notice boards at several locations within the study area.

7.2 DRAFT BAR

I&APs are informed in writing and through the site and newspaper notices of the availability of the Draft BAR. The Draft BAR is made available for 30 calendar days and I&APs are encouraged to provide ABS Africa with feedback, comments or concerns regarding the proposed prospecting activities and the Draft BAR.

The draft report is available electronically and a hard copy of the report is available at the Orion office in Prieska.

7.3 I&AP IDENTIFICATION, CONSULTATION AND DATABASE MANAGEMENT

Throughout the BA Process, the PPP Team has compiled and maintained an electronic database of I&APs that contains a full and complete record of all public participation activities.

All landowners and land occupiers required to be notified in terms of the EIA Regulations, 2014 (as amended) have been identified and requested to participate in the BA Process. This was achieved through the following means:

- Records made available by the Applicant;
- Contacting landowner associations or organised agriculture in the study area; and
- Collating landowner information during field visits, and I&AP discussions including referrals.

7.4 MUNICIPAL COUNCILLORS

In terms of representative democracy and in line with the provisions of the Municipal Systems Act, 2000, Councillors are recognised as the elected representatives of the people. Councillors have a mandate as elected representatives to participate on behalf of and also to provide feedback to their constituencies. The relevant municipal councillors for the ward in which the proposed prospecting area is located has been registered on the I&AP database and included in the public participation notifications.

7.5 FINAL BAR

All I&APs will be notified of the submission of the Final BAR and provided with access thereto on request.

7.6 NOTIFICATION OF DECISION

Upon receipt of the decision on the EA, the EIA Project Team will assist the applicant in making the application decision available to all registered I&APs and notifying them of the appeal procedure to be followed in terms of the National Appeal Regulations [Government Notice No. R.993 promulgated in terms of section 44(1a) and 43(4) of NEMA].

7.7 SUMMARY OF ISSUES RAISED BY I&APS

All comments from I&APs are captured and responded to in the Final Basic Assessment Report.

8 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT ALTERNATIVES

8.1 BASELINE ENVIRONMENT - TYPE OF ENVIRONMENT AFFECTED BY THE PROPOSED ACTIVITY

A desktop review of available information on the baseline environment has been undertaken. A summary of this review is presented below.

The baseline information on the environment has been collated from various sources including the several environmental impact assessment studies undertaken to inform the renewable energy developments.

The baseline has further been informed through specialist input from other applications undertaken by Orion on nearby properties.

8.1.1 CLIMATE

The proposed activity is situated in the BWh (mild desert climate) of the Köppen Climate Classification System. Climatic conditions are characterised by warm to hot summers, high evaporation and dry warm winters, a mean annual rainfall of 198 mm and a large degree of variability in the monthly rainfall. Potential evaporation is extremely high. The temperatures are highest in January and the coldest month is in July.

8.1.2 MEAN ANNUAL RAINFALL

Mean Annual Rainfall for the area is 198 mm (Peens & Associates, 2017) . Rainfall is strongly seasonal with approximately 60% of the yearly rainfall falling in the summer months (October to January) (Table 8-1).

8.1.3 MEAN ANNUAL EVAPORATION

Regional evaporation data obtained from gauging stations operated by the Department of Water and Sanitation (DWS) indicate a Mean Annual Evaporation (MAE) of 2714 mm for the area (Table 8-1).

TABLE 8-1: MEAN MONTHLY AND ANNUAL RAINFALL AND EVAPORATION

MONTH	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
RAINFALL													
MM	26.6	31.2	41.0	23.3	9.3	4.8	5.2	5.5	5.2	12.2	15.3	18.8	**198**
%	13.4	15.7	20.7	11.8	4.7	2.4	2.6	2.8	2.6	6.1	7.7	9.5	100
EVAPORATION													
MM	283	336	380	373	295	241	158	109	82	100	146	211	**2 714**
%	10.4	12.4	14.0	13.7	10.9	8.9	5.8	4.0	3.0	3.7	5.4	7.8	100

Source: Peens & Associates (2017)

8.1.4 TEMPERATURE

High maximum and very low minimum temperatures characterise the environment. The temperatures are highest in January with an average around 26.9°C. July is the coldest month with 9.8°C on average.

TABLE 8-2: MEAN MONTHLY AND ANNUAL TEMPERATURES

MONTH	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
RAINFALL													
MIN	12.1	15	17.8	19.2	18.5	16	11.3	5.9	1.5	1	3.7	7.5	**10.8**
MAX	29.2	31.3	34.1	34.6	33.8	31	26.8	22.3	18.8	18.6	21.7	25.2	**27.3**
AVE	**20.6**	**23.1**	**25.9**	**26.9**	**26.1**	**23.5**	**19**	**14.1**	**10.1**	**9.8**	**12.7**	**16.3**	

Source: South African Weather Service (Prieska Weather Station)

8.1.5 WIND SPEED AND DIRECTION

Dominant wind directions and wind speed across the site are presented in Figure 8-1. Seasonal and daytime/night-time variation in wind speeds and direction are also shown.

Wind roses comprise 16 spokes, which represent the directions from which the wind blew during a specific period. The colours used in the wind roses reflect the distinct categories of wind speeds; for example, yellow representing winds in between 1.5 and 2 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s are also indicated.

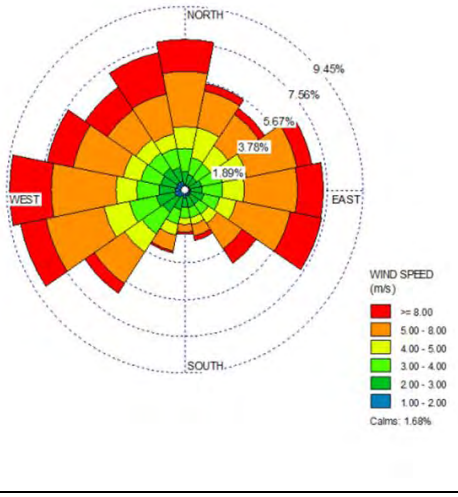
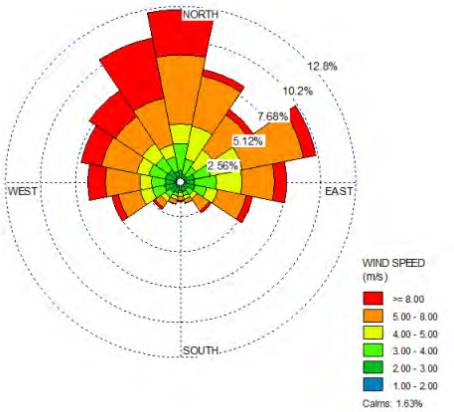
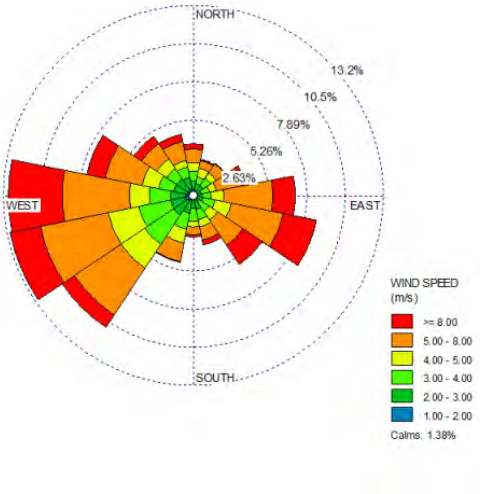
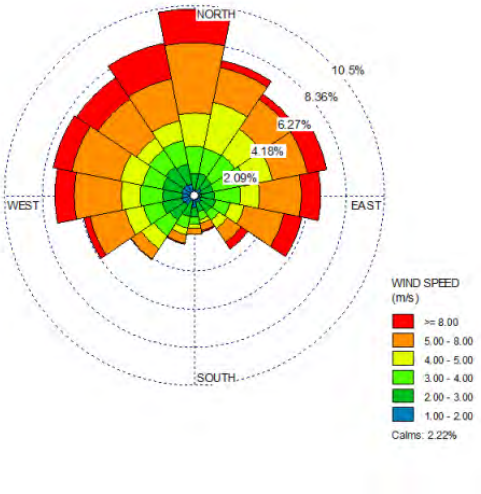
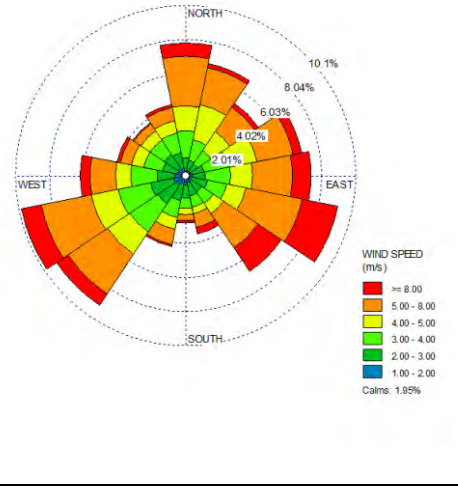
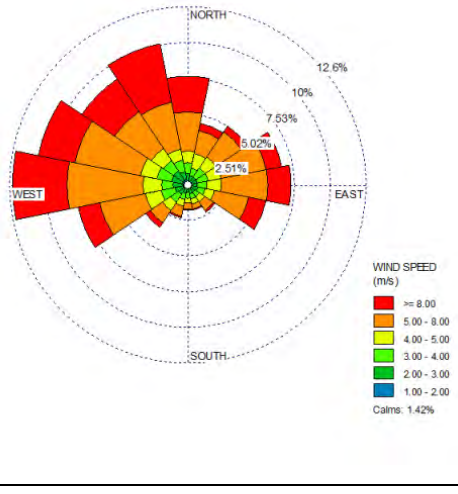
Annual average wind direction is dominant from the west and west-west-south. Winds from the north, east and east-east-south are also frequent. Wind is a characteristic of the region, with calm conditions (wind speed less than 1m/s) only being present for 1.58% of the time.

There is a distinct seasonal variation between summer and winter wind direction with predominant winds in winter being from the north and north-north-west. In summer, the predominant wind direction is from the west and west-west-south with south-easterly winds also important. Autumn and spring wind direction is similar to that of winter and summer respectively.

Daytime average wind direction is from the south-west and south-east whereas night-time wind direction is predominantly from a westerly direction. Wind speeds are stronger during night-time compared with daytime conditions.

8.1.6 TOPOGRAPHY

The area is flat with no significant natural physiographic features present in the area. The terrain type can be described as slightly irregular plains.

	
Annual Average	**Winter Average**
	
Summer Average	**Autumn Average**
	
Daytime Average	**Night-time Average**

Source: MM5 Data (2014-2016)

FIGURE 8-1. AVERAGE ANNUAL WIND DIRECTION AND SPEED FOR COPPERTON

8.1.7 GEOLOGY

The Prieska Orebody is hosted by highly deformed metamorphic rocks of the Copperton Formation of the Areachap Group, which forms part of the Namaqualand Metamorphic Province.

The Areachap Group represents a mid-Proterozoic fossil island arc environment consisting of amphibolite, hornblende gneiss, quartz-feldspathic gneiss, calc- silicates and pelitic schists. Chemical compositions of these highly deformed upper amphibolite/granulite grade metamorphosed rocks indicate protoliths ranging from rhyolite/rhyodacite, calc-alkaline basalt, tholeiite to ultramafic igneous rocks and sediments. The above-mentioned assemblage is typical of an island arc environment.

Island arc environments are ideal hosts for volcanic hosted massive sulphide (VHMS) type deposits and may successfully be explored by using the VHMS lithogeochemical alteration model. VHMS deposits not only yield strategic base metals such as zinc (Zn), copper (Cu) and lead (Pb), but significant grades of gold (Au) and silver (Ag) are associated with these deposits.

8.1.8 SOILS AND AGRICULTURAL LAND CAPABILITY

The soils associated with the Bushmanland Arid Grassland vegetation type are red-yellow apedal soils, freely drained, with a high base status and <300 mm deep, with about one fifth of the area deeper than 300 mm, typical of Ag and Ae land types (Ecosoil, 2017).

The soils in the Bushmanland Basin Shrubland vegetation type are shallow Glenrosa and Mispah forms, with lime generally present in the entire landscape and, to a lesser extent, red-yellow apedal, freely drained soils with a high base status and usually <15% clay are also found. The salt content in these soils is very high.

8.1.9 TERRESTRIAL ECOLOGY

The study area is situated within the Nama-Karoo Biome. The flora of the Nama-Karoo is not as diverse and rich as the adjacent Succulent Karoo and does not contain any centres of plant endemism (Ecorex, 2017). Three geographically distinct bioregions are present within this biome, namely the Bushmanland, Upper Karoo and Lower Karoo. The study area is situated within the Bushmanland Bioregion at the junction of two national vegetation types, namely Bushmanland Arid Grassland (NKb3) and Bushmanland Basin Shrubland (NKb6).

Bushmanland Basin Shrubland dominates the proposed prospecting right area. It has a conservation status of Least Threatened (Rouget et al. 2004). The vast majority of the plant species occurring in the quarter degree square in which the study area is located are currently classified as either Least Concern (661 spp) or Not Evaluated (66 spp). Vegetation communities recorded by Aurecon (2015) within the study area are summarised as follows:

- Rhigozum trichotomum- dominant in areas of red sand and surface rocks and has a low ecological sensitivity.
- Asteraceous Shrubland- present in shallow sandy loam soils and is not ecologically sensitive.
- 'Leegte' Shrubland – present in shallow drainage lines and has been recorded as sensitive.
- Psilocaulon junceum – mostly present in disturbed areas and not ecologically sensitive.
- Endorheic pans - Endorheic pans are sensitive habitats

The properties under application is mainly disturbed through grazing and solar farms.

The *Hoodia officinalis* may occur within the study area and has been recorded on surrounding properties. This species is listed as Near Threatened (Sivest, 2015).

Disturbance of this species is to be avoided during the invasive prospecting activities. Mitigation measures in this regard are included in the EMPr.

8.1.10 FAUNA

8.1.10.1 Mammals

Numerous small mammal species are endemic to the Namib-Karoo Biome, of which the following have been confirmed to occur within the general vicinity of the study area (Friedman & Daly, 2004 in Ecorex (2017): Western Rock Sengi (*Elephantulus rupestris*), Round-eared Elephant Shrew (*Macroscelides proboscideus*), Spectacled Dormouse (*Graphiurus ocularis*), Pygmy Rock Mouse (*Petromyscus collinus*), Brukkaros Pygmy Rock Mouse (*P. monticularis*), Bush Vlei Rat (*Otomys unisulcatus*), Brants's Whistling Rat (*Parotomys brantsii*) and Littledale's Whistling Rat (*P. littledalei*).

8.1.10.2 Birds

Twenty-three species are listed by Barnes (1998) as being endemic to the Namib-Karoo biome i.e. not occurring outside of the biome, of which 15 species (65%) have been recorded within the general vicinity of the study area during the current Southern African Bird Atlas Project (SABAP2) (Ecorex, 2017).

While only four of these species were located on adjacent properties to the project area, it is likely that species such as Karoo Long-billed Lark *Certhilauda subcoronata*, Sickle-winged Chat *Cercomela sinuata* and Tractrac Chat *C. tractrac* also occur. A number of near-endemics such as Rufous-eared Warbler *Malcorus pectoralis*, Namaqua Sandgrouse *Pterocles namaqua* and White-throated Canary *Crithagra albogularis* were also observed in the area. Two species that are endemic to the Kalahari-Highveld biome have also been recorded in the same area.

The study area is also situated in a designated secondary Endemic Bird Area, namely the Karoo EBA (s047) (Barnes *et al.*, 2001). There are no Important Bird Areas within the vicinity of the study area, the closest being the Platberg-Karoo Conservancy IBA (ZA037), approximately 130 km to the east (Barnes, 1998).

8.1.10.3 Herpetofauna (Reptiles and Amphibians)

A total of 48 reptile species could be expected to occur within and surrounding the study area of which three species are endemic and three are considered as near-endemic (Bates et al., 2014 in Ecorex, 2017). Only seven (15%) of these species were previously observed within the QDS of the study area (ReptileMap, 2017).

8.1.11 WATER SOURCES

The study area falls within the Orange (D) Primary catchment, the D5 Secondary catchment and the Lower Orange DWS water management area. It falls within the D54D quaternary catchment. The watershed associated with the survey area drains toward the Basterput se Leegte River within the adjacent catchment, which drains northwards into the Hartbees River, which then confluences with the Orange River near the town of Kakamas.

The quaternary sub-catchment's underlying geology consists of tillite, undifferentiated assemblage of compacted sedimentary extrusive and intrusive rocks as well as principally arenaceous strata. The underlying geology is covered with moderate to deep sandy soils with a medium erodibility index and an estimated annual sediment yield of 10 000 tons per annum. The entire catchment area falls with an endoreic area, which is classified as a catchment area that does not contribute to mean annual runoff. Hence, this catchment only produces runoff during major storms.

Several non-perennial rivers traverse the surface area. (Appendix B).

8.1.12 AIR QUALITY

There are no ambient air quality monitoring stations near PCM. The ambient air quality in the area is however expected to be within the acceptable range of all the pollutants specified in the National Ambient Air Quality Standards, Government Notice 1210, promulgated in terms of the National Environmental Management: Air Quality Act 39 of 2004. This is attributed to the remoteness of the site and the absence of any significant atmospheric emission sources in the region.

Existing sources of emissions to the local airshed are expected to be from the following activities:

- Dust entrainment from vehicles using unsurfaced roads and tracks;
- Burning of biomass; and
- Windblown dust and particulate emissions from exposed areas, including historical mining structures at the adjacent Prieska Copper Mine.

8.1.13 ENVIRONMENTAL NOISE

Noise sensitive receptors generally include places of residence and areas where members of the public may be affected by noise generated by prospecting and transport activities. Office workers and employees, and any on-site accommodation structures may also be affected.

Noise sensitive receptors include residences and employees on surrounding farms as well as the farms under application. Baseline noise levels have been recorded by Aurecon (2015) as 'rural' with day and night-time noise levels of 45dBA and 35dBA respectively.

8.1.13.1 Environmental Noise Propagation and Attenuation Potential

Site conditions which may influence noise propagation and attenuation potential include the following:

- At wind speeds of more than 5 m/s, ambient noise levels are mostly dominated by wind generated noise;
- There are no natural terrain features between potential sources of noise and the closest noise sensitive receptors that would provide acoustic shielding; and
- Based on observations made during the visit to site, ground cover is acoustically hard, that is, not conducive to noise attenuation.

8.1.14 HERITAGE

Heritage Contracts and Archaeological Consulting CC (HCAC) has undertaken a desktop scoping study to inform the section below. The full report is attached as Appendix D

Previous heritage studies were conducted in the greater study area (SAHRIS) by Van Ryneveld (2006) and Orton (2015) and Kaplan and Wiltshire (2011). All the studies recorded ESA, MSA and LSA artefacts scattered over the landscape with MSA and LSA sites centred on pans and watercourses. Studies by Van der Walt (2012, 2013, 2017) concurred with these findings and also recorded widespread Stone Age scatters and some discreet MSA and LSA sites. Interestingly the farms under investigation or parts thereof were subjected to HIA studies for other projects and is summarised below and the findings are recorded in Appendix D:

Author	Year	Project	Findings
Orton, J.	2011	Heritage impact assessment for a proposed photovoltaic energy plant on the farm Hoekplaas near Copperton, Northern Cape	Stone Age scatters and stone walled enclosures.
Orton, J. & Webley,L.	2013a	Heritage Impact Assessment for Multiple Proposed Solar Energy	Archaeological resources were found to be widespread across the site but the majority are of low value. A few sites, located predominantly around the pans, were of

		Facilities on Farm Hoekplaas 146, Copperton, Northern Cape	higher value and would require mitigation if they cannot be protected. Particularly important in this regard is an MSA site with fossil bone located at a quarried pan alongside the main road. One area at PV11 has extensive archaeological resources and is best avoided
Orton, J. & Webley, L.	2013b	Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on The Remainder of Farm Klipgats Pan 117, Copperton, Northern Cape	Archaeological resources were found to be widespread across the site but the majority are of low value. A few sites, located predominantly around the pans and on the hill in the south, were of higher value and would require mitigation if they cannot be protected. One area, the northern part of Alternative 1 PV2, has extensive archaeological resources and is best avoided.
De Kock, SE & Narainne, GJR.	2016	Integrated Heritage Impact Assessment In Terms Of Section 38(8) Of The National Heritage Resources Act, 1999 (Act 25 Of 1999) Proposed Development Of Humansrus Solar PV Facility 4 On The Farm Humansrus 147, Prieska District And Pixley Ka Seme District Municipality, Northern Cape Province	The archaeological survey identified an amorphous distribution of Early and Middle Stone Age artefacts randomly scattered across the landscape. No Later Stone Age sites, such as those mitigated by Orton (2014) on the adjoining farm of Klipgats Pan 117, were observed.

Beaumont et al. (1995: 240) observed that "thousands of square kilometres of Bushmanland are covered by a low-density lithic scatter". These artefacts are generally very well weathered and mostly pertain to the ESA and MSA. Occasional LSA artefacts are also noted. What is noteworthy of the Northern Cape archaeological record is the presence of pans which frequently display associated archaeological material. Of interest, is the work of Kiberd (2001, 2005, 2006) who excavated Bundu Pan, some 25 to 30 km northwest of Copperton. The site yielded ESA, MSA and LSA horizons and the artefacts were accompanied by warthog and equid teeth to name a few (Beaumont et al. 1995).

Orton (2011) noted that to the northwest, west and southwest of Copperton sites have been investigated by Beaumont and colleagues (1995), Smith (1995) and Parsons (2003, 2004, 2007, 2008) yielding LSA deposits. Work on these sites led to a distinction between hunter-gatherer and herder sites, based on stone artefact assemblages (Beaumont et al. 1995). All these Later Stone Age sites have very few, if any, organic items on them. The only organic material found on sites like these is fragments of ostrich eggshell probably belonging to broken water containers. Such flasks have been widely recorded across the Northern Cape (Morris 1994).

The archaeological importance of pans in the area are now well documented (Kiberd 2006, Kaplan & Wiltshire 2011, Orton 2012) and if any occur in the study area they could be of significance. Van der Walt (2012) recorded low densities of ESA, MSA and LSA scatters and these occurrences were given a field rating of low archaeological significance. However, several discrete MSA and LSA sites were also documented.

Most of the material expected for the study area is MSA in nature consisting of large flakes, radial and bipolar cores, points, end scrapers, large utilized and retouched blade tools, and utilized and retouched flakes.

Potential Significance of Heritage Resources

Based on the current information obtained for the area at a desktop level it is anticipated that any sites that occur within the proposed development area will have a Generally Protected B (GP.B) or lower field rating and all sites should be mitigatable. No red flags have been identified.

8.1.14.1 Palaeontology

The oldest rocks in the area are those of the Keimos Suite and they are a group of syn- to post-tectonic granitoids that have intruded into the igneous and metamorphic rocks of the Namaqua-Natal Province. There are also outcrops of the quartzites of the Uitdraai Formation and the Dagbreek Formation. The rocks of the Prieska Copper Mine are known as the Copperton Volcanic Centre (Cornell et al., 2006) and include the Copperton Formation, the Kielder Formation, topped by the Dagbreek Formation.

Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 3-1. The proposed site is in the Dwyka Group tillites, sandstone, mudstone and shales, and these potentially could preserve fossils. Around 300-290 Ma the climate in southern Africa was still relatively cool, but there were well developed Carboniferous floras in the northern hemisphere. In South Africa, however, much of the land surface was covered by ice sheets. As they melted, they dropped the moraine trapped in the ice, together with limited plant matter from the vegetation that gradually recovered and colonised the land surface.

Terrestrial vertebrates had not evolved at this time. The late Carboniferous flora comprised Glossopteris leaves and seeds, wood, and other plants such as lycopods, sphenophytes and ferns.

The Dwyka Group is made up of seven facies that were deposited in a marine basin under differing environmental settings of glacial formation and retreat (Visser, 1986, 1989; Johnson et al., 2006). In the north these are called the Mbizane Formation, and the Elandsvlei Formation in the south. Described below are the seven facies (Johnson et al., 2006 p463-465):

The massive diamictite facies comprises highly compacted diamictite that is clast-poor in the north. It was deposited in subaqueous or subglacial positions.

The stratified diamictite comprises alternating diamictite, mudrock, sandstone and conglomerate beds. They are interpreted as being rapidly deposited, sediment gravity flows but with some possible reworking of the subglacial diamictites.

The massive carbonate-rich diamictite facies is clast-poor and was formed by the rainout of debris, with the carbonate probably originating by crystallisation from interstitial waters.

The conglomerate facies ranges from single layer boulder beds to poorly sorted pebble and granule conglomerates. The boulder beds are interpreted as lodgement deposits whereas the poorly sorted conglomerates are a product of water-reworking of diamicton by high-density sediment gravity flows.

The sandstone facies were formed as turbidite deposits.

The mudrock with stones facies represents rainout deposits in the distal iceberg zone.

The **mudrock facies** consists of dark-coloured, commonly carbonaceous mudstone, shale or silty rhythmite that was formed when the mud or silt in suspension settled. This is the only fossiliferous facies of the Dwyka Group.

The Dwyka Glossopteris flora outcrops are very sporadic and rare. Of the seven facies that have been recognised in the Dwyka Group fossil plant fragments have only been recognised from the mudrock facies. They have been recorded from around Douglas only (Johnson et al., 2006; Anderson and McLachlan 1976) although the Dwyka Group exposures are very extensive. Jurassic Dolerites do not contain fossils as they are igneous intrusives.

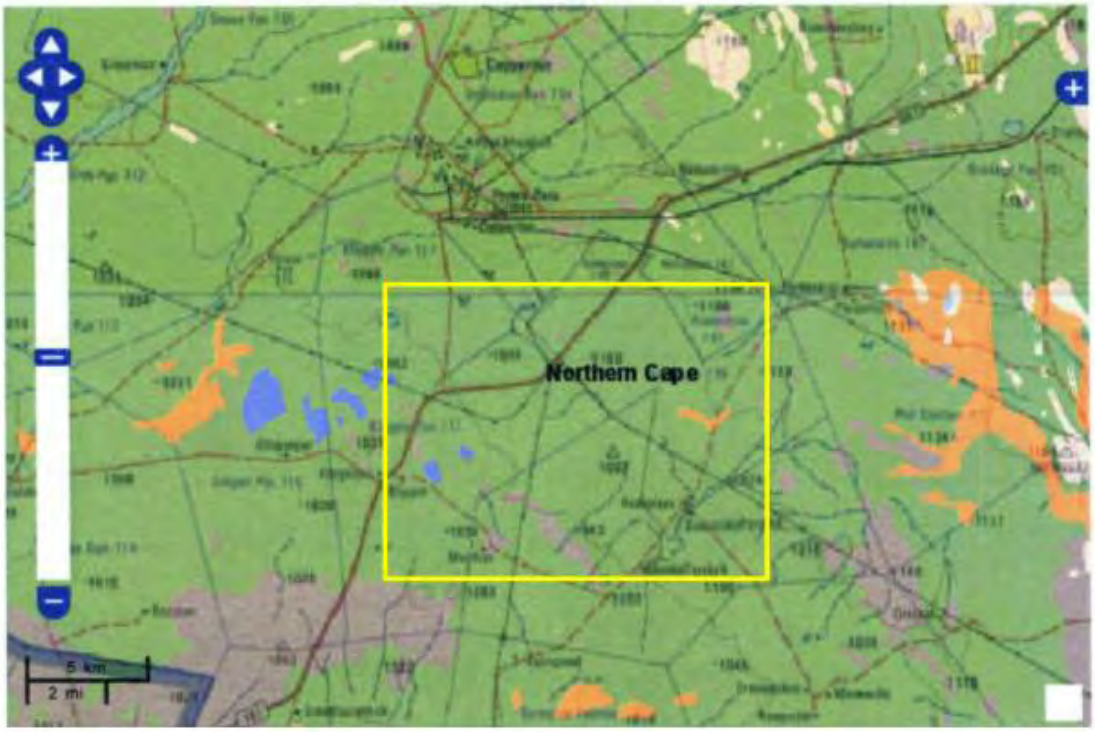


FIGURE 8-2: SAHRIS PALAEOSENSITIVITY MAPS FOR THE PROPOSED PROSPECTING RIGHT

Degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above, the area is indicated as moderately sensitive (green; Figure 8-2) and an associated desktop assessment by Prof. Marion Bamford was thus undertaken to inform this palaeontological study. No fossils have been reported from the Copperton area but there is a very small chance that fossil plant fragments could occur in the prospecting area relatively close to the surface, mainly because the underlying strata, that is the target of the project, are too old for fossils. Fossils are not likely to be seen on the land surface because of extensive weathering and previous farming or mining activities.

8.1.14.2 Findings

Archaeological finds

Based on CRM studies conducted in the area ESA, MSA and LSA scatters as well as distinct sites can be expected. No Impacts to heritage resources is envisaged during the non-invasive prospecting activities but invasive activities can alter/ destroy heritage resources.

Historical finds

Historical finds include middens, structural remains and the cultural landscape. Impacts to heritage resources will occur primarily during invasive activities and no impacts are expected during the initial non-invasive activities.

Burials and Cemeteries

There are no graves on record for the study area, but graves and informal cemeteries can be expected anywhere on the landscape

Impact on Heritage resources

During the non-invasive prospecting no impacts are foreseen on heritage resources. The future invasive prospecting activities of the proposed project could directly impact on graves, archaeological sites and historical sites.			
Issue	**Nature of Impact**	**Extent of Impact**	**No-Go Areas**
Disturbance and destruction of archaeological sites, historical sites and graves.	Invasive exploration activities could cause irreversible damage or destroy heritage resources and depletion of the archaeological record of the area.	Low to Medium on a local scale.	TBC after field work
Description of expected significance of impact Significance of sites, mitigation and significance of possible impact can only be determined after a field survey has been conducted but based on previous work in the area Stone Age finds and graves can be expected.			
Gaps in knowledge & recommendations for further study Large sections of the study area have been subjected to heritage resource surveys and it is assumed that information obtained for the wider region is applicable to the study area. It is recommended that prior to invasive prospecting, impact areas should subject to a field study to confirm the presence of heritage resources after which mitigation measures will be recommended (if needed).			

8.1.15 SOCIO-ECONOMIC ENVIRONMENT[1]

8.1.15.1 Siyathemba Local Municipality

The proposed prospecting right area is located within Ward 4 of the Siyathemba Local Municipality (SLM), which is managed by the Pixley Ka Seme District Municipality, within the Northern Cape Province of South Africa. The towns of Brakbos, Brulpoort, Draghoender, Koegas, Marydale, Niekerkshoop, Prieska, Shamley's Farm, Uitvlug, and Westerberg fall within the boundaries of the SLM (Figure 8-3).

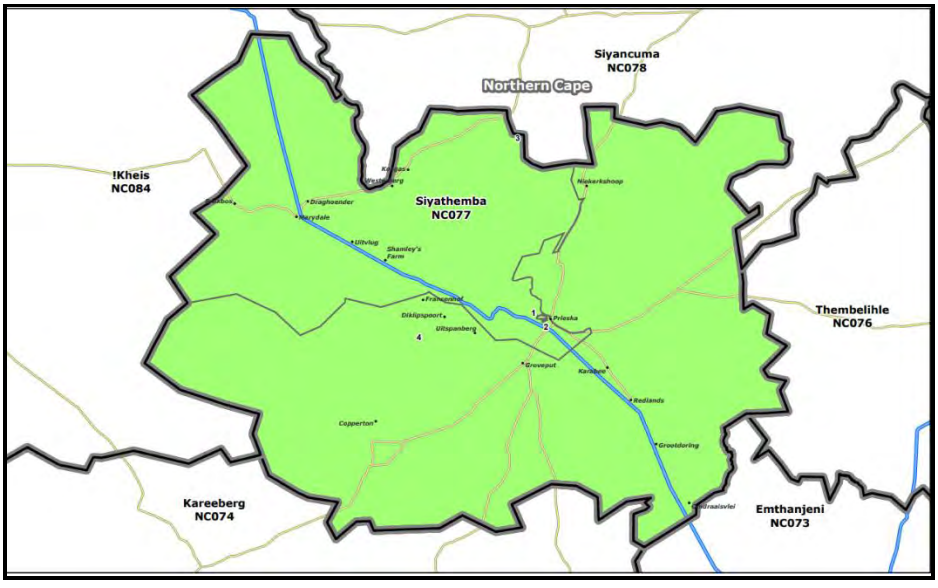


FIGURE 8-3: GEOGRAPHICAL BOUNDARY OF THE SLM

[1] There is a general lack of recent published demographic and other socio-economic data for the SLM. Except where noted, the information in this section has been summarised from Statistics South Africa Census Data (2011) and the SLM Local Economic Development Strategy (2012)

SLM was established in 2001 and is a category B municipality. It is located within the central easterly parts of the Northern Cape Province along the Orange River. It Is approximately 220 km away from the nearest business center of Kimberley. The surface area of the municipality is approximately 8 200 km^2, accounting for 8% of the total district surface area and approximately 3% of the provincial area. A summary of the key statistics of the municipality is provided in Table 8-3.

8.1.15.2 Spatial and Regional Development Planning

The SLM Spatial Development Framework (SDF) was compiled in 2006 and, according to the SLM IDP (2017-2018), is no longer used for guiding for development planning in the municipality. No development planning guidelines or objectives have therefore been defined for Copperton or the proposed prospecting right area.

Similarly, no local or regional development plans for the Copperton area have been proposed.

8.1.15.3 Population

There are approximately 22 000 people residing in the municipality. This represents approximately 1.9% of the total population in the Northern Cape. The population of Siyathemba contracted by 0.4% on average per annum between 2000 and 2010. The decline of the Siyathemba population was mainly driven by lower fertility rates.

The death rate (the number of deaths per 1,000 people in a year) increased from 11.2 deaths per 1,000 people in 1995 to 11.6 during 2010.

This is significantly lower than the death rates recorded over the same period for the Northern Cape and South Africa. The reason for the lower death rate in the study area was mainly the result of lower HIV/AIDS prevalence rates when compared with South African averages.

The most dominant population group in the SLM are Coloured individuals, who represent more than 75% of the total population in the municipal area. Black African and White population groups comprise around 12% and 8% of the population respectively. The dominant languages in the SLM are Xhosa and Afrikaans. Afrikaans is the most widely spoken language (78%).

TABLE 8-3: KEY STATISTICS OF SIYATHEMBA LOCAL MUNICIPALITY

KEY STATISTICS	NUMERICAL VALUE
Total population	21,591
Young (0-14)	30,8%
Working age	63,2%
Elderly (65+)	6%
Dependency Ratio	58,2%
Gender Ratio	99.3%
Growth Rate	1.57% (2001 - 2011)
Population density	1 person/km^2
Unemployment rate	24.3%
Youth unemployment rate	30.2%
No schooling aged 20+	11.5%
Higher education aged 20+	5.3%
Matric aged 20+	18%
Number of Households	5.831%
Number of Agricultural Households	1.334%
Average Household size (person)	3.6

Female headed households	36.1%
Formal dwellings	88.6%
Housing owned/paying off	54.3%
Flush toilet connected to sewerage	64.9%
Weekly refuse removal	73.9%
Piped water inside dwelling	43.1%
Electricity for lighting	86.2%

Source: Statistics South Africa (2011)

8.1.15.4 Educational Facilities and Education

There is a total of 10 schools (3 combined, 6 primary and 1 secondary) within the SLM (SLM IDP 2017-2018).

4.2% of the municipal population has not attended any type of a schooling system, while 48.5% have primary school education. A little over 1700 individuals (4%) have graduated from a University / Technikon.

In Siyathemba, around 14% of adults have a matric certificate compared to 24.7% in the Northern Cape. The percentage of the population with a tertiary education in Siyathemba (5.1%) is also lower than that for the Northern Cape (7.3%).

8.1.15.5 Access to Water, Sewage and Solid Waste Services

SLM is the Water Services Authority (WSA) and Water Services Provider (WSP) for the 3 towns within their area of authority. Piped water is accessed by about 98% of the SLM population and about 90% of the municipal population have access to flush toilets[2].

Siyathemba has three water supply schemes. For PCM, water is provided from the Water Treatment Works in Prieska. Water abstraction is from the Orange River. Waterborne sanitation is only available in the urban areas of Prieska.

About 75% of the population have access to a weekly refuse collection service[3]. There is an existing licensed waste disposal site in Prieska. This facility is a G:C:B$^-$ licensed facility and can only accept general waste. According to the SLM IDP (2017-2018), the site has a remaining airspace of 20 years. SLM has indicated that the site is not well managed at present due to financial and personnel constraints[6]. A new incinerator is proposed to be installed at the facility, the timing of which is unclear.

8.1.15.6 Housing

Within the Pixley Ka Seme District Municipality, 87.2% of households live in formal units, while 12.8% are found in informal housing units.

A variety of residential components are available within the municipal boundaries. More than 81% of household dwellings found in Siyathemba can be classified as houses or brick structures on separate stands. The average for the Northern Cape is 77.4%. Some 8.6% of local dwellings can be described as shacks.

The average household size in the larger Pixley Ka Seme District Municipality is about 3.7, female headed households is about 36.90%, formal dwellings at 86.30% and the housing owned is at 52.00%.

[2] SLM Water Services Development Plan, 2017

[3] SLM IDP (2017-2018)

8.1.15.7 Public Safety and Security

There are three police stations within the SLM, situated in Marydale, Niekerkshoop, and Prieska respectively. There is no municipal fire-fighting capability in the SLM and no disaster manager plan for the municipality.

8.1.15.8 Community Health and Health Facilities

There is a total of 4 health facilities within the SLM, namely Niekerkshoop Clinic, E'Thembeni Clinic, Marydale PHCC, and Prieska Clinic.

The 2010 HIV/AIDS prevalence rate of the Siyathemba population was 6%. This is lower than the prevalence rates in the Northern Cape (8%) and South Africa (13%). However, since 2000, the number of people living with HIV/AIDS in the Siyathemba municipal area more than doubled from about 400 to just over 1,200 people in 2010. The prevalence rate is expanding faster in Siyathemba (at 11% p.a.) when compared with South Africa (at 6% on average p.a. since 2000).

SLM manages 3 cemeteries in Prieska, and 2 cemeteries in Niekerkshoop and Marydale. Expansion of the cemeteries in each of these towns is planned.

8.1.15.9 Electricity and Energy

Around 86% of household dwellings found in Siyathemba have access to electricity. This indicator is on par with the provincial average.

Between 2006 and 2011, there was a general increase in the use of electricity as a primary source of energy. This is due to local electrical infrastructure improvements across the province (SLM IDP, 2016).

As shown in the graph below, the majority of the population have access to electricity, which is used primarily for cooking, heating and lighting. The proportion of households within the municipality that use electricity for lighting has increased from 57% in 1996 to approximately 84% in 2011.

Although relatively expensive, paraffin and gas are used for cooking and heating in some places. Households using electricity as a source of energy for cooking increased from 48% in 1993 to 74% in 2011.

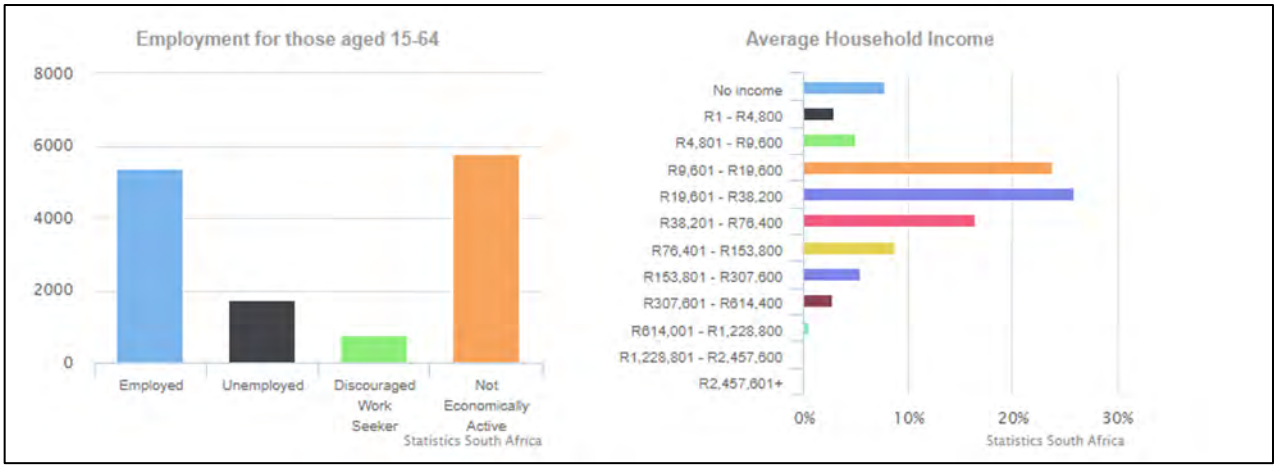
8.1.15.10 Employment[4]

Between 2001 and 2011, there has been a decrease in the number of people employed and a concomitant increase in the number of unemployed people across the Pixley Ka Seme District Municipality.

For Siyathemba, 5 787 individuals remain as being economically inactive, while 5 370 are employed. The unemployment rate in SLM in 2011 was 24.3%.

The average household income is approximately R9 000 – R19 500. Obtaining any form of income generating employment within the municipality has become increasingly difficult in recent years. This is attributed to the lack of education, resulting in the uneducated experiencing the highest incidences of poverty.

[4] SLM IDP (2017-2018)



Source: Statistics South Africa (2011)

FIGURE 8-4: SUMMARY OF EMPLOYMENT AND INCOME IN SLM

8.1.15.11 Labour

The labour participation rate across the Pixley Ka Seme District Municipality is 50%. The labour dependency ratio for Siyathemba is estimated at 2 (An additional two persons are supported by every person in the labour force).

Other significant labour ratio statistics for SLM are provided in Table 8-4.

TABLE 8-4 LABOUR RATIOS FOR SLM

LABOUR PARTICIPATION RATE	LABOUR DEPENDENCY RATIO	LABOUR YOUTH DEPENDENCY RATIO	LABOUR AGED DEPENDENCY RATIO
48	2	0.4	84

Source: SLM IDP (2017-2018)

8.1.15.12 Economy

The SLM Local Economic Development (LED) Vision is "Ensuring long term economic sustainability through local value addition and social upliftment, as well as integrated community development. We strive towards an economy owned by local people."

The regional and local economy is poorly diversified with a reliance on, in the case of SLM, the government and agriculture sectors. The mining and manufacturing sectors provide very few of the employment opportunities in the SLM.

The mining sector is identified within the SLM IDP (2017-2018) as a sector with development potential.

8.1.16 ENVIRONMENTAL AND CURRENT LAND USE MAP

Please refer to Appendix B.

8.1.17 DESCRIPTION OF THE CURRENT LAND USES

The dominant land use within the prospecting right area is grazing for small livestock.

The central north and north-eastern sections of the proposed prospecting right area include 10 (ten) proposed renewable energy developments which have been granted environmental authorisation and 2 (two) operating renewable energy developments (Mulilo Prieska PV). These facilities are shown in Appendix B.

It is understood that the 10 proposed renewable energy developments have been unsuccessful in the application for preferred bidder status in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) and their future development status is uncertain.

Current land uses within the boundary of the proposed prospecting area are as follows:

- Several proposed solar PV facilities situated towards the central north and north-east of the proposed prospecting area;
- Two operating solar power plants (Mulilo Prieska PV and Mulilo Sonnedix Prieska PV); ;
- Section of the R357 road;
- Overhead transmission line infrastructure;
- Windmills, boreholes, farm dams and related agricultural infrastructure;
- Section of disused railway line; and
- Farmsteads and access roads;

8.1.18 ADJACENT LAND USE

- Grazing of livestock;
- Windmills, boreholes, farm dams and related agricultural infrastructure;;
- Two existing quarry operations;
- Overhead transmission line infrastructure;
- The Alkantpan landing strip;
- Road to Copperton and Alkantpan from the R357;
- Disused rail siding;
- Alkantpan Test Range;
- Various structures and infrastructure associated with the historical PCM;
- Residential town of Copperton; and
- Eskom Cuprum and Eskom Kronos Substations.

8.2 DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON THE SITE

8.2.1 SURFACE WATER FEATURES AND WETLANDS

8.2.1.1 Wetlands and Pans

The region has an arid climate and therefore persistent surface water ecosystems are rare. Poorly-developed watercourses are commonplace, but defined channels are rare due to the generally low volumes of rainfall events. Most watercourses are barely perceptible and convey small volumes of water only during rainfall events.

In addition to the non-perennial rivers, there are several wetlands (endorheic pans) present within the proposed prospecting application area.

The location of all watercourses and the applicable buffers, namely 100 m for non-perennial rivers and 500 m for wetlands (pans) are shown in the sensitivity map (Appendix B)

8.2.2 CRITICAL BIODIVERSITY AREA AND ECOLOGICAL SUPPORT AREA

Several CBA and ESA areas are located within the application area. However, the size of these areas is small, relative to the extent of the prospecting right area. These sites will be avoided during the invasive prospecting activities.

9 IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION AND PROBABILITY

The impacts and risks identified for the proposed prospecting activities is summarised in Table 16-1.

10 METHODOLOGY USED IN DETERMINING AND RANKING THE NATURE, SIGNIFICANCE, CONSEQUENCES, EXTENT, DURATION AND PROBABILITY OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

10.1 OVERVIEW

The impact assessment methodology comprised of a risk-based impact matrix in which the outcomes, impacts and residual risk of the project activities was determined as follows:

- Step 1: Identify and describe the impact in terms of its nature (negative or positive) and type (direct or indirect);
- Step 2: Assess the impact severity (including reversibility and the potential for irreplaceable loss of resources), impact duration and impact spatial scale (extent);
- Step 3: Assign an impact consequence rating;
- Step 4: Assess the impact probability;
- Step 5: Assign the impact significance rating;
- Step 6: Identify measures and controls by which the impact can be avoided, managed or mitigated; and
- Step: Repeat the impact assessment on the assumption that the mitigation measures are applied and assign the residual impact (post mitigation) significance rating.

The purpose of the impact assessment was not to identify every possible risk and impact which the proposed project activities may have on the receiving social environment. Rather, the assessment was focused on identifying and assessing the most material impacts, commensurate with the nature of the project activity and the characteristics of the receiving social environment.

10.2 APPLICATION OF IMPACT RATING CRITERIA

The various impact rating criteria used and how they were applied are described in the section that follows.

The first phase of impact assessment is the identification of the various project activities which may impact upon the identified environmental categories.

The identification of significant project activities is supported by the identification of the various receiving environmental receptors and resources. These receptors and resources allow for an understanding of the impact pathways and assessment of the sensitivity of the receiving environment to change.

The significance of the impact is then assessed by rating each variable numerically, according to defined criteria as provided in Table 10-1. The purpose of the significance rating of the identified impacts is to develop a clear understanding of the influences and processes associated with each impact.

The severity, spatial scope and duration of the impact together comprise the consequence of the impact; and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact and can obtain a maximum value of 10.

The values for likelihood and consequence of the impact are then read from a significance rating matrix as shown in Table 10-1 and Table 10-2.

The model outcome of the impacts is then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations the model outcomes are adjusted. Arguments and descriptions for such adjustments, as well as arguments for each specific impact assessments are presented in the text and encapsulated in the assessment summary table linked to each impact discussion.

TABLE 10-1: CRITERIA FOR ASSESSING THE SIGNIFICANCE OF IMPACTS

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5
SPATIAL SCOPE OF IMPACT	**RATING**
Activity specific	1
Area specific	2
Whole project site / local area	3
Regional	4
National/International	5
DURATION OF IMPACT	**RATING**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5
FREQUENCY OF ACTIVITY / DURATION OF ASPECT	**RATING**
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5
FREQUENCY OF IMPACT	**RATING**
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

CONSEQUENCE

LIKELIHOOD

***Activity**: a distinct process or task undertaken by an organisation for which a responsibility can be assigned.*

***Environmental aspect**: an element of an organisation's activities, products or services which can interact with the environment.*

***Environmental impacts**: consequences of these aspects on environmental resources or receptors.*

***Receptors**: comprise, but are not limited to people or man-made structures.*

***Resources**: include components of the biophysical environment.*

***Frequency of activity**: refers to how often the proposed activity will take place.*

***Frequency of impact**: refers to the frequency with which a stressor will impact on the receptor.*

***Severity**: refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.*

***Spatial scope**: refers to the geographical scale of the impact.*

***Duration**: refers to the length of time over which the stressor will cause a change in the resource or receptor.*

TABLE 10-2: SIGNIFICANCE RATING MATRIX

LIKELIHOOD (FREQUENCY OF ACTIVITY + FREQUENCY OF IMPACT)	CONSEQUENCE (SEVERITY + SPATIAL SCOPE + DURATION)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

TABLE 10-3: POSITIVE/NEGATIVE MITIGATION RATINGS

COLOUR CODE	SIGNIFICANCE RATING	VALUE	NEGATIVE IMPACT MANAGEMENT RECOMMENDATION	POSITIVE IMPACT MANAGEMENT RECOMMENDATION
	Very High	126-150	Improve current management	Maintain current management
	High	101-125	Improve current management	Maintain current management
	Medium-High	76-100	Improve current management	Maintain current management
	Low-Medium	51-75	Maintain current management	Improve current management
	Low	26-50	Maintain current management	Improve current management
	Very Low	1-25	Maintain current management	Improve current management

11 THE POSITIVE AND NEGATIVE IMPACTS THAT THE PROPOSED ACTIVITY AND ALTERNATIVES WILL HAVE ON THE ENVIRONMENT AND THE COMMUNITY THAT MAY BE AFFECTED

The positive and negative impacts are presented in the stipulated format in Table 16-1.

12 THE POSSIBLE MITIGATION MEASURES THAT COULD BE APPLIED AND THE LEVEL OF RISK

Proposed mitigation measures are summarised in Table 12-1.

TABLE 12-1: PROPOSED MITIGATION MEASURES

ACTIVITY **whether listed or not listed.** (E.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	**POTENTIAL IMPACT** (e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc….etc…)	**ASPECTS AFFECTED**	**PHASE** In which impact is anticipated	**SIGNIFICANCE** if not mitigated	**MITIGATION TYPE**[5] (modify, remedy, control, or stop) through (e.g. noise control measures, storm-water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc. etc) E.g. Modify through alternative method. Control through noise control Control through management and monitoring through rehabilitation	**SIGNIFICANCE** if mitigated
Summary of Socio-Economic Impacts and Risks						
All activities involving employment and procurement of goods and services	Local procurement of goods and services during the prospecting activities.	Socio-Economic Environment	All Phases	Low '-'	Enhance through implementation of the SLP	Low '-'
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Traffic Injuries and fatalities to community members from accidents with prospecting vehicles / equipment	Socio-Economic Environment	All Phases	Medium-High'-'	Control through planning, design and operational controls	Low - Medium '-'

[5] Please refer to the EMPr for details of the mitigation measures

Summary of Groundwater Impacts and Risks						
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Groundwater contamination through pollution from the uncontrolled release of drilling fluids and/or the establishment of a preferential pathway for contaminants during and after drilling has been completed.	Groundwater	Site Preparation, Operational and Closure	Low - Medium '-'	Control through design and operational controls	Low '-'
Summary of Air Quality Impacts and Risks						
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Increased Dustfall, PM10 and PM2.5 Levels	Air quality	Site Preparation, Operational and Closure	Medium-High'-'	Control through design and operational controls	Low - Medium '-'
Summary of Soils Impacts and Risks						
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Disturbance/Loss of Soil Resources Due to Erosion as well as Contamination.	Soils	Site Preparation, Operational and Closure	Medium-High '-'	Avoid / minimise through design and operational controls	Low - Medium '-'
Summary of Noise Impacts and Risks						
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Increased noise impacts generated may impact on the sensitive receptors	Noise	Site Preparation, Operational and Closure	Low-Medium '-'	Avoid / minimise through design and operational controls	Low - Medium '-
Summary of Surface Water Impacts and Risks						
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Surface Water Contamination from Hydrocarbon Spills	Surface Water	Site Preparation, Operational and Closure	Low-Medium '-'	Avoid / minimise through design and operational controls	Low '-'
Summary of Terrestrial Ecology Impacts and Risks						

Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Loss of Natural Habitat	Flora	Site Preparation, Operational and Closure	Medium-High '-'	Avoid / minimise through design and operational controls	Low - Medium '
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Loss of Medicinal / Conservation Important Plant Species	Flora	Site Preparation, Operational and Closure	Medium-High '-'	Avoid / minimise through design and operational controls	Low - Medium '
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Loss of Faunal Habitat	Fauna	Site Preparation, Operational and Closure	Medium-High '-'	Avoid / minimise through design and operational controls	Medium-High '-'
Summary of Heritage Impacts and Risks						
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Disturbance/Loss of Significant Archaeological or Cultural Heritage Sites/Remains	Archaeology, palaeontology, and cultural heritage	Site Preparation, Operational and Closure	Medium-High '-'	Maintain / monitor through implementation of chance-find procedure	Low - Medium '
Summary of Impacts to MeerKAT/SKA Observatory						
Operating of drilling equipment and machinery, including communication devices	EM and RF interference within the declared Karoo Central AAA and the impact this may have on the operation of the MeerKAT/SKA Observatory	EM and RF Interference	Site Preparation, Operational and Closure	High '-'	Avoid / minimise through design and operational controls	Low '-'

13 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

The properties included in the prospecting right application represent the cadastral units relating to the geological formation of interest, namely a portion of the Areachap Group. The proposed location of the prospecting activities on each property is similarly determined by the location of the resource on that property.

The location of the invasive prospecting activities (drilling and trenching) will be informed by the information obtained through the non-invasive prospecting activities, particularly the TDEM survey data. The invasive prospecting activities will avoid the areas identified in the environmental sensitivity map.

14 STATEMENT MOTIVATING THE ALTERNATIVE DEVELOPMENT LOCATION WITHIN THE OVERALL SITE

No alternative development location has been identified.

15 FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE (IN RESPECT OF THE FINAL SITE LAYOUT PLAN) THROUGH THE LIFE OF THE ACTIVITY

The impact assessment methodology is described in Section 10 of this report.

16 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

The assessment is presented in the required format in Table 16-1.

TABLE 16-1: ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

SOILS								
Project Activity		Soils	Likelihood		Consequence			Significance Rating
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Disturbance/Loss of Soil Resources Due to Erosion as well as Contamination	5	5	3	3	3	90
			Significance Post-Mitigation					
			5	4	2	1	2	45
AIR QUALITY								
Project Activity	Air Quality		Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Increased Dustfall, PM10 and PM2.5 Levels	5	5	3	3	3	90
			Significance Post- Mitigation					
			5	2	2	2	2	42
NOISE								
Project Activity	Noise		Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity		5	4	2	3	3	72
			Significance Post- Mitigation					

		Increased noise impacts generated may impact on the sensitive receptors	5	2	2	2	2	42
SURFACE WATER RESOURCES								
Project Activity	Surface Water Resources		Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Surface Water Contamination from Hydrocarbon Spills	5	3	3	3	2	64
			Significance Post- Mitigation					
			5	2	1	1	1	21
FLORA								
Project Activity		Flora	Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Loss of Natural Habitat	5	4	4	2	3	81
			Significance Post-Mitigation					
			5	3	2	2	2	48
Project Activity	Flora		Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Loss of Medicinal / Conservation Important Plant Species	5	3	3	2	5	80
			Significance Post-Mitigation					

			5	1	3	2	5	60
FAUNA								
Project Activity		Fauna	Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Loss of Faunal Habitat	5	5	3	2	5	100
			Significance Post-Mitigation					
			5	4	2	2	5	81
ARCHAEOLOGY								
Project Activity		Archaeology & Cultural Heritage	Likelihood		Consequence			Significance Rating
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Disturbance/Loss of Significant Archaeological or Cultural Heritage Sites/Remains	5	3	4	1	5	80
			Significance Post-Mitigation					
			5	2	2	1	5	56
PALAEONTOLOGY								
Project Activity	Palaeontology		Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Indirect	Significance Pre-Mitigation					
	Resulting Impact from Activity	Disturbance/Loss of Significant palaeontological features	5	3	3	3	4	80
			Significance Post- Mitigation					
			5	1	4	3	4	66
HEALTH AND SAFETY								

Project Activity	Health and Safety		Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Indirect	Significance Pre-Mitigation					
	Resulting Impact from Activity	Traffic Injuries and fatalities to community members from accidents with prospecting vehicles / equipment	5	4	4	3	4	99
			Significance Post- Mitigation					
			5	1	4	3	4	66
SOCIO-ECONOMIC								
Project Activity	Socio-economic		Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct **Positive** Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Local procurement of goods and services during the prospecting activities	5	2	2	2	2	42
			Significance Post- Mitigation					
			5	2	2	2	2	42
GROUNDWATER								
Project Activity	Groundwater		Likelihood		Consequence			
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	Groundwater contamination through pollution from the uncontrolled release of drilling fluids and/or the establishment of a preferential pathway for contaminants during and after drilling has been completed	5	3	3	3	2	64
			Significance Post- Mitigation					
			5	2	2	1	2	35
MeerKAT/SKA OBSERVATORY								
Project Activity	Groundwater		Likelihood		Consequence			

Operating of drilling equipment and machinery, including communication devices	Phase of Project	Site Preparation, Operational and Closure	Frequency of Activity	Frequency of Impact	Severity	Spatial Scope	Duration	Significance Rating
	Impact Classification	Direct Impact	Significance Pre-Mitigation					
	Resulting Impact from Activity	EM and RF interference within the declared Karoo Central AAA and the impact this may have on the operation of the MeerKAT/SKA Observatory	5	4	4	4	4	108
			Significance Post- Mitigation					
			5	2	2	2	2	42

17 SUMMARY OF SPECIALIST REPORTS

The specialist studies compiled as part of the EIAs for the several renewable energy developments proposed within the prospecting right area have been considered in the BAR.

18 ENVIRONMENTAL IMPACT STATEMENT

18.1 SUMMARY OF THE KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

Key findings of the impact assessment for the proposed prospecting activities are as follows:

- Sufficient and appropriate information on the proposed development and the receiving environment was available for conducting the impact assessment;
- With mitigation measures applied, the proposed development is compatible with current land uses; and
- No significant negative impacts have been identified. Impacts identified have been assessed to be reversible and can be satisfactorily mitigated.

18.2 FINAL SITE MAP

The locations for invasive prospecting activities can only be established after the geophysical surveys have been completed. The environmentally sensitive areas identified in the sensitivity map will be avoided.

18.3 SUMMARY OF THE POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS OF THE PROPOSED ACTIVITY AND IDENTIFIED ALTERNATIVES

A summary of the positive and negative impacts and risks associated with the proposed development are provided below:

18.3.1 POSITIVE IMPACTS

- Although limited, the prospecting activities will have a positive impact on the procurement of local goods and services by the applicant, employees and contractors.

18.3.2 NEGATIVE IMPACTS

The potentially negative impacts of the development which were assessed to be of most importance were as follows:

18.3.2.1 Soils

- Disturbance/Loss of Soil Resources Due to Erosion as well as Contamination

18.3.2.2 Air Quality

- Increased Dustfall, PM10 and PM2.5 Levels

18.3.2.3 Noise

- Increased noise impacts generated may impact on the sensitive receptors

18.3.2.4 Water

- Surface Water Contamination from Hydrocarbon Spills

18.3.2.5 Groundwater

- Groundwater contamination through pollution from the uncontrolled release of drilling fluids and/or the establishment of a preferential pathway for contaminants during and after drilling has been completed

18.3.2.6 Terrestrial Ecology

- Loss of natural habitat
- Loss of Medicinal / Conservation Important Plant Species

18.3.2.7 Traffic

- Traffic Injuries and fatalities to community members from accidents with prospecting vehicles / equipment

18.3.2.8 Archaeology

- Disturbance/loss of significant archaeological or cultural heritage sites/remains

18.3.2.9 EM and RF Interference

- EM and RF interference from prospecting equipment and machinery and the impact this may have on the MeerKAT/SKA Observatory.

19 PROPOSED IMPACT MANAGEMENT OBJECTIVES AND THE IMPACT MANAGEMENT OUTCOMES FOR INCLUSION IN THE EMPR

The key objectives of an EMPr are to set out the management and monitoring measures required to both minimise any potentially adverse environmental impacts and enhance the environmental benefits of the proposed prospecting activities, and to ensure that responsibilities and appropriate resources are efficiently allocated to implement the plan.

The aspects which are considered to be of most importance to the development, including the respective management objectives and outcomes for the impacts associated with these aspects are provided in Table 19-1.

The management objectives and outcomes will be achieved through the implementation of the management actions in the EMPr.

TABLE 19-1: IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES

ASPECT	MANAGEMENT OBJECTIVE	MANAGEMENT OUTCOME
Soil	➲ Manage suitable onsite soil resources for rehabilitation activities. ➲ Prevent the contamination of soil resources. ➲ Managed response to the clean-up of accidental spillages and leaks.	➲ Soil resources protected from contamination. ➲ Accidental leaks and spillages responded to rapidly and all contamination remediated in accordance with legal requirements.
Air	➲ Surrounding land users minimally affected by prospecting activities. ➲ Control and minimise particulate and dust emissions to air.	➲ Good stakeholder relations with community members. ➲ Air emissions from the development managed in accordance with legal requirements.
Water resources	➲ Prevent the contamination of surface and groundwater resources. ➲ Managed response to the clean-up of accidental spillages and leaks.	➲ Good stakeholder relations with community members. ➲ Surface and Groundwater resources protected from contamination. ➲ Accidental leaks and spillages responded to rapidly and all contamination remediated in accordance with legal requirements.

Health and Safety	➲ Prevent criminal activities onsite. ➲ Prevent occupational and community health and safety incidents.	➲ Secure and safe site.
Noise	➲ Prevent noise impacts from prospecting activities at sensitive noise receptors. ➲ Complaints which are received are properly investigated and responded to appropriately.	➲ Good stakeholder relations with community members and authorities.
Heritage	➲ Protection of heritage resources.	➲ No heritage resources damaged or destroyed during construction activities.
Traffic and Road Safety	➲ Prevent road safety incidents and limit disruptions to traffic flow. ➲ Complaints which are received are properly investigated and responded to appropriately.	➲ Damage to road surfaces minimised. ➲ Good stakeholder relations with community members and authorities.
Socio-Economic	➲ Support for the development by the local community is enhanced. ➲ Maximise the local economic development potential of the development.	➲ Employment from local community where possible. ➲ Local procurement. ➲ Good stakeholder relations with community members and authorities.

20 FINAL PROPOSED ALTERNATIVES

No other alternatives to those identified and assessed through the impact assessment process are proposed for the prospecting activities.

21 ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION

The following conditions should be included in the authorisation:

- The EMPr, including all management and monitoring measures must be implemented;
- No invasive prospecting activities are to take place in any of the areas identified in the environmental sensitivity plan.

22 DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES, AND GAPS IN KNOWLEDGE

Advisory on Business and Sustainability Africa (Pty) Ltd. (ABS Africa) has prepared this report specifically for Exploration No.5 (Pty) Ltd. The contents of this report:

- Are based on the legal requirements for undertaking a Basic Assessment Process, as defined in the National Environmental Management Act, 1998 (Act No. 107 of 1998), the EIA Regulations (2014) and the scope of services as defined within the contractual undertakings between Orion Exploration No.5 and ABS Africa;
- Are specific to the intended development at the proposed site. The report shall not be used nor relied upon neither by any other party nor for any other purpose without the written consent of ABS Africa. ABS Africa accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report;

- Reflect the best judgement of ABS Africa in light of the information available at the time of preparation. The analyses contained in this report has been developed from information provided by Orion Exploration No.5 and other parties. This information is not within the control of ABS Africa and ABS Africa has not audited such information and makes no representations as to the validity or accuracy thereof; and
- The assessment has been based on the project description provided by the Applicant. Changes to this project description may influence the assessment and the mitigation measures in the EMPr.

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

23.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORISED OR NOT

Based on the findings of the impact assessment, and with the understanding that the mitigation measures will continue to be implemented throughout the prospecting period, the EAP is of the opinion that an environmental authorisation for the prospecting activities may be granted.

23.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

23.2.1 SPECIFIC CONDITIONS TO BE INCLUDED INTO THE COMPILATION AND APPROVAL OF EMPR

The Applicant must continue to reassess the risks and impacts of the development throughout its operational life. Should any change in the risk and impact profile of the development be determined, additional management controls and mitigation measures must be implemented and the EMPr amended to reflect these changes.

24 PERIOD FOR WHICH ENVIRONMENTAL AUTHORISATION IS REQUIRED

The environmental authorisation is required for a period of 2 years.

25 FINANCIAL PROVISION

25.1 DETERMINATION OF THE AMOUNT OF FINANCIAL PROVISION

Drill sites will be rehabilitated on an ongoing basis as they are completed. Financial provisioning was determined by calculating the cost of rehabilitation for drilling sites and access tracks by ripping, reinstating topsoil and reseeding affected areas. The DMR master rate for rehabilitation was applied to the area of disturbance. .

25.2 CONFIRM THAT THIS AMOUNT CAN BE DERIVED FROM THE OPERATING EXPENDITURE

In compiling and submitting their Prospecting Work Programme, the Applicant has confirmed that the required amount for financial provision for rehabilitation and closure can be derived from operating expenditure over the LOM.

26 OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

In compliance with the provisions of sections 24(4) (a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998), the EIA report must include the:

(1) Impact on the socio-economic conditions of any directly affected person.

Positive and negative socio-economic impacts were identified and mitigation measures have been recommended and included in the EMPr.

(2) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act.

The scope of work comprises a heritage scoping report for a large prospecting right area comprising approximately 19 727 ha. Due to the geographical size of the exploration application and the fact that no intrusive activities will occur at this point of the application, it was deemed not feasible to conduct fieldwork at this point. Several large-scale heritage surveys were conducted for renewable energy and mining projects and the archaeological character of the area is now well described (e.g., Orton & Webley 2013 a and b, van der Walt 2012, 2013 & 2017). This desktop study is informed by available data for the area. Some of the aforementioned studies, covered portions of the current study area and 127 heritage features is on record for the study area. Based on these studies the following resources can be expected in the study area as indicated below.

Paleontological resources

The proposed site lies on the Late Carboniferous-Early Permian Dwyka Group tillites, sands, shales, mudstones. Although fossils have not been reported from this site there is a small chance that typical (but very infrequent) early Glossopteris flora plants could occur in the sediments just below the surface. A Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required unless fossils are revealed once excavations and drilling has commenced (Bamford 2018).

Widespread Stone Age scatters and sites (ESA; MSA and LSA)

Every site is relevant to the Heritage Landscape, but it is anticipated that few sites in the study area could have conservation value. The impact of non-invasive exploration on these features are considered negligible how ever known sites should be avoided during planning stages for intrusive exploration.

Historical finds and Cultural landscape

Some structures could occur that are older than 60 years. No impact on structures older than 60 years is foreseen during prospecting activities, however if structures are to be impacted destruction/ alteration permits will have to be applied for.

Burials and cemeteries

Formal and informal cemeteries as well as pre-colonial graves occur widely across Southern Africa. It is generally recommended that these sites are preserved in situ and within a development. These sites can however be relocated if conservation is not possible, but this option must be seen as a last resort and is not advisable. The presence of any grave sites must be confirmed during a field survey and the public consultation process when exploration localities are fixed.

General

It is anticipated that any sites that occur within the project area will have a Generally Protected B (GP.B) or lower field rating, all sites should be mitigatable, and no red flags have been identified. It is therefore recommended that non-invasive exploration can commence (based on approval from SAHRA) with the following conditions of authorisation in the EMPr:

- Before commencing invasive prospecting activities, the impact areas should be subjected to a heritage walk down.
- Inclusion of a chance find protocol (both archaeology and palaeontology) has been included in the EMPr.

(3) Other matters required in terms of sections 24(4) (a) and (b) of the Act.

All reasonable and feasible alternatives in terms of site layout, location, public participation, potential impacts and mitigation have been addressed throughout this report.

UNDERTAKING

The EAP herewith confirms

a. the correctness of the information provided in the reports

b. the inclusion of comments and inputs from stakeholders and I&APs

c. the inclusion of inputs and recommendations from the specialist reports where relevant; and

d. the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

DISCLAIMER

Advisory on Business and Sustainability Africa (Pty) Ltd. (ABS Africa) has prepared this report specifically for Exploration No.5(Pty) Ltd.

The contents of this report:

- Are based on the legal requirements for undertaking a Basic Assessment, as defined in the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the scope of services as defined within the contractual undertakings between Exploration No.5 and ABS Africa.
- Are specific to the intended development at the proposed site. The report shall not be used nor relied upon neither by any other party nor for any other purpose without the written consent of ABS Africa. ABS Africa accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.
- Reflect the best judgement of ABS Africa in light of the information available at the time of preparation. The analyses contained in this report has been developed from information provided by Exploration No.5 and other parties. This information is not within the control of ABS Africa and ABS Africa has not audited such information and makes no representations as to the validity or accuracy thereof.

PART B
ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

27 DRAFT ENVIRONMENTAL PROGRAMME REPORT

27.1 DETAILS OF THE EAP

Name of the Practitioner:	ABS Africa (Pty) Ltd.
Tel No.:	+27 11 805 0061
E-mail address:	paul@abs-africa.com

Details of the EAPs experience and qualifications are provided in Part A, Section 1.

27.2 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

The description of the aspects of the activity are provided in Part A, Section 3.

28 COMPOSITE MAP

The environmental sensitivity map identifying areas to be avoided by the proposed prospecting activities is provided in Appendix B.

29 DESCRIPTION OF IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENTS

The key objectives of an EMPr are to set out the management and monitoring measures required to both minimise any potentially adverse environmental impacts and enhance the environmental benefits of the Project, and to ensure that responsibilities and appropriate resources are efficiently allocated to implement the plan.

The aspects which are considered to be of most importance to the development, including the respective management objectives and outcomes for the impacts associated with these aspects are provided in Table 19-1.

The management objectives and outcomes will be achieved through the implementation of the management actions in the EMPr.

29.1 DETERMINATION OF CLOSURE OBJECTIVES

The main closure objectives of the proposed prospecting activities are:

- To restore the site to its current land capability in a sustainable matter;
- To prevent the establishment of any permanent structures or features, unless otherwise agreed with stakeholders;
- To establish a stable and self-sustainable vegetation cover in areas disturbed by prospecting;
- To limit and rehabilitate any erosion features and prevent any permanent impact to the soil capability in areas disturbed by prospecting;
- To limit and manage the visual impact of the prospecting activities;
- To safeguard the safety and health of humans and animals on the site;

- To close the prospecting operation efficiently, cost effectively and in accordance with legal requirements;
- Cleaning up of the sources of possible contamination still present on the site to protect the downstream receiving environment;
- Removing waste material;
- Cleaning-up and rehabilitating of contaminated soil areas, if applicable; and
- Limiting the possible loss of topsoil by committing the available topsoil to key pre-determined rehabilitation areas.

29.2 VOLUMES AND RATES OF WATER USE REQUIRED FOR THE OPERATION

Water required for the diamond-core drilling will be 10 kl per day (per drill rig) and will be obtained from existing licensed sources. A brief description of the manner in which the water is used in the exploration drilling process is provided below:

- The drilling process recirculates water through a system of three High-Density Polyethylene (HDPE) Lined settling ponds. The latter are excavated next to the selected drilling location and are each approximately 2 m (length) x 1 m (width) x 1 m (depth) in size;
- The excavated material is stockpiled upgradient of the three settling ponds;
- The water supply is pumped into the first pond through an HDPE pipeline from where it gravitates into a second and third pond. Water for the drilling is abstracted from one of the ponds and returned to a different pond through a separate return water pipeline. In the ponds, suspended material arising from the drilling through the rock settles, so that the water can be reused and does not cause a blockage in the pipe; and
- Once the drilling is complete, the HDPE-lining is removed and the settling ponds backfilled with the stockpiled excavated material. The small amount of wastewater remaining in the hole after drilling is complete is absorbed into the soil matrix during the backfilling process.

Sanitary wastewater generated by drill rig personnel is managed through chemical toilets which are serviced by a contractor.

FIGURE 29-1: SETTLING PONDS USED FOR THE RECYCLING OF WATER AT A DRILLING RIG

29.2.1 HAS A WATER USE LICENCE BEEN APPLIED FOR?

A water use licence is not required for the proposed prospecting activities. No abstraction of water will be required, and no prospecting will take place within 100 m of a watercourse or within 500 m of a wetland.

TABLE 29-1: IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

ACTIVITY	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION TYPES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
Soils and Land Use					
Clearing of Vegetation and Stockpiling of Topsoil	All phases	7375 m^2	➲ Vegetation clearing and topsoil removal must be kept to a minimum to that needed for accessing drilling sites and completion of the prospecting works programme. ➲ Avoidance of areas identified as sensitive in the environmental sensitivity plan including applicable buffer areas around wetlands and watercourses. ➲ All vehicles and equipment maintained according to manufacturer specifications and regular inspections undertaken to ensure that leaks and spills are identified and corrected as soon as possible. ➲ Spill response kits available for all vehicles / machinery used for the prospecting. ➲ Provision and maintenance of chemical toilets. ➲ Apply dust control measures including vehicle speed limits, wet suppression of access tracks, and covering temporary stockpiles during high wind speed conditions. ➲ Training on EMPr provided to all personnel involved in the prospecting, including aspects such as site access protocol, waste management, water management and dust control.	MPRDA and NEMA Regulations MHSA Water management measures in compliance with NWA and GN704. SANS Noise Standards Dust mitigation to comply with Dust Control Regulation GNR 827 of 2013 and NEM:AQA, 2004	Throughout Prospecting Activities

Housekeeping and Management of Stockpiles and Exposed Soils	Construction and operation phases	As above	➲ Topsoil and subsoil stockpiles should preferably be placed in a free draining location to minimize soil erosion and possible water logging. ➲ The stripped soils should be stockpiled upslope of areas of disturbance to prevent contamination of stockpiled soils by dirty runoff or seepage. ➲ Erosion control and protection measures installed as part of the construction of the project will be adapted for the specific area and situation should signs of erosion appear. ➲ Rehabilitate eroded areas as soon as possible. ➲ Prospecting and related activities will be conducted in such a manner that it will minimize the amount of soil exposed at a certain period of time. ➲ Top-soil recovered from lay down areas and drill sumps will then be used to rehabilitate the exposed surfaces.		Throughout Prospecting Activities
Air Quality					
Preparation and Use of Access Tracks to Drill Sites	Construction and operation phases	As above	➲ Vehicle speed are to be set at no more than 40 km/h on gravel roads within a 1km distance from any solar plant and 60 km/h on gravel access roads within 2-4km distance from the solar plant. ➲ Vehicles transporting material due to Orion's activities which have the potential of becoming airborns will either be appropriately covered but if not practical, they will be sprayed with water, at a frequency as necessary to ensure dust generation is minimised within the 4km radius. ➲ The R357 Regional road from Prieska is be avoided at all costs beyond the Copperton turn off (29°58'10.34"S 22°22'58.20"E 30°) to the Slimes Dam intersection (1'57.48"S 22°17'40.87"E). Prior experience during construction of the Solar Projects showed that this portion of road results in significant dust generation and soiling of the two larger 75MW Solar Projects. Should this section be required as a main transport route for prospecting or mining, strict speed limits will be be enforced <40km/h. Alternatively, application can be made to the	Dust suppression to comply with Dust Control Regulation GNR 827 of 2013 and NEM:AQA, 2004.	Throughout Prospecting Activities

			Department of Public Road Works to upgrade the surface material (ie tarred) for this portion. ➲ Stockpiled soil or sand utilised during the drilling operations for borehole establishment ("Stockpiles") will be covered in windy conditions. ➲ Stockpiles will not exceed 2m in height. This will reduce dust loss. ➲ Wind breaks / demarcation with wind protective covers will be considered in case dust generation becomes a continuous issue. ➲ Cement will be stored in weather proof containers to avoid the wind from blowing cement dust that might be harmful to employees in the immediate environment or contaminate soil and water sources in the immediate environment.		
Noise					
Diamond-Core Drilling	All phases	Not Applicable	➲ All vehicles and equipment maintained according to manufacturer specifications. ➲ Operations must meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993); ➲ In managing noise specifically related to truck and vehicle traffic, efforts should be directed at: o Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program. o Avoid unnecessary idling times. ➲ Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours. ➲ A noise complaints register must be maintained on site.	SANS Environmental Noise Standards IFC Performance Standards	Throughout Prospecting Activities
Surface Water Resources					

All invasive prospecting phase activities Hydrocarbon spills and product spills Storage and handling of hazardous materials and chemicals Management and disposal of general waste, including liquid wastes	All phases	As above	➲ Monitor and maintain the separation of clean and dirty water. ➲ Reuse and recycling of water. ➲ Provision and maintenance of chemical toilets. ➲ Spill response kits available for all vehicles / machinery used for the prospecting. ➲ The transport, storage, use and disposal of chemicals and hydrocarbons carefully controlled and recorded. ➲ Secondary containment facilities and pollution control structures to be provided for any on-site fuel storage containers. ➲ No drilling may take place within 100 m of a watercourse or within 500 m of a wetland. ➲ All solid waste to be stored in appropriate receptacles and removed from site for offsite disposal daily ➲ All vehicles and equipment maintained according to manufacturer specifications and regular inspections undertaken to ensure that leaks and spills are identified and corrected as soon as possible. ➲ Water for dust suppression will be authorised by a Water Services Authority, prior to extraction and use. ➲ Borehole water requires the necessary approvals and permits authorising Orion's use of the resource for such activities.	MPRDA, NEMA and NEM:WA Regulations MHSA Water management measures in compliance with NWA and GN704.	Throughout Prospecting Activities
Groundwater					
Invasive Prospecting: Drilling	All phases	As above	➲ Use to be made of drilling fluids which do not present a contamination risk to groundwater. ➲ Boreholes will be rehabilitated and closed after drilling. ➲ Any boreholes which are agreed to remain must be capped ➲ The prospecting rights make provision for water from the Siyathemba Municipal supply from Prieska via the Alkantpan pipeline. Orion has a working agreement for water supply from the	MPRDA, NEMA and NEM:WA Regulations	Throughout Prospecting Activities

			Siyathemba Municipality. Water Use Licenses will be obtained for any planned groundwater extraction as is required by law.		
Terrestrial Ecology (Fauna and Flora)					
Clearing of vegetation for drilling and access tracks Drilling and movement of equipment	All phases	As above	➲ Limit vegetation clearing to drilling site areas and access. ➲ Monitoring of man and machinery movement and prevention of access to areas outside of the drilling area. ➲ The site speed limit should be set at a maximum of 40 kph for all vehicles. ➲ No hunting or open fires are to be permitted. ➲ All noise generating activities are to be within legal noise limits. ➲ Establishment of an appropriate safety barrier to prevent unauthorised man/animal access to the drilling area. ➲ The natural vegetation will be disturbed to a minimum and vegetative cover will be protected and kept in a good condition and maintained to keep all surfaces covered. Vehicle movement will be restricted to existing roads or pre-approved routes and drilling pads confined to as small a footprint as possible.	NEMBA MPRDA NEMA	Throughout Prospecting Activities
Heritage					
All invasive prospecting activities	All phases	As above	Before commencing invasive prospecting activities, the impact areas should be subjected to a heritage walk down. Historical farmsteads and graves will not be affected (altered, demolished, renovated, removed) prior to the investigation of these structures by a historical architect. The historical architect has to apply for a permit from SAHRA who would authorise any (recommended) changes to these historical structures which may include alterations, restoration, demolition, removal etc. If any potential heritage resources or human remains are unearthed during prospecting, the site will be demarcated and access restricted. An archaeologist will then be commissioned to visit the site and advise on further steps to be taken.	SAHRA	Throughout Prospecting Activities

			Chance Find Procedure If during the any phase of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager. It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area. The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.		
Rehabilitation and Closure					
Rehabilitation of Mining Area	All phases	As above	➲ Financial provisioning established and maintenance in accordance with the Financial Provisioning Regulations, 2015 ➲ Rehabilitation of all areas disturbed by prospecting activities concurrently with prospecting ➲ Rehabilitate drilling sites and access tracks by ripping, reinstating topsoil and reseeding affected areas ➲ Removal of all remaining solid waste from site and disposal at a licensed waste disposal facility ➲ Removal of all remaining prospecting equipment from the area ➲ Reinstatement and compensation for any property damage / losses to landowners	Water management measures in compliance with NWA and GN704. Rehabilitation in terms of MPRDA and NEMA and relevant Regulations	Throughout Prospecting Activities

Traffic					
Movement of Man and Machinery	All phases		➲ Avoid / minimise road traffic impacts through design and operational controls. ➲ The site speed limit should be set at a maximum of 40 kph for all vehicles. ➲ Apply dust suppression. ➲ Limit traffic times to between 6:00 and 18:00. ➲ Vehicles are to remain on existing or otherwise agreed access tracks.	Health and Safety SANS Environmental Noise Standards IFC Performance Standards National Road Traffic Act NEMA	Throughout Prospecting Activities
Socio-Economic					
Employment Invasive Prospecting Activities	All Phases		➲ Ensure that employment opportunities and skills requirements are advertised locally and that recruitment centres (labour desks) are easily accessible to the local population. ➲ Enhance/prioritise employment of local people. Goods and services to be procured from local service providers ➲ The site speed limit should be set at a maximum of 40 kph for all vehicles. ➲ A complaints register must be maintained on site.	MPRDA	Throughout Prospecting Activities
EM and RF interference with MEERKAT / SKA Observatory					
All prosepecting activities involving the use of machinery and equipment	All Phases	As above	➲ Radio frequency transmitters to comply with the Saturation threshold of (minus) -100 dBm in the territory of any of the radio astronomy stations ➲ Radio frequency transmitters to comply with the SARAS protection levels at the SKA Virtual Centre ➲ Electromagnetic emissions by electrical infrastructure and electrical equipment to comply with the SARAS protection levels in the territory of any of the radio astronomy station	Astronomy Geographic Advantage Act, 2007 and the regulations promulgated in terms thereof	Throughout the LOM

TABLE 29-2: IMPACT MANAGEMENT OUTCOMES

ACTIVITY	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	MITIGATION TYPE / MEASURES	COMPLIANCE WITH STANDARDS
Soils and Land Use					
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Disturbance/loss of soil resources disturbances/ losses of soil due to erosion as well as contamination	Soils	All phases	➲ Avoid/ minimise through design and operational controls.	MPRDA NEMA NEMBA GN704
Air Quality					
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Increased Dustfall, PM10 and PM2.5 Levels	Air quality	All phases	➲ Control through design and operational controls ➲ Apply dust suppression	Dust suppression to comply with Dust Control Regulation GNR 827 of 2013 and NEM:AQA, 2004.
Noise					
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Increased noise impacts generated may impact on the sensitive receptors .	Noise	All phases	➲ Minimise through design and operational controls	SANS Noise Standards IFC Performance Standards
Surface Water Resources					

Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Surface Water Contamination from Hydrocarbon Spills	Surface water	All phases	➲ Avoid/ minimise through design and operational controls.	MPRDA NEMA NEMBA GN 704
Groundwater					
Invasive Prospecting: Drilling	Groundwater contamination through pollution from the uncontrolled release of drilling fluids and/or the establishment of a preferential pathway for contaminants during and after drilling has been complete.	Groundwater	All phases	➲ Avoid/ minimise through design and operational controls.	MPRDA NEMA NEMWA
Terrestrial Ecology					
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Loss of Natural Habitat	Terrestrial flora	All phases	➲ Avoid/ minimise through design and operational controls	MPRDA NEMA NEMWA NEMBA
	Loss of Medicinal / Conservation Important Plant Species	Terrestrial flora	All phases		
	Loss of Faunal Habitat	Terrestrial fauna	All phases		
Heritage					

Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Disturbance/Loss of Significant Archaeological or Cultural Heritage Sites/Remains	Archaeology, palaeontology, and cultural heritage	All phases	Maintain / monitor through implementation of chance find procedure	SAHRA
Traffic and Road					
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Traffic Injuries and fatalities to community members from accidents with prospecting vehicles / equipment	Traffic and Road Safety	All phases	➲ Avoid / minimise through design and operational controls.	Health and Safety National Road Traffic Act
Socio-Economic					
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Local procurement of goods and services during the prospecting activities	Socio-Economic Environment	All Phases	Ensure that employment opportunities and skills requirements are advertised locally and that recruitment centres (labour desks) are easily accessible to the local population. Enhance/prioritise employment of local people. Goods and services to be procured from local service providers	Community liaison

TABLE 29-3: IMPACT MANAGEMENT ACTIONS

ACTIVITY	POTENTIAL IMPACT	MITIGATION TYPE / MEASURES	TIMEFRAME FOR IMPLEMENTATION	COMPLIANCE WITH STANDARDS
Soils and Land Use				
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Disturbance/loss of soil resources disturbances/ losses of soil due to erosion as well as contamination	➲ Avoid/ minimise through design and operational controls.	Throughout Prospecting Phase	MPRDA NEMA NEMBA GN704
Air Quality				
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Increased Dustfall, PM10 and PM2.5 Levels	➲ Avoid/ minimise through design and operational controls.	Throughout Prospecting Phase	Dust suppression to comply with Dust Control Regulation GNR 827 of 2013 and NEM:AQA, 2004.
Noise				
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Increased noise impacts generated may impact on the sensitive receptors	➲ Minimise through design and operational controls	Throughout Prospecting Phase	SANS Noise Standards IFC Performance Standards

Surface Water Resources				
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Surface Water Contamination from Hydrocarbon Spills	➲ Avoid/ minimise through design and operational controls.	Throughout Prospecting Phase	MPRDA, NEMA and NWA Regulations.
	Erosion and stormwater management		Throughout Prospecting Phase	
Groundwater				
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Groundwater contaminitation through pollution from the uncontrolled release of drilling fluids and/or the establishment of a preferential pathway for contaminants during and after drilling has been completed	➲ Avoid/ minimise through design and operational controls	Throughout Prospecting Phase	MPRDA NEMA NEMWA
Terrestrial Ecology				
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Loss of Natural Habitat	➲ Avoid/ minimise through design and operational controls	Throughout Prospecting Phase	MPRDA NEMA NEMWA NEMBA
	Loss of Medicinal / Conservation Important Plant Species		Throughout Prospecting Phase	
	Loss of Faunal Habitat		Throughout Prospecting Phase	
Traffic and Road				
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Traffic Injuries and fatalities to community members from accidents with prospecting vehicles / equipment	➲ Avoid / minimise through design and operational controls.	Throughout Prospecting Phase	Health and Safety National Road Traffic Act
Heritage				

Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Disturbance/Loss of Significant Archaeological or Cultural Heritage Sites/Remains	Maintain / monitor through implementation of chance find procedure	Throughout Prospecting Phase	SAHRA
Socio-Economic				
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Local procurement of goods and services during the prospecting activities	No mitigation Identified	Throughout Prospecting Phase	Community liaison
EM and RF interference with MeerKAT / SKA Observatory				
Operating of drilling equipment and machinery, including communication devices	EM and RF interference within the declared Karoo Central AAA and the impact this may have on the operation of the MeerKAT/SKA Observatory	➲ Radio frequency transmitters to comply with the Saturation threshold of (minus) -100 dBm in the territory of any of the radio astronomy stations ➲ Radio frequency transmitters to comply with the SARAS protection levels at the SKA Virtual Centre ➲ Electromagnetic emissions by electrical infrastructure and electrical equipment to comply with the SARAS protection levels in the territory of any of the radio astronomy station	Throughout Prospecting Phase	Astronomy Geographic Advantage Act, 2007 and the regulations promulgated in terms thereof

30 FINANCIAL PROVISION

30.1 DETERMINATION OF THE AMOUNT OF FINANCIAL PROVISION

30.1.1 DESCRIBE THE CLOSURE OBJECTIVES AND THE EXTENT TO WHICH THEY HAVE BEEN ALIGNED TO THE BASELINE ENVIRONMENT DESCRIBED UNDER THE REGULATION.

The main closure objectives of the proposed prospecting activities are:

- To restore the site to its current land capability in a sustainable matter;
- To prevent the establishment of any permanent structures or features, unless otherwise agreed with stakeholders;
- To establish a stable and self-sustainable vegetation cover in areas disturbed by prospecting;
- To limit and rehabilitate any erosion features and prevent any permanent impact to the soil capability in areas disturbed by prospecting;
- To limit and manage the visual impact of the prospecting activities;
- To safeguard the safety and health of humans and animals on the site;
- To close the prospecting operation efficiently, cost effectively and in accordance with legal requirements;
- Cleaning up of the sources of possible contamination still present on the site to protect the downstream receiving environment;
- Removing waste material;
- Cleaning-up and rehabilitating of contaminated soil areas, if applicable; and
- Limiting the possible loss of topsoil by committing the available topsoil to key pre-determined rehabilitation areas.

30.2 CONFIRM SPECIFICALLY THAT THE ENVIRONMENTAL OBJECTIVES IN RELATION TO CLOSURE HAVE BEEN CONSULTED WITH LANDOWNER AND INTERESTED AND AFFECTED PARTIES

The Applicant has already entered into discussions with potentially affected landowners regarding the proposed prospecting activities, including the applicable closure requirements. Landowners, known land users and I&APs were notified of the availability of the Draft BAR report and provided with an opportunity to comment thereon All comments and responses received from landowners and I&APs will accompany the Final BAR.

30.3 PROVIDE A REHABILITATION PLAN THAT DESCRIBES AND SHOWS THE SCALE AND AERIAL EXTENT OF THE MAIN MINING ACTIVITIES, INCLUDING THE ANTICIPATED MINING AREA AT THE TIME OF CLOSURE.

30.3.1 REHABILITATION OF BOREHOLES

- All shallow boreholes will be backfilled and levelled.
- All boreholes will be covered with a metal plate and 1000 mm of previously stored topsoil.

30.3.2 FINAL REHABILITATION OF ACCESS TRACKS AND / ROADS

Roads that are not needed for closure and post-closure uses will be rehabilitated. This will include:

- Removal of all signage, fencing, shade structures, traffic barriers, etc.;
- All roads will be ripped,ploughed and re-vegetated; and

- All potentially contaminated soils will be removed and disposed of at a licensed landfill site.

30.3.3 Site Rehabilitation

- All construction equipment must be removed from the site. This includes vehicles, temporary structures, fencing, unused pipes/culverts etc;
- All waste will be removed from site to a licensed landfill facility;
- Any contaminated soil will be removed and disposed of at a licensed landfill facility;
- All disturbed surfaces will be revegetated;
- Topography will be free draining after rehabilitation; and
- The Contractor shall ensure that all weeds and alien/invasive species cleared for prospecting activities are removed from site.

30.3.4 Explain why it can be Confirmed that the Rehabilitation Plan is Compatible with the Closure Objectives

The objective of the rehabilitation process is to restore as much as possible of the area disturbed during the prospecting activities to a land use as close as possible to that previously practiced before prospecting. The rehabilitation activities proposed in the above rehabilitation plan will ensure that the land reverts back to its original state upon closure of the prospecting activities.

30.3.5 Calculate and State the Quantum of the Financial Provisions Required to Manage and Rehabilitate the Environment in accordance with the Applicable Guideline

Financial provisioning was determined by calculating the cost of rehabilitation for drilling sites and access tracks by ripping, reinstating topsoil and reseeding affected areas. The DMR master rate for rehabilitation was applied to the area of disturbance.

A summary of the calculated liability for rehabilitation is provided in Table 30-1 below.

TABLE 30-1: CALCULATED LIABILITY FOR REHABILITATION

Description	Disturbance Area (ha)	Cost of Rehabilitation	Unit for Rehabilitation	Total
General surface rehabilitation	0.34	R52 600,00	ha	R17 752,50
Rehabilitation of access roads	0,4	R17,00	m2	R68 000,00
Aftercare and Maintenace	0,74	R52 600,00	ha	R38 792,50
			Total excl. VAT	R85 752,50
			VAT 15%	R12 862,88
Total				**R98 615,38**

30.3.6 Confirm that the Financial Provision will be Approved as Determined

Orion Exploration No.5 will provide a financial guarantee to the DMR upon request thereof and prior to the granting of the environmental authorisation.

TABLE 30-2: MECHANISM FOR MONITORING COMPLIANCE WITH AND PERFORMANCE ASSESSMENT AGAINST THE ENVIRONMENTAL MANAGEMENT PROGRAMME AND REPORTING THEREON

Activity	Impacts Requiring Monitoring Programmes	Functional Requirements for Prospecting	Roles and Responsibilities	Implementation / Compliance Monitoring Mechanism	Monitoring and Reporting Frequency
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Loss of Faunal Habitat	Monitoring should occur via a logbook system where staff members take note of the date, time and location of the sighting/ incident. This will allow determination of the locations where the greatest likelihood exists of causing a road mortality and to develop mitigations for these areas.	ECO / SHE Representatives	Day to day inspections, compliance monitoring and sampling as may be required	Ongoing throughout prospecting activities
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Loss of Natural Habitat Loss of Medicinal / Conservation Important Plant Species	Monitoring of movement of equipment, site personnel and workers should be carried out to minimise unauthorized activities in any part of the project area	ECO / SHE Representatives	Day to day inspections	Ongoing throughout prospecting activities
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Contamination of surface water, groundwater and soil through hydrocarbon spills	➲ Inspections and compliance audits (internal and external)	ECO / SHE Representatives	Emergency response kit, log incident and water and sampling as may be required	Ongoing throughout prospecting activities
Invasive Prospecting: Preparation of Access Tracks and Drilling	Increased Dustfall, PM10 and PM2.5 Levels	➲ Design and operational control	ECO / SHE Representatives	The monthly dust monitoring and mereological reports will be compiled by Airshed and submitted to the Solar Plants within 21	Ongoing throughout prospecting activities

Areas, Drilling and Trenching				days of the end of the specific monitoring period. Incidences and complaints regarding noise and dust must be logged in a complaints register.	
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Increased noise impacts generated may impact on the sensitive receptors	➲ Design and operational control	ECO / SHE Representatives	Incidences and complaints regarding noise and dust must be logged in a complaints register.	Ongoing throughout prospecting activities
Invasive Prospecting: Preparation of Access Tracks and Drilling Areas, Drilling and Trenching	Loss of palaeontological resources	The following procedure is only required if fossils are seen on the surface and when drilling or excavations commence. ➲ When drilling or excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, wood, bone, coal) should be put aside in a suitably protected place. This way the prospecting activities will not be interrupted. ➲ Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 5, 6). This information will be built into the EMP's training and awareness plan and procedures.	ECO / SHE Representatives	Day to day inspections	Ongoing throughout prospecting activities

		➲ Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment. ➲ If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible. ➲ Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits. ➲ If no good fossil material is recovered then the site inspections by the palaeontologist will not be necessary. Annual reports by the palaeontologist must be sent to SAHRA. ➲ If no fossils are found and the excavations have finished then no further monitoring is required.			

30.3.7 INDICATE THE FREQUENCY OF THE SUBMISSIONS OF THE PERFORMANCE REPORT

The environmental liability will be assessed annually as required by NEMA. For prospecting activities, it is recommended that a performance assessment / environmental audit be conducted once the invasive prospecting activities have been completed. The performance assessment / environmental audit report will be completed at the frequency stipulated in the conditions of the environmental authorisation.

30.3.7.1 Audit and report on performance measures

The following compliance monitoring and reporting actions shall be undertaken:

Inspection

SHE inspections of the Works shall be conducted daily on an *ad hoc* basis and formally at least once a week.

Internal Auditing

Internal SHE compliance audits shall be conducted as specified in Table 30-2 The purpose of the internal compliance audits shall be to confirm that all management actions outlined in the EMPr have been implemented. The Contractor / Owner will be responsible for the implementation of corrective measures that may result from the findings of such audits, which will investigate at least the following:

- Completeness of SHE documentation, including planning documents and inspection records;
- Compliance with monitoring requirements;
- Suitability of EMPr in addressing general environmental performance at the Site;
- Efficacy of management controls to address any non-compliance with monitoring requirements; and
- Training activities and record keeping.

30.3.7.2 External Auditing

External audits shall be completed in the manner and frequency determined in Table 30-2.

30.3.7.3 Environmental Incidents and Non-Compliances

The reporting of an environmental incident and or non-compliance shall be as follows:

- Site personnel shall, as soon as possible, inform the site manager of the incident and/or non-compliance, the severity thereof and the corrective actions taken;
- The incident and/or non-compliance details shall be recorded on a register maintained on site;
- Depending on the level of the incident the Owner shall inform the relevant authorities of the incident / non-compliance; and
- Any corrective actions required following the incident and / or non-compliance, including any rehabilitation requirements, shall be implemented by the Contractor / Operator.

30.3.8 MANNER IN WHICH THE APPLICANT INTENDS TO INFORM HIS OR HER EMPLOYEES OF ANY ENVIRONMENTAL RISK WHICH MAY RESULT FROM THEIR WORK

Orion Exploration No. 5 will be responsible for ensuring implementation of the EMPr for the proposed prospecting activities. Orion Exploration No. 5 will also ensure that a procedure is developed such that all senior positions on site have their environmental responsibilities and accountabilities clearly outlined. These descriptions will form part of the contractual obligations upon which individual employees are engaged. Specific accountabilities and responsibilities outlined in the procedures will be communicated through the Project Manager.

The Company is committed to ensuring that the Occupation Health & Safety (OHS) and Environment Departments' staffs are appropriately qualified for implementing their assigned responsibilities effectively. In order to fulfil this requirement, the Company shall recruit competent individuals and put in place a continuous training and skills upgrading program. Typical duties and responsibilities for the OHS and Environment staff will include, inter alia to:

- Ensure that environmental monitoring programs are carried out on schedule and correctly;
- Review environmental data and recommend appropriate actions;
- Monitor environmental compliance of all operations;
- Train others in the team and general personnel on prospecting related environmental issues;
- Design and implement restoration of disturbed areas and re-vegetation studies;
- Establish, train and ensure readiness of the emergency response teams;
- Report on environmental data and incidents of significance as per regulations;
- Liaise with the appropriate regulatory authorities on incidences with environmental risks;
- Provide technical and environmental support to mining operations;
- Ensure commitments listed in the EMPr are met, and
- Review (periodically) the existing monitoring system and design.

30.3.9 Manner in which Risk will be Dealt with in order to Avoid Pollution or the Degradation of the Environment

Potential risk associated with the proposed project has been assessed in Part A of the BAR and the implementation of the management measures in the EMPr will reduce the risk posed to the environment. In conjunction with the EMPr, an Emergency Preparedness and Response Plan shall be available on site dealing with different environmental and safety procedures should an emergency occur.

30.3.10 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

In compliance with the provisions of sections 24(4) (a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998), the EIA report must include the:

(1) Impact on the socio-economic conditions of any directly affected person.

The socio-economic impacts are included as Part A of the BAR.

(2) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act.

The scope of work comprises a heritage scoping report for a large prospecting right area comprising approximately 19 727 ha. Due to the geographical size of the exploration application and the fact that no intrusive activities will occur at this point of the application, it was deemed not feasible to conduct fieldwork at this point. Several large-scale heritage surveys were conducted for renewable energy and mining projects and the archaeological character of the area is now well described (e.g., Orton & Webley 2013 a and b, van der Walt 2012, 2013 & 2017). This desktop study is informed by available data for the area. Some of the aforementioned studies, covered portions of the current study area and 127 heritage features is on record for the study area. Based on these studies the following resources can be expected in the study area as indicated below.

Paleontological resources

The proposed site lies on the Late Carboniferous-Early Permian Dwyka Group tillites, sands, shales, mudstones. Although fossils have not been reported from this site there is a small chance that typical (but very infrequent) early Glossopteris flora plants could occur in the sediments just below the surface. A Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required unless fossils are revealed once excavations and drilling has commenced (Bamford 2018).

Widespread Stone Age scatters and sites (ESA; MSA and LSA)

Every site is relevant to the Heritage Landscape, but it is anticipated that few sites in the study area could have conservation value. The impact of non-invasive exploration on these features are considered negligible how ever known sites should be avoided during planning stages for intrusive exploration.

Historical finds and Cultural landscape

Some structures could occur that are older than 60 years. No impact on structures older than 60 years is foreseen during prospecting activities, however if structures are to be impacted destruction/ alteration permits will have to be applied for.

Burials and cemeteries

Formal and informal cemeteries as well as pre-colonial graves occur widely across Southern Africa. It is generally recommended that these sites are preserved in situ and within a development. These sites can however be relocated if conservation is not possible, but this option must be seen as a last resort and is not advisable. The presence of any grave sites must be confirmed during a field survey and the public consultation process when exploration localities are fixed.

General

It is anticipated that any sites that occur within the project area will have a Generally Protected B (GP.B) or lower field rating, all sites should be mitigatable, and no red flags have been identified. It is therefore recommended that non-invasive exploration can commence (based on approval from SAHRA) with the following conditions of authorisation in the EMPr:

- Before commencing invasive prospecting activities, the impact areas should be subjected to a heritage walk down.
- Inclusion of a chance find protocol (both archaeology and palaeontology) has been included in the EMPr.

(3) Other matters required in terms of sections 24(4) (a) and (b) of the Act.

All reasonable and feasible alternatives in terms of site layout, location, public participation, potential impacts and mitigation have been addressed throughout Part A of the BAR.

REFERENCES

ABS Africa, 2018. Final Environmental Impact Assessment for the Prieska Zinc Copper Project

Almond, J.E, 2016. Proposed construction of Humansrus solar 4 alternative energy facility on farm 147, humansrus near Copperton, Siyathemba Municipality, Northern Cape

Aurecon, 2015. Proposed 75MW PV8 photovoltaic energy plants on the farm Hoekplaas near Copperton, Northern Cape

Airshed Planning Professionals, 2018. Air Quality Specialist Study for the Prieska Zinc Copper Mine

Airshed Planning Professionals, 2018. Noise Specialist Study for the Orion Minerals NL Prieska Copper Mine

Beaumont, P.B., Smith, A.B. & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In: Smith, A.B. (ed.) Einiqualand: studies of the Orange River frontier: 236-264. Cape Town: University of Cape Town Press Reports International Series 207.

Driver, A., Maze, K., Rouget, M., Lombard, A.T., Nel, J., Turpie, J.K., Cowling, R.M., Desmet, P., Goodman, P., Harris, J., Jonas, Z., Reyers, B., Sink, K. & Strauss, T, 2005. National Spatial Biodiversity Assessment 2004: priorities for biodiversity conservation in South Africa. Strelitzia 17. South African National Biodiversity Institute, Pretoria

ECOREX Consulting, 2017. Terrestrial Ecology Study

Ecosoil, 2018. Soil Classification and Land Capability of the Prieska Copper Mine Project Area

Engineering, G. M. (2013). Pre-Economic Assessment.

HCAC - Heritage Consultants, 2018. Heritage Impact Assessment for the Prieska Zinc Copper Project

Orion Gold NL, 2017. Prieska Copper Mine Scoping Study

Orion Minerals, 2018. Prieska Zinc Copper Project Scoping Study Report

Sivest, 2015. Proposed Construction of the Helena 1 75MW Solar Photovoltaic (PV) Energy Facility near Copperton, Northern Cape Province. Draft Scoping Report

Siyathemba Local Municipality, 2006. Spatial Development Framework

Siyathemba Local Municipality, 2017. Integrated Development Plan 2017 - 2018

APPENDIX A: EAP EXPERIENCE

30.4 UNDERTAKING

The EAP herewith confirms:

(a) The correctness of the information provided in this report

(b) The inclusion of comments and inputs from stakeholders and I&APs

(c) The inclusion of inputs and recommendations from the specialist reports where relevant, and

(d) The acceptability of the project in relation to the fining of the assessment and the level of mitigation proposed,

CURRICULUM VITAE

PAUL FURNISS

ENVIRONMENTAL ADVISOR / ENVIRONMENTAL ASSESSMENT PRACTITIONER

BACKGROUND

Paul is a Director of ABS Africa. He has 16 years environmental assessment and management experience in the energy, water, mining and infrastructure sectors. His project experience includes conducting environmental assessment studies in South Africa, Guinea, Lesotho, Democratic Republic of Congo, Sudan, Namibia, Botswana, Zimbabwe, and Mozambique.

In the role of environmental manager, he has been responsible for the setup and auditing of environmental construction management procedures for a range of developments. Having led various environmental due diligence assessments for mining clients and project financiers, he has a good understanding of international environmental governance requirements including Equator Principles and IFC Performance Standards.

FIELDS OF COMPETENCE

- Environmental and Social Impact Assessments for the energy, water, mining, and infrastructure sectors
- Integration of environmental management principles into EPCM activities throughout the project lifecycle
- Environmental risk and screening assessments
- Environmental permitting
- Environmental auditing
- Environmental due diligence studies
- Strategic environmental assessment
- Integrated waste management

ACADEMIC QUALIFICATIONS

- Bachelor of Agricultural Science in Animal Science: University of Pretoria, 1998
- Bachelor of Science (Honours) in Wildlife Management: University of Pretoria, 1999
- Master of Science in Environmental Science (Water Resource Management): University of Pretoria, 2000

PROFESSIONAL REGISTRATION

Pr.Sci.Nat. Professional Natural Scientist (Environmental Science): The South African Council for Natural Scientific Professions, 2007

Certified Environmental Assessment Practitioner: Environmental Assessment Practitioners Association of South Africa

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDIES

PRIESKA ZINC COPPER PROJECT – SOUTH AFRICA (2017-2018)

Environmental Assessment Practitioner for an environmental authorisation, waste management license and integrated water use licence for the proposed re-establishment of the Prieska Copper Mine, near Copperton in the Northern Cape Province.

TRI-K GOLD PROJECT – GUINEA (2017-2018)

Environmental Assessment Practitioner for an IFC-compliant ESIA for a greenfields gold mining project in the Mandiana Prefecture of Guinea.

Lenasia South Hospital Project – South Africa (2016)

Environmental Assessment Practitioner for an environmental authorisation, waste management license and atmospheric emission license for the conversion of a community health centre into a Level 1 District Hospital.

Sedibeng Water Hartswater Regional Office Project – South Africa (2016-2017)

Environmental Assessment Practitioner for a rapid environmental screening assessment and compilation of an Environmental Management Plan for the new Sedibeng Water Regional Office in Hartswater.

Springs Fresh Produce Market Expansion Project – South Africa (2016-2017)

Environmental Assessment Practitioner for an environmental authorisation for the expansion of the Springs Fresh Produce Market.

Morupule B Units 5 & 6 – Botswana (2015-2016)

Specialist consultant for a JBIC and IFC compliant ESIA for a 300 MW thermal coal power plant.

EDF Project Tizert – Morocco (2015-2016)

Technical advisory services for an IFC-compliant ESIA for a copper mine and associated facilities in the Taroudant Province.

Pumpi Copper and Cobalt Project – Democratic Republic of Congo (2014 – 2016)

Project Environmental Manager responsible for a comprehensive update of the Environmental Impact Study for an open-cast copper and cobalt mine, process plant and associated infrastructure.

Hassaï VMS Project – Sudan (2014 – 2015)

Lead consultant responsible for the legal register, review and gap analysis of environmental and social aspects for a gold mining and processing prefeasibility study at the Hassaï Mine.

Thusanang Housing Project – South Africa (2013)

Project Environmental Manager for the EIA and EMP for a 4000 unit residential 1 housing development for Anglo American Platinum, Rustenburg Local Municipality and the Department of Human Settlements.

Manganese Project – Burkina Faso and Côte d'Ivoire (2013)

Environmental coordinator for a prefeasibility study for a proposed mine, port and rail project for the export of Manganese from Burkina Faso to the Port of Abidjan.

Mineral Sands Project – Mozambique (2012)

Environmental programme manager responsible for establishing and coordinating all social and environmental studies for a pre-feasibility study for a large mineral sands project in Mozambique.

Confidential Project – Mozambique (2012)

Project Environmental Manager responsible for the preparation of environmental and social design criteria and high-level comparison of different rail alignment and port location options for a coal export project.

Landau Lifex Project - South Africa (2012)

Project Environmental Manager responsible for the compilation of non-mineral waste management plan and hazardous substances plan as part of a pre-feasibility study for Anglo American Thermal Coal.

Confidential Project – South Africa (2011-2012)

Project Environmental Manager for a pre-feasibility study for the development of a new iron and steel plant in South Africa including all associated infrastructure. Inputs included a multi-criteria site selection analysis and coordination of all environmental and social assessment inputs to the study.

National Integrated Resource Plan – Namibia (2011)

Environmental advisor responsible for the assessment and description of the environmental and social issues associated with primary and secondary generation options.

150 MW Wind Farm Project – Lesotho (2011)

Project Environmental Manager responsible for the management and coordination of all environmental studies and environmental approval processes required for a 150 MW wind farm development in the Lesotho Highlands.

Transnet Capital Expansion Programme – South Africa (2008-2011)

Mobilised as a full-time Environmental Manager for the Richards Bay region for the HMG-Joint Venture. The latter was established as the EPCM agent for the Transnet Capital Projects operating division of Transnet Limited. The role involved management and coordination of numerous environmental studies throughout the project lifecycle process including an environmental resource economic study for the Port of Richards Bay, environmental authorisation processes and fatal flaw assessments.

Nuclear 1 Project – South Africa (2008)

Senior Project Scientist for the EIA and EMP for the proposed construction of a conventional nuclear power station and associated infrastructure in the Western Cape.

Pebble-Bed Modular Reactor Demonstration Power Plant Project – South Africa (2007-2008)

Project Manager and Senior Project Scientist for the Impact Assessment Phase of the EIA and EMP for the proposed Pebble Bed Modular Reactor Demonstration Power Plant in the Western Cape.

600 MW Morupule B Power Station Project – Botswana (2008)

Team Leader for the 600 MW Morupule B coal-fired power station in Botswana. Compilation of the ESIA in a manner that complied with Botswana legislation and World Bank Group requirements.

Ingula Pumped Storage Scheme – South Africa (2007)

Project Manager for seven mining permit applications for borrowpits in the Free State and KwaZulu-Natal Provinces for the Ingula (previously Braamhoek) Pumped Storage Scheme Project.

Gaborone Wastewater Reclamation Project– Botswana (2007)

Senior Project Scientist for the Gaborone Wastewater Reclamation EIA. This project was aimed at determining the feasibility of reclaiming wastewater for direct potable reuse in Gaborone and its satellite villages.

Selebi-Phikwe Water Master Plan – Botswana (2006)

Senior Project Scientist for the EIA, EMP and Public Consultation Process for the Selebi-Phikwe Water Master Plan.

Hydra-Perseus 765kV Power Line EIA – South Africa (2007)

Senior Project Scientist for the EIA for the 260 km 765 kV transmission power line from the Hydra to Perseus Substations.

ENVIRONMENTAL MANAGEMENT, COMPLIANCE MONITORING AND REGULATION

Dingleton Resettlement Project – South Africa (2014)

Project Environmental Control Officer responsible for compilation of an Environmental Execution Plan for the Feasibility Study and the setup and implementation of the environmental compliance monitoring requirements for the project implementation phase.

DEA Compliance Monitoring Project - South Africa (2007)

Task Team Leader for the Department of Environmental Affairs (DEA) Compliance Monitoring Project. The project involved the development of guidelines, systems and programmes for the Compliance Monitoring Directorate of DEA including compilation of a guideline for Emergency Incident reporting in terms of section 30 of the National Environmental Management Act, 1998 (Act 107 of 1998) and a compliance monitoring protocol for environmental authorisations.

JOHANNESBURG CITY PARKS GENERIC EMP - SOUTH AFRICA (2006)

Project Manager and Senior Project Scientist for the Generic EMP for Johannesburg City Parks (JCP). The Generic EMP was developed as a tool for managing the activities of all contractors employed to undertake construction work in the Public Open Spaces within the jurisdiction of the JCP.

ENVIRONMENTAL AUDITS AND DUE DILIGENCE

CONFIDENTIAL PROJECT – SOUTH AFRICA (2017)

Technical due diligence of environmental risks and closure liabilities associated with several operating gold and coal mine assists in South Africa.

CHROME ASSET ACQUISITION – SOUTH AFRICA (2016)

Technical due diligence review of an existing chrome washing facility. The due diligence required identification of environmental and social risks, a review of all existing environmental licenses and consideration of rehabilitation and closure liabilities.

CONFIDENTIAL PROJECT – GUINEA (2012)

Environmental specialist responsible for advising on environmental risks associated with a potential project acquisition of an iron ore resource in West Africa.

SOLAR ENERGY FACILITY – SOUTH AFRICA (2012)

Environmental specialist for a lender's technical due diligence review against local regulations, International Finance Corporation performance standards and Equator Principles for a proposed 30 MW solar energy facility in the Western Cape Province.

WIND ENERGY FACILITY – SOUTH AFRICA (2012)

Environmental specialist for a technical due diligence review against local regulations, International Finance Corporation performance standards and Equator Principles for a proposed new wind energy facility in the Western Cape Province.

SUSTAINABILITY REPORTING

SASOL LIMITED SUSTAINABILITY ASSURANCE PROJECT – SOUTH AFRICA (2009)

Project Manager for the 2009 sustainability reporting assurance engagement for Sasol Limited. The engagement consisted of assuring sustainable performance data from health and safety, environmental and social indicators. Site audits were undertaken at numerous operational sites representative of Sasol's different business units.

ANGLO AMERICAN PLC SUSTAINABILITY ASSURANCE PROJECT – VARIOUS COUNTRIES (2009)

Project Manager for the 2009 sustainability reporting assurance engagement for Anglo American plc. This assurance engagement comprised of site audits at representative operations within Anglo Platinum, Kumba Iron Ore, Scaw, Anglo Coal and Tarmac. The site audits were undertaken in South Africa, Brazil, Chile, Australia and the United Kingdom with twenty sustainability indicators in key performance areas of human capital, natural capital and social capital.

STRATEGIC ENVIRONMENTAL ASSESSMENTS

SEA FOR THE PORT HARCOURT MASTERPLAN – NIGERIA (2008)

Project Manager and Senior Project Scientist for the Strategic Environmental Assessment of the Masterplan for the city of Port Harcourt. The Masterplan was to provide for the development of a new city, appropriately designed for the current and future population of the existing Port Harcourt.

SEA FOR ELECTRICITY DISTRIBUTION INFRASTRUCTURE FOR THE MAGALIESBERG AND SURROUNDING AREAS - SOUTH AFRICA (2007)

Project Manager and Senior Project Scientist for the Strategic Environmental Assessment of the Magaliesberg and Surrounding Areas for Eskom Distribution. The SEA considered the environmental attributes of the study area and provided an environmental planning framework specific to the needs of Eskom Distribution.

SEA for Heritage Park - South Africa (2006)

Senior Project Scientist for the Strategic Environmental Assessment of the one million ha Heritage Park. This ecologically sensitive and socio-economically complex Park encompasses Pilansberg and Madikwe Nature Reserve and crosses the border between South Africa and Botswana.

ABS Africa

Sustainability Advisors

Company Profile

www.abs-africa.com

Company overview

Advisory on Business and Sustainability Africa (Pty) Ltd. (ABS Africa) provides advisory and consulting services focussed on sustainable development. The company was established in recognition of the need for business-specific and flexible professional advisory services on sustainability planning and implementation.

With more than 40 years collective experience in the mining, energy, and infrastructure sectors, our capabilities include prefeasibility and feasibility environmental assessments, independent competent persons reporting, environmental licensing, sustainability reporting, due diligence audits, compliance monitoring, resettlement planning, mine closure planning and spatial analysis.

The foundation of our service offering is our value system. We are committed to being unconditionally honest, excellent in the services we offer and available to our clients for as long as they think we can add value to their business.

ABS Africa
Sustainability Advisors

ABS Africa

ABS Africa offers a complete range of sustainability services to clients in the mining, infrastructure and energy sectors.

We understand the complexity of environmental and social systems and the significant role these play in the long-term sustainability of a business.

From complex Environmental and Social Impact Assessments (ESIAs) to specialist advisory services in water, biodiversity, air quality, soils, and waste, our team of social and environmental professionals have been privileged to work for public and private sector institutions across the African continent.

We have established a network of selected specialist expertise and in-country sustainability professionals across Africa to complement our team. Through this network, we are able to ensure that our service, quality and value proposition remains consistent, regardless of where we work.

Developed from our success in the resources sector, we have gained considerable experience in the application of best practice standards and guidelines including the IFC Performance Standards and Equator Principles.

Our Core Services are as Follows:

- Sustainable Development Advisory Services
- Due Diligence Investigations and Review
- Environmental Assessment
- Environmental Audits and Compliance Monitoring
- Environmental Management Programmes
- GIS, Spatial Analysis and Spatial Planning
- Mine Closure and Rehabilitation Planning
- Permitting and Licensing

Capabilities

Sustainable Development Advisory Services

From early sustainable development interventions in the mid-1990s to the more recent commitments reached at COP21 and the UN Post-2015 Development Agenda, the ABS Africa team of professionals are privileged to be involved in advising clients on a range of sustainability aspects. We provide advisory services across the sustainable development continuum including sustainability business risk and opportunity assessments, carbon, GHG and climate change planning, and sustainability reporting. ABS Africa is a member of the Green Building Council of South Africa (GBCSA).

Due Diligence Investigations and Review

As trusted advisors to financial institutions, private investors, project owner's and some of the largest project engineering companies in the world, we have applied our expertise in advising clients on the potential risks and mitigation measures associated with acquisitions, third party reviews, recommissioning and other related activities.

Environmental Assessment

Our team of social and environmental professionals have completed numerous Environmental and Social Impact Assessments (ESIAs) in the mining, energy and infrastructure sectors. We have experience in applying our environmental assessment expertise throughout the project development process, from screening studies in concept stage to the successful completion of complex ESIAs compliant with international standards. With a project footprint encompassing most regions in Africa, we are familiar with the need to ensure that the assessment process addresses both in-country legal requirements and the IFC Performance Standards and Equator Principles.

Environmental Audits and Compliance Monitoring

From rapid gap analysis audits to comprehensive facility audits of complex industrial sites, we have experience in conducting audits against license conditions, company management systems and international best practice. We have assisted in the development of a guideline on compliance monitoring for a regulatory agency and provided compliance monitoring services during the construction phase of various developments including residential, port, rail and petroleum storage.

Capabilities

Environmental Management Programmes

Having been responsible for the setup and implementation of environmental management controls for the construction phase of a variety of large infrastructure projects, we are familiar with the challenges of constructing a development within the ambit of overly restrictive or inflexible management measures. From basic construction environmental management plans for small infrastructure developments to IFC-compliant Environmental Management Programmes with Action Plans, we have experience in compiling management plans and programmes which are risk-based, flexible and pragmatic.

GIS, Spatial Analysis and Spatial Planning

Our GIS capability includes a range of services including basic mapping for environmental assessments, environmental monitoring, floodline analysis and environmental permit applications. Spatial analysis, 3D analysis, geodatabases and the classification and interpretation of remotely sensed data is also undertaken. With access to a range of spatial data through our preferred partners, we also advise clients on the selection of the most appropriate spatial data for a particular project application.

Mine Closure Planning and Implementation

Working with selected specialists, ABS Africa has experience in the quantification of closure liabilities, the development and compilation of closure plans, specifications and the more practical aspects of setting up and managing rehabilitation and closure contracts.

Permitting and Licensing

Supported by our selected network of specialists and in-country environmental professionals, ABS Africa has considerable experience in obtaining the various environmental permits that may be required for a development. These include waste management licences, atmospheric emission licences, heritage permits, water use licences and permits for the relocation and/or removal of fauna and flora.

CONTACT US

Johannesburg

info@abs-africa.com

+27 11 805 0061

PO Box 14003, Vorna Valley, 1686, South Africa

Building 2, Country Club Estate, Woodlands Drive, Woodmead, 2052

Cape Town

info@abs-africa.com

+27 21 403 6570

Convention Towers, 1st Floor, Cnr Heerengracht & Walter Sisulu Street, Foreshore, Cape Town, 8001

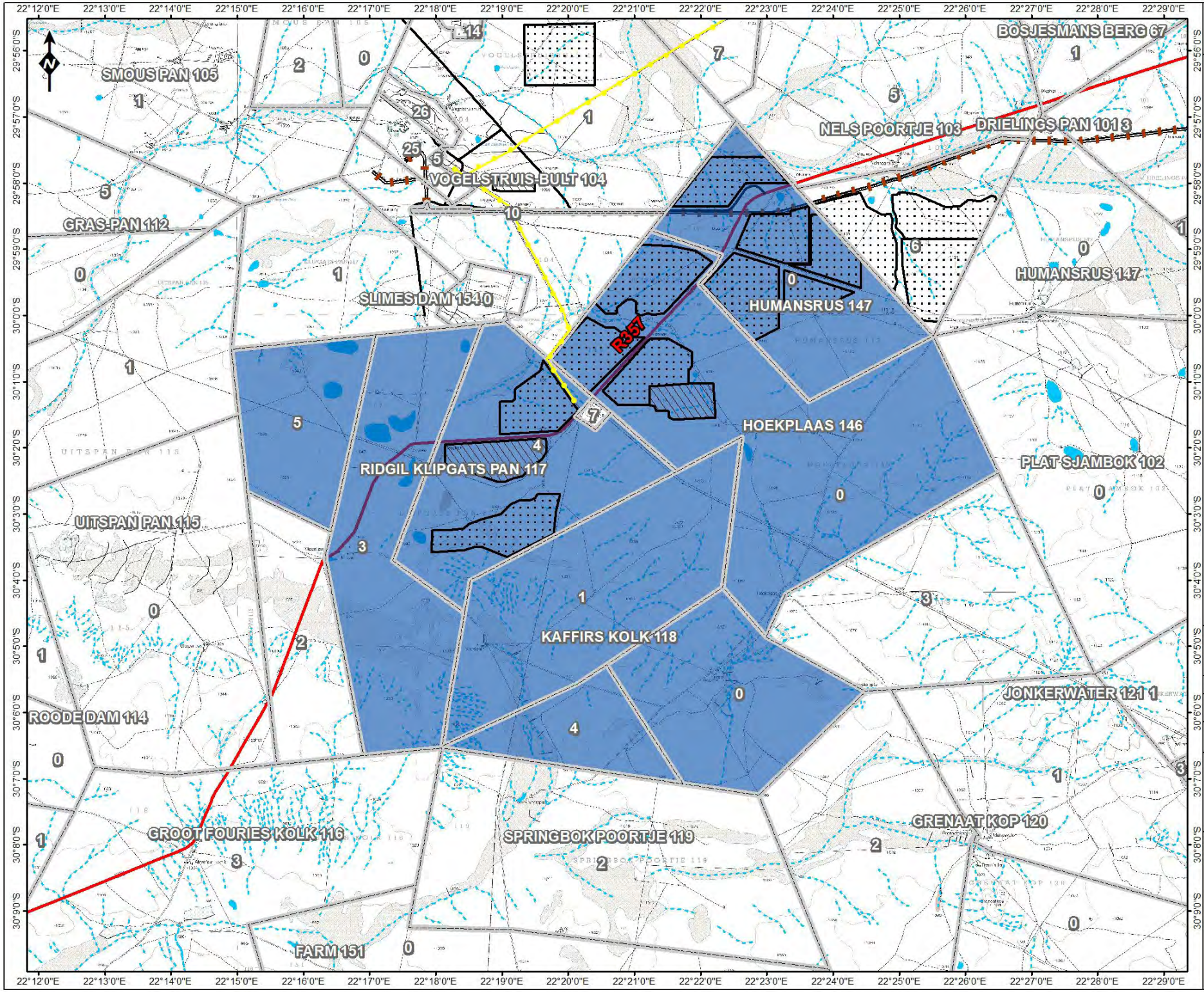
www.abs-africa.com

ABS Africa
Sustainability Advisors

Company Profile

APPENDIX B: MAPS

MAP 1: REGIONAL LOCALITY MAP



Orion Exploration
No. 5 – Prospecting Right

Legend

- Powerline
- Farm Boundaries

PROSPECTING RIGHTS APPLICATION

- Prospecting Right Boundary

OPERATING & PROPOSED DEVELOMENTS

- Operating
- Proposed

ROAD NETWORK

- Main Road
- Secondary Road
- Railway line

RIVERS & STREAMS

- Perennial River
- Non-Perennial River
- Wetlands

LOCALITY

0 1 000 2 000 4 000 Meters

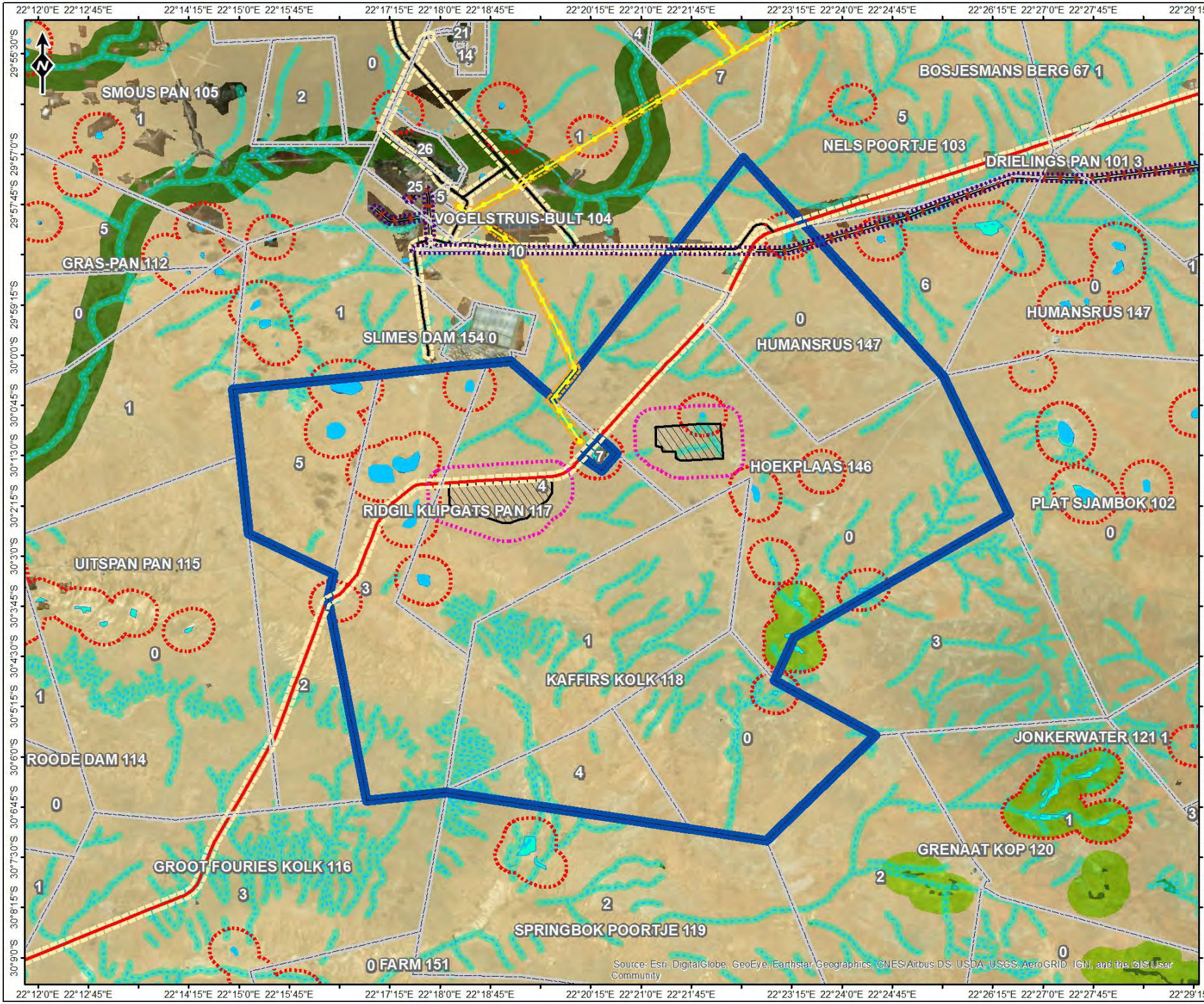
Reviewed:	Drawn by:
P Furniss Environmental Scientist	NH Cele GIS Specialist

Coordinate System: GCS WGS 1984
Datum: WGS 1984

ABS Africa
Sustainability Advisors

Scale: 1:96 326
Version: Final
Date: 2018/11/05

MAP 2: SENSITIVITY



Orion Exploration No. 5 – Prospecting Right

Legend

- Powerline
- 500m C&I Buffer
- 100m Roads Buffer
- 100m Railway Buffer
- 100m Powerline Buffer
- 500m Operating Solar Facility Buffer
- Farm Boundaries

PROSPECTING RIGHTS APPLICATION

- Prospecting Right Boundary

CRITICAL BIODIVERSITY ASSESSMENT

- Critical Biodiversity Area One
- Critical Biodiversity Area
- Ecological Support Area
- Other Natural Areas
- Protected Area

OPERATING SOLAR FACILITY

- Operating

RIVERS & STREAMS

- Non-Perennial River
- 100m GN704 Buffer
- Wetlands

Sensitivity Map

0 750 1 500 3 000 Meters

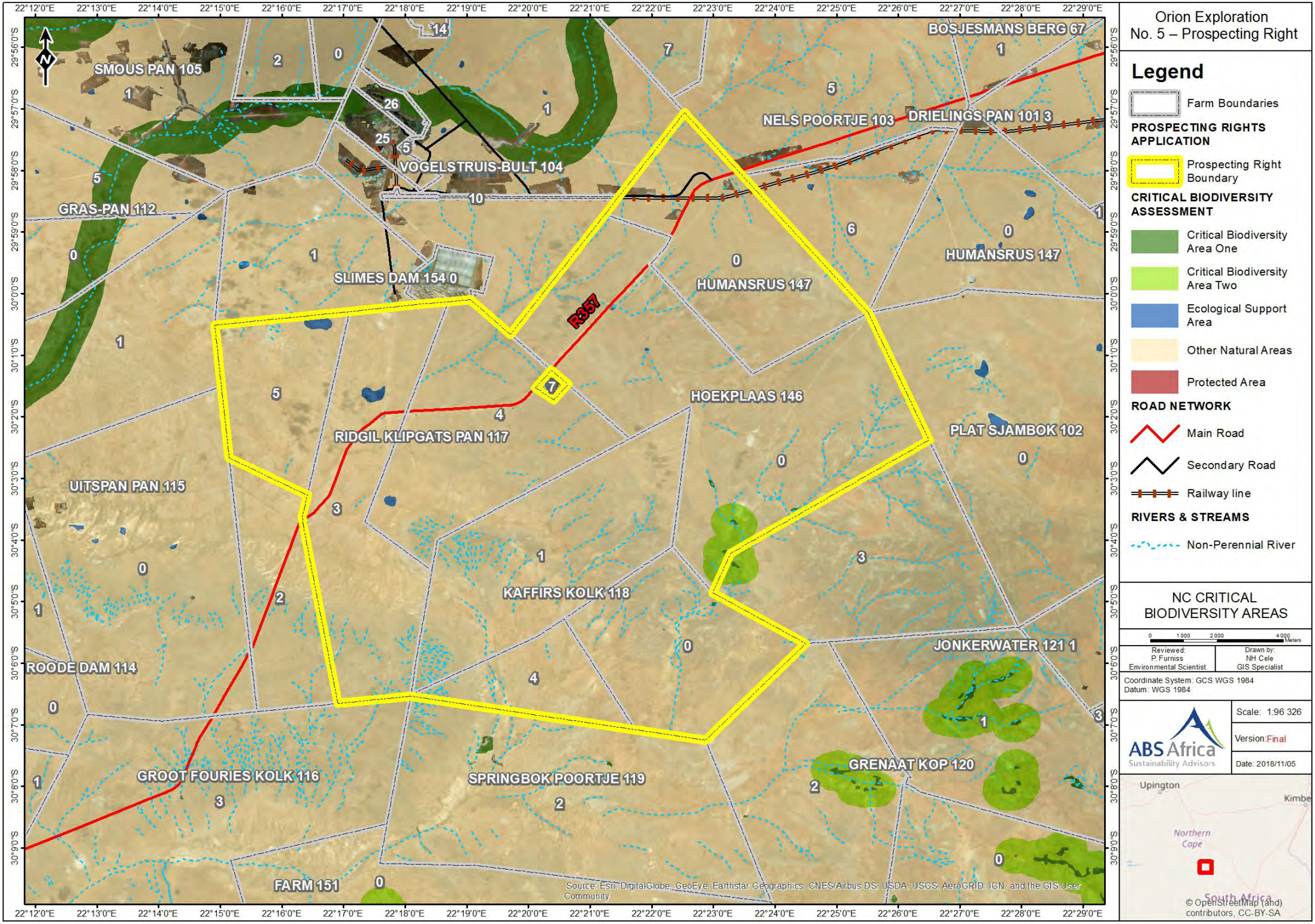
Reviewed:	Drawn by:
P. Furniss Environmental Scientist	NH Cele GIS Specialist

Coordinate System: GCS WGS 1984
Datum: WGS 1984

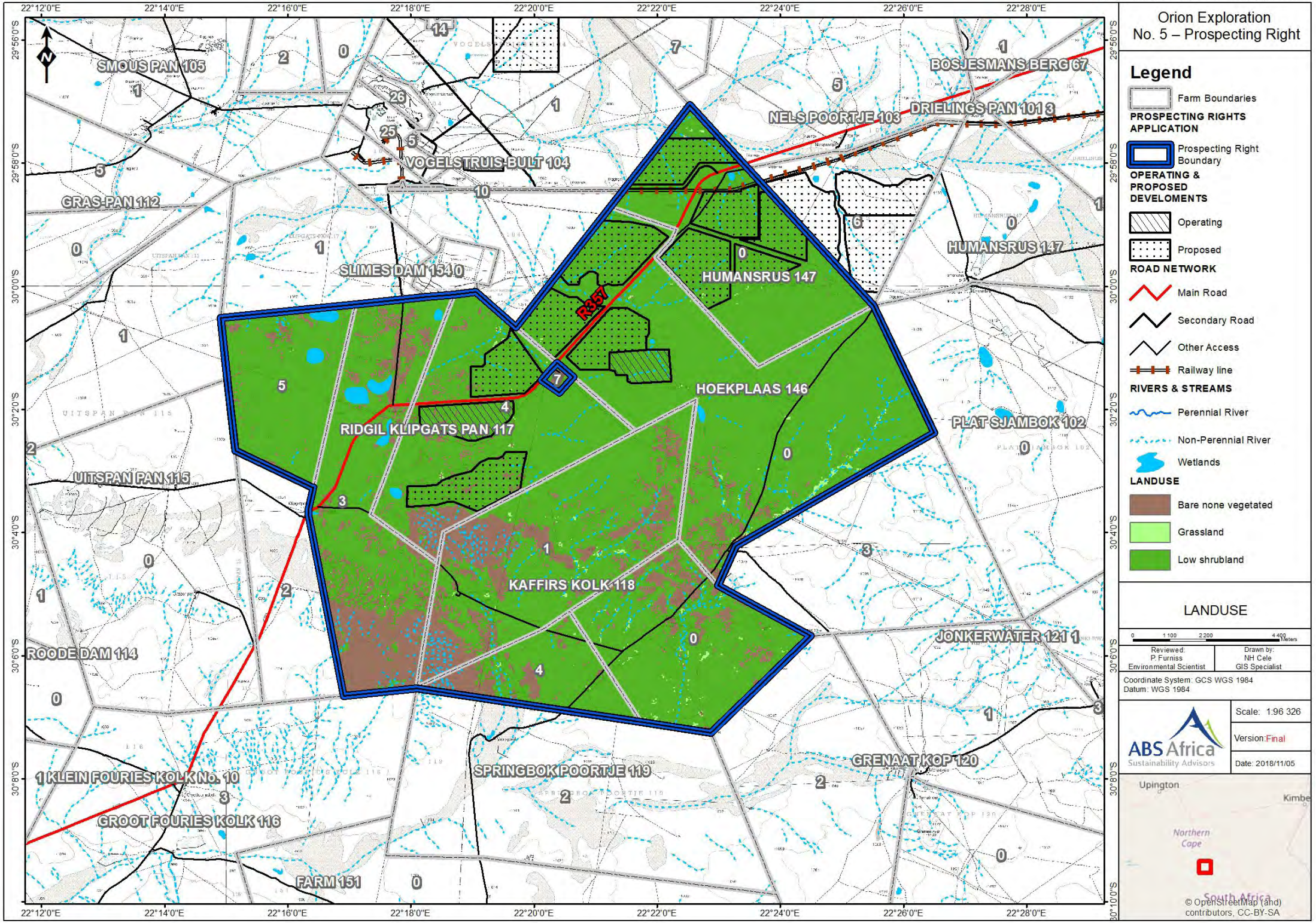
ABS Africa
Sustainability Advisors

Scale: 1:96 326
Version: Final
Date: 2018/11/06

MAP 3: CRITICAL BIODIVERSITY AND ECOLOGICAL SUPPORT AREAS


Orion Exploration
No. 5 – Prospecting Right
Legend
Farm Boundaries
PROSPECTING RIGHTS APPLICATION
Prospecting Right Boundary
CRITICAL BIODIVERSITY ASSESSMENT
Critical Biodiversity Area One
Critical Biodiversity Area Two
Ecological Support Area
Other Natural Areas
Protected Area
ROAD NETWORK
Main Road
Secondary Road
Railway line
RIVERS & STREAMS
Non-Perennial River
NC CRITICAL BIODIVERSITY AREAS
Reviewed: P. Furniss Environmental Scientist
Drawn by: NH Cele GIS Specialist
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Scale: 1:96 326
Version: Final
Date: 2018/11/05
ABS Africa
Sustainability Advisors
SMOUS PAN 105
BOSJESMANS BERG 67
NELS POORTJE 103
DRIELINGS PAN 101 3
VOGELSTRUIS-BULT 104
GRAS-PAN 112
SLIMES DAM 154 0
HUMANSRUS 147
HUMANSRUS 147
R357
HOEKPLAAS 146
PLAT SJAMBOK 102
RIDGIL KLIPGATS PAN 117
UITSPAN PAN 115
KAFFIRS KOLK 118
JONKERWATER 121 1
ROODE DAM 114
GROOT FOURIES KOLK 116
SPRINGBOK POORTJE 119
GRENAAT KOP 120
FARM 151
Upington
Northern Cape
South Africa
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
© OpenStreetMap (and) contributors, CC-BY-SA

MAP 4: CURRENT LANDUSES


Orion Exploration
No. 5 – Prospecting Right
Legend
Farm Boundaries
PROSPECTING RIGHTS APPLICATION
Prospecting Right Boundary
OPERATING & PROPOSED DEVELOMENTS
Operating
Proposed
ROAD NETWORK
Main Road
Secondary Road
Other Access
Railway line
RIVERS & STREAMS
Perennial River
Non-Perennial River
Wetlands
LANDUSE
Bare none vegetated
Grassland
Low shrubland
LANDUSE
SMOUS PAN 105
BOSJESMANS BERG 67
DRIELINGS PAN 101 3
NELS POORTJE 103
VOGELSTRUIS-BULT 104
GRAS-PAN 112
SLIMES DAM 134 0
HUMANSRUS 147
R357
HOEKPLAAS 146
RIDGIL KLIPGATS PAN 117
PLAT SJAMBOK 102
UITSPAN PAN 115
KAFFIRS KOLK 118
JONKERWATER 121 1
ROODE DAM 114
1 KLEIN FOURIES KOLK No. 10
GROOT FOURIES KOLK 116
SPRINGBOK POORTJE 119
GRENAAT KOP 120
FARM 151
22°12'0"E
22°14'0"E
22°16'0"E
22°18'0"E
22°20'0"E
22°22'0"E
22°24'0"E
22°26'0"E
22°28'0"E
29°56'0"S
29°58'0"S
30°0'0"S
30°2'0"S
30°4'0"S
30°6'0"S
30°8'0"S
30°10'0"S
0 1 100 2 200 4 400 Meters
Reviewed: P Furniss Environmental Scientist
Drawn by: NH Cele GIS Specialist
Coordinate System: GCS WGS 1984
Datum: WGS 1984
Scale: 1:96 326
Version: Final
Date: 2018/11/05
ABS Africa
Sustainability Advisors
Upington
Kimbe
Northern Cape
South Africa
© OpenStreetMap (and) contributors, CC-BY-SA

APPENDIX C: PUBLIC PARTICIPATION MATERIALS

APPENDIX C1 – STAKEHOLDER NOTIFICATION LETTER

NOTICE OF APPLICATION FOR A PROSPECTING RIGHT AND ENVIRONMENTAL AUTHORISATION

ORION EXPLORATION NO. 5 (PTY) LTD, EXPLORATION PROSPECTING, COPPERTON, SIYATHEMBA LOCAL MUNICIPALITY, NORTHERN CAPE

30 November 2018

NC30/5/1/1/2/12258PR

Dear Interested or Affected Party

Notification and Project Summary

Notification is hereby given in terms of the National Environmental Management Act 107 of 1998 and the Mineral and Petroleum Resources Development Act 28 of 2002 of the application for a Prospecting Right and Environmental Authorisation (EA) for prospecting activities in the vicinity of the historical Prieska Copper Mine (PCM).

Orion Exploration No.5 intends to undertake prospecting activities for a variety of minerals on the farms, Klipgatspan, Humansrus, Kaffirs Kolk and Hoekplaas.

Prospecting activities will be undertaken through non-invasive (review of historical activities, geophysical survey, geophysical mapping, analysis of drill samples, feasibility study) and invasive (core drilling and trenching) techniques.

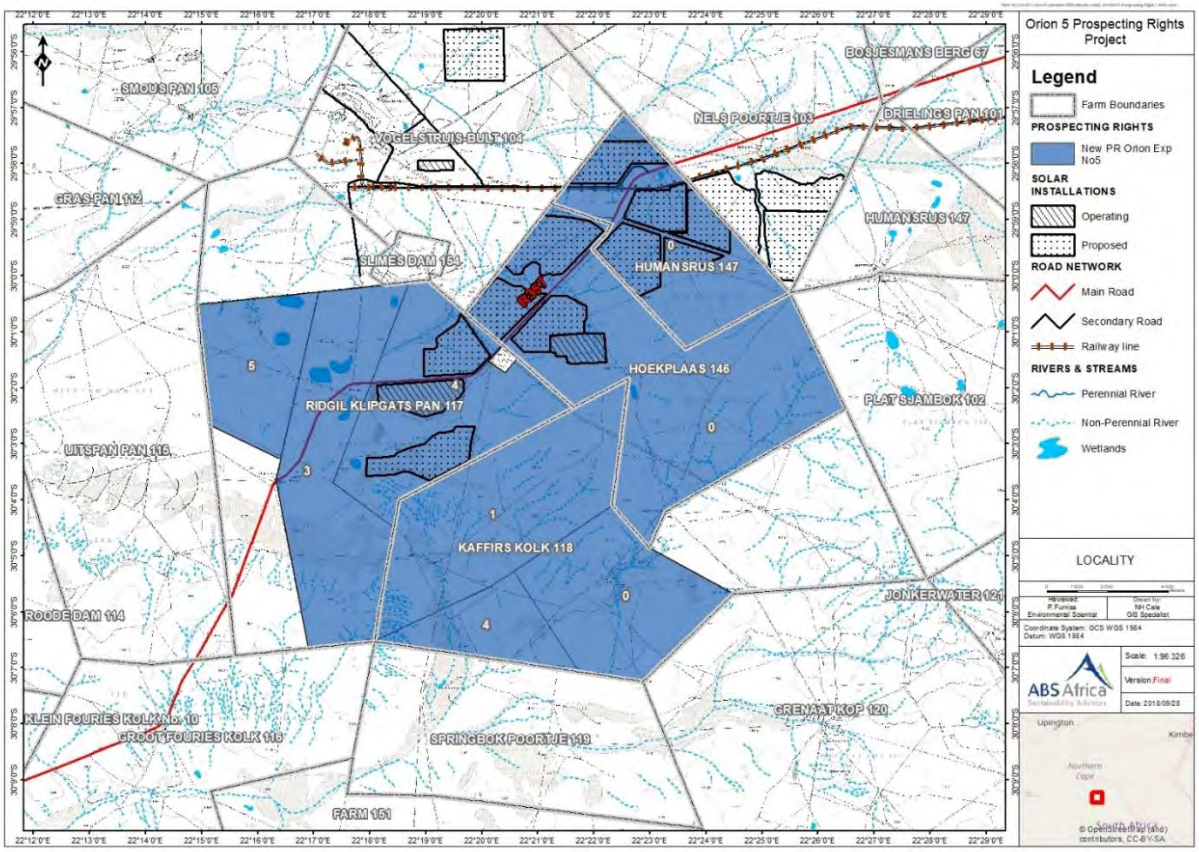


Figure 1: Location of the Prospecting Boundary

The prospecting right concerns listed activities identified in Listing Notice 1 of the EIA Regulations, 2014 (as amended). Accordingly, a Basic Assessment (BA) Process must be applied to the application for EA.

ABS Africa has been appointed as the Environmental Assessment Practitioner, responsible for undertaking the required BA Process. The Draft BAR has been completed and is available for a 30-day commenting period and may be accessed as follows:

- By download: http://www.abs-africa.com/project-documents/
- By e-mail: prieskappp@abs-africa.com
- Hard copies are available for review at the following venues:
  - Orion Minerals Site Office, Copperton
  - Prieska Municipal Library, Stewart Street, Prieska
  - Orion Minerals Office, Loots Boulevard, Prieska

Comments on the Draft BAR are to be submitted to ABS Africa by **22 January 2019**.

Please note: As per the EIA Regulations, 2014 (as amended) there will be an exclusion period from 15 December 2018 to 5 January 2019 for the public participation process. The comment period and availability of the hard copies of the Draft BAR will thus be from 30 November 2018 to 14 December 2018 and from 7 January 2019 to 22 January 2019.

Comments received will be captured into an Issues and Response Report which will be included in the Final BAR to be submitted to the Department of Mineral Resources. Registered Interested and Affected Parties will be notified of the availability of the Final BAR.

Should you have any queries with respect to this letter, please contact the undersigned.

We welcome your ongoing participation.

Kind Regards

Ms. Chané Pretorius

ABS Africa (Pty) Ltd
Tel: +27 21 403 6570
e-mail: prieskappp@abs-africa.com
Postal address: PO Box to 14003, Vorna Valley, 1686

Encl:
Registration and Comment Sheet

REGISTRATION AND COMMENT SHEET

Should you wish to be registered as an Interested and Affected Party (I&AP) for the Project, please complete your details in the form below and return to prieskappp@abs-africa.com.

Registration as an I&AP will ensure that you will receive further notifications on the status of the applications and that you will be informed of the availability of the Basic Assessment Report for your review and comment.

Please also make use of the form to note any initial queries or comments you may have regarding the applications.

Would you like to be registered as an Interested and Affected Party (I&AP) for the Project			**Yes**	**No**
I would like to receive further information regarding the Project via:	**Email**	**Post**	**Fax**	

Name & Surname			
Organisation			
Telephone Number		**Fax**	
Cell phone Number		**Email**	
Postal Address			
Comments:			
Please register the following I&APs for the Process:			

KENNISGEWING RAKENDE DIE AANSOEK OM N PROSPEKTEERREG EN OMGEWINGSMAGTIGING

ORION EXPLORATION NO. 5 (EDMS) BPK, PROSPEKTERING, COPPERTON, SIYATHEMBA PLAASLIKE MUNISIPALITEIT, NOORD KAAP

30 November 2018

NC30/5/1/1/2/12258PR

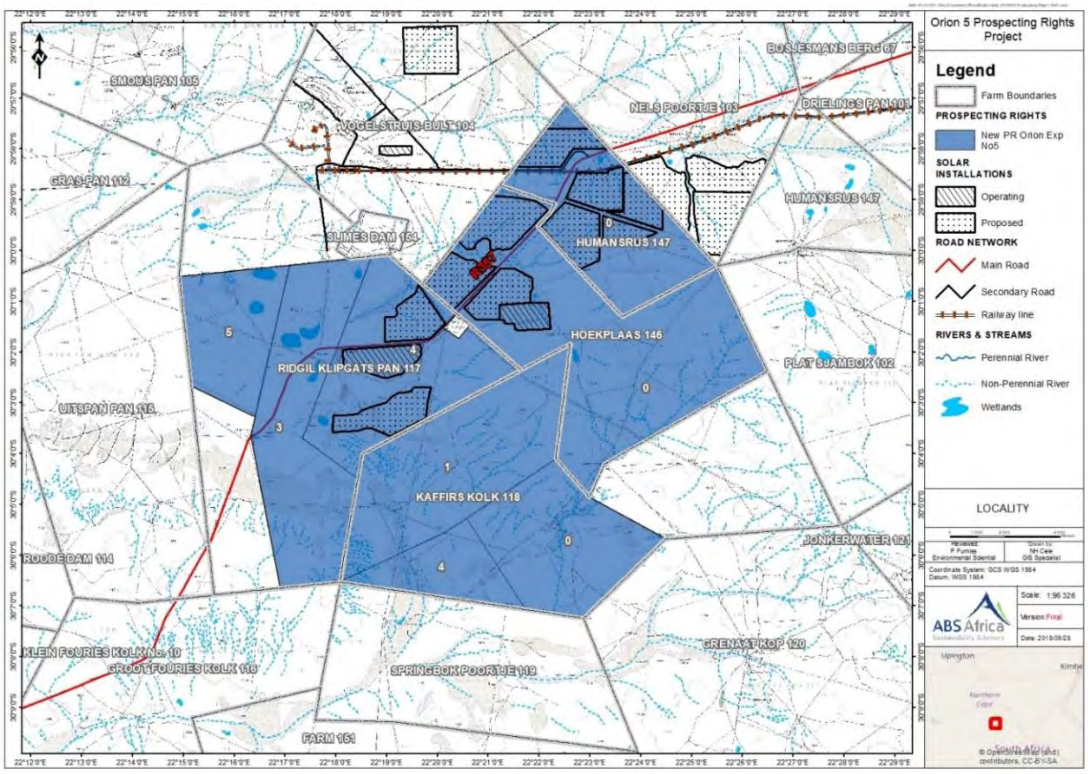
Geagte Belanghebbende en Geaffekteerde Party

Kennisgewing en Projek Beskrywing

Kennis word hiermee gegee ingevolge die Nasionale Omgewingsbestuur Wet (NOBW), (Wet 107 van 1998), die Wet op die Ontwikkeling van Minerale en Petroleum Hulpbronne (OMPW), (Wet No. 28 van 2002), van die aansoek om 'n Prrospekteerreg en Omgewingsmagtiging vir prospekteeraktiwiteite in die omgewing van die historiese Prieska Koper Myn(PCM).

Orion Exploration No. 5 beoog om prospekteeraktiwiteite vir 'n verskeidenheid minerale op die plase, Klipgatspan, Humansrus, Kaffers Kolk en Hoekplaas te onderneem.

Prospekteeraktiwiteite sal onderneem word deur nie-indringende (oorsig van historiese aktiwiteite, geofisiese opname, geofisiese kartering, analise van boormonsters, uitvoerbaarheidstudie) en indringende (kernboor en slootuitgrawings) tegnieke.



Figuur 1: Ligging van die Prospekteerreg Aansoek Area

Die voorgestelde ontwikkeling het betrekking tot gelyste aktiwiteite wat geïdentifiseer is in Noteringskennisgewing 1 van die Omgewings Impak Bepallings-regulasies, 2014. Gevolglik moet 'n Basiese Assessering (BA) -proses op die aansoek vir n Omgewingsmagtiging onderneem word.

ABS Africa (Pty) Ltd (ABS Africa) is aangestel as onafhanklike omgewingsbepalingspraktisyn om die BA-proses te onderneem. Die Konsep BA verlsag is voltooi en is beskikbaar vir 'n kommentaarperiode van 30 dae en kan soos volg bereik word:

- Deur af te laai via die internet: http://www.abs-africa.com/project-documents/
- Via e-pos: prieskappp@abs-africa.com
- Kopieë van die dokument kan ook by die volgende plekke besigtig word:
  - Orion Minerals Werf Kantore, Copperton
  - Prieska Munisipale Biblioteek, Stewart Straat, Prieska
  - Orion Minerals Kantore, Loots Boulevard, Prieska

Insette en kommentaar rakende die voorlopige Omvangsbepalingsverslag moet ABS Africa asb. bereik voor of op **22 Januarie 2019**.

Let wel: Soos per die OIS-regulasies, 2014 (soos gewysig) sal daar 'n uitsluitings periode wees vanaf 15 Desember 2018 tot 5 Januarie 2019 vir die publieke deelname proses. Die harde kopieë van die Konsep BA verlag sal dus van 30 November 2018 tot 14 Desember 2018 en vanaf 7 Januarie 2019 tot 22 Januarie 2019 vir kommentaar beskikbaar wees.

Indien verdere inligting verlang word aangaande die inhoud van hierdie brief, kan die onderstaande persoon gekontak word.

Ons sien uit na U voortgesette deelname in die publieke deelname proses.

Die Uwe

Me. Chané Pretorius
Tel: +27 21 403 6570
e-pos: prieskappp@abs-africa.com
Pos adres: PO Box to 14003, Vorna Valley, 1686
Ingesluit:
Registrasie en Kommentaar Blad

REGISTRASIE EN KOMMENTAAR BLAD

Indien u wil registreer as 'n Belanghebbende en Geaffekteerde Party (BGP) vir die projek, voltooi asb. die aangehegde vorm en stuur die voltooide vorm terug aan prieskappp@abs-africa.com.

Registrasie as 'n BGP sal verseker dat u in die toekoms verwittig sal word van die status van die aansoek asook die beskikbaarheid van Basiese Impakbepalingverslag.

Die vorm kan ook gebruik word om voorlopige kommentaar of opmerkings te maak rakende die aansoek.

Wil u geregistreer word as 'n BGP vir die projek			**Ja**	**Nee**
Ek wil verdere inligting ontvang rakende die Projek via:	**E-Pos**	**Pos**	**Fax**	

Naam & Van			
Organisasie			
Telefoon No.		**Fax**	
Sellulêre Telefoon No.		**E-Pos**	
Pos Adres			
Opmerkings			
Registreer asb. die volgende persoon as 'n BGP vir die projek:			

APPENDIX C2 - ADVERT

KENNISGEWING RAKENDE DIE AANSOEK OM N PROSPEKTEERREG EN OMGEWINGSMAGTIGING

Orion Exploration No. 5 (Edms) Bpk, Prospektering, Copperton, Siyathemba Plaaslike Munisipaliteit, Noord Kaap

NC30/5/1/1/2/12258PR

Kennisgewing en Projek Beskrywing

Kennis word hiermee gegee ingevolge die Nasionale Omgewingsbestuur Wet (NOBW), (Wet 107 van 1998), die Wet op die Ontwikkeling van Minerale en Petroleum Hulpbronne (OMPW), (Wet No. 28 van 2002), van die aansoek om 'n Prospekteringsreg en Omgewingsmagtiging vir prospekteeraktiwiteite in die omgewing van die historiese Prieska Koper Myn (PCM).

The applikant doen aansoek vir prospekteerregte op die volgende plase:

Farm Name	Farm Number	Portion
Klipgats Pan	117	5
Kaffirs Kolk	118	1
Kaffirs Kolk	118	4
Klipgats Pan	117	4
Hoekplaas	146	RE
Kaffirs Kolk	118	RE
Humansrus	147	RE
Klipgats Pan	117	3

Prospekteeraktiwiteite sal onderneem word deur nie-indringende (oorsig van historiese aktiwiteite, geofisiese opname, geofisiese kartering, analise van boormonsters, uitvoerbaarheidstudie) en indringende (kernboor en slootuitgrawings) tegnieke..

Basiese Impakbepalings Proses

Die voorgestelde aktiwiteite het betrekking op gelyste aktiwiteite wat geïdentifiseer is in Noteringskennisgewing 1 van die OIB-regulasies, 2014. Gevolglik moet 'n Basiese Impakbepalings Proses op die aansoek vir omgewingsmagtiging toegepas word. ABS Africa (Pty) Ltd (ABS Africa) is aangestel as onafhanklike omgewingsbepalingspraktisyn om die Basiese Impakbepalings Proses te onderneem

Die Konsep BA verlsag is voltooi en is beskikbaar vir 'n kommentaarperiode van 30 dae en kan soos volg bereik word:

- Deur af te laai via die internet: http://www.abs-africa.com/project-documents/
- Via e-pos: prieskappp@abs-africa.com
- Kopieë van die dokument kan ook by die volgende plekke besigtig word:
    - Orion Minerals Werf Kantoor, Copperton
    - Prieska Munisipale Biblioteek, Stewart Straat, Prieska
    - Orion Minerals Kantore, Loots Boulevard, Prieska

Let wel: Soos per die OIS-regulasies, 2014 (soos gewysig) sal daar 'n uitsluitings periode wees vanaf 15 Desember 2018 tot 5 Januarie 2019 vir die publieke deelname proses. Die harde kopieë van die Konsep BA verlag sal dus van 30 November 2018 tot 14 Desember 2018 en vanaf 7 Januarie 2019 tot 22 Januarie 2019 vir kommentaar beskikbaar wees.

Om te registreer as 'n Belangstellende en Geaffekteerde Partye (B&GP'e) of om verdere inligting te bekom, kontak asb. die onderstaande onafhanklike omgewingsbepalingspraktisyn:

Me. Chané Pretorius
ABS Africa (Pty) Ltd
Tel: +27 21 403 6570
Posbus 14003, Vorna Valley, 1686
E-pos: prieskappp@abs-africa.com

ABS Africa
Sustainability Advisors

APPENDIX C3 – SITE NOTICE

NOTICE OF APPLICATION PROSPECTING RIGHT AND ENVIRONMENTAL AUTHORISATION

Orion Exploration No. 5 (Pty) Ltd, Exploration Prospecting, Copperton, Siyathemba Local Municipality, Northern Cape

NC30/5/1/1/2/12258PR

Notification and Project Summary

Notification is hereby given in terms of the National Environmental Management Act 107 of 1998 and the Mineral and Petroleum Resources Development Act 28 of 2002 of application for a Prospecting Right and Environmental Authorisation (EA) for prospecting activities in the vicinity of the historical Prieska Copper Mine (PCM).

The applicant is applying for a Prospecting Right on the following properties:

Farm Name	Farm Number	Subdivision Number
Klipgats Pan	117	5
Kaffirs Kolk	118	1
Kaffirs Kolk	118	4
Klipgats Pan	117	4
Hoekplaas	146	RE
Kaffirs Kolk	118	RE
Humansrus	147	RE
Klipgats Pan	117	3

Prospecting activities will be undertaken through non-invasive (review of historical activities, geophysical survey, geophysical mapping, analysis of drill samples, feasibility study) and invasive (core drilling and trenching) techniques.

Basic Assessment Process

The proposed development concerns listed activities identified in Listing Notice 1 of the EIA Regulations, 2014. Accordingly, a Basic Assessment (BA) Process must be applied to the application for EA. ABS Africa has been appointed as the Environmental Assessment Practitioner, responsible for undertaking the required BA Process.

The Draft BAR has been completed and is available for a 30-day commenting period and may be accessed as follows:

- By download: http://www.abs-africa.com/project-documents
- By e-mail: prieskappp@abs-africa.com
- Hard copies are available for review at the following venues:
  - Orion Minerals Site Office, Copperton
  - Prieska Municipal Library, Stewart Street, Prieska
  - Orion Minerals Office, Loots Boulevard, Prieska

Comments on the Draft BAR are to be submitted to ABS Africa by **22 January 2019**.

Please note: As per the EIA Regulations, 2014 (as amended) there will be an exclusion period from 15 December 2018 to 5 January 2019 for the public participation process. The comment period and availability of the hard copies of the Draft BAR will thus be from 30 November 2018 to 14 December 2018 and from 7 January 2019 to 22 January 2019.

Should you have any queries or wish to register as an Interested and Affected Party (I&AP), please contact the undersigned.

Ms. Chané Pretorius
ABS Africa (Pty) Ltd
Tel: +27 21 403 6570
PO Box to 14003, Vorna Valley, 1686
Email: prieskappp@abs-africa.com
Date of Placement: 30 November 2018

ABS Africa
Sustainability Advisors

KENNISGEWING RAKENDE DIE AANSOEK OM N PROSPEKTEERREG EN OMGEWINGSMAGTIGING

Orion Exploration No. 5 (Edms) Bpk, Prospektering, Copperton, Siyathemba Plaaslike Munisipaliteit, Noord Kaap

NC30/5/1/1/2/12258PR

Kennisgewing en Projek Beskrywing

Kennis word hiermee gegee ingevolge die Nasionale Omgewingsbestuur Wet (NOBW), (Wet 107 van 1998), die Wet op die Ontwikkeling van Minerale en Petroleum Hulpbronne (OMPW), (Wet No. 28 van 2002), van die aansoek om 'n Prospekteringsreg en Omgewingsmagtiging vir prospekteeraktiwiteite in die omgewing van die historiese Prieska Koper Myn (PCM).

The applikant doen aansoek vir prospekteerregte op die volgende plase:

Farm Name	Farm Number	Subdivision Number
Klipgats Pan	117	5
Kaffirs Kolk	118	1
Kaffirs Kolk	118	4
Klipgats Pan	117	4
Hoekplaas	146	RE
Kaffirs Kolk	118	RE
Humansrus	147	RE
Klipgats Pan	117	3

Prospekteeraktiwiteite sal onderneem word deur nie-indringende (oorsig van historiese aktiwiteite, geofisiese opname, geofisiese kartering, analise van boormonsters, uitvoerbaarheidstudie) en indringende (kernboor en slootuitgrawings) tegnieke..

Basiese Impakbepalings Proses

Die voorgestelde aktiwiteite het betrekking op gelyste aktiwiteite wat geïdentifiseer is in Noteringskennisgewing 1 van die OIB-regulasies, 2014. Gevolglik moet 'n Basiese Impakbepalings Proses op die aansoek vir omgewingsmagtiging toegepas word. ABS Africa (Pty) Ltd (ABS Africa) is aangestel as onafhanklike omgewingsbepalingspraktisyn om die Basiese Impakbepalings Proses te onderneem

Die Konsep BA verlsag is voltooi en is beskikbaar vir 'n kommentaarperiode van 30 dae en kan soos volg bereik word:

- Deur af te laai via die internet: http://www.abs-africa.com/project-documents/
- Via e-pos: prieskappp@abs-africa.com
- Kopieë van die dokument kan ook by die volgende plekke besigtig word:
  - Orion Minerals Werf Kantore, Copperton
  - Prieska Munisipale Biblioteek, Stewart Straat, Prieska
  - Orion Minerals Kantore, Loots Boulevard, Prieska

Insette en kommentaar rakende die voorlopige Omvangsbepalingsverslag moet ABS Africa asb. bereik voor of op **22 Januarie 2019.**

Let wel: Soos per die OIS-regulasies, 2014 (soos gewysig) sal daar 'n uitsluitings periode wees vanaf 15 Desember 2018 tot 5 Januarie 2019 vir die publieke deelname proses. Die harde kopieë van die Konsep BA verlag sal dus van 30 November 2018 tot 14 Desember 2018 en vanaf 7 Januarie 2019 tot 22 Januarie 2019 vir kommentaar beskikbaar wees.

Om te registreer as 'n Belangstellende en Geaffekteerde Partye (B&GP'e) of om verdere inligting te bekom, kontak asb. die onderstaande onafhanklike omgewingsbepalingspraktisyn:

Me. Chané Pretorius

ABS Africa (Pty) Ltd
Tel: +27 21 403 6570
PO Box to 14003, Vorna Valley, 1686
E-pos: prieskappp@abs-africa.com

Datum van Kennisgewing: 30 November 2018

APPENDIX D: HERITAGE AND PALAEONTOLOGICAL ASSESSMENT

HERITAGE DESKTOP REPORT

FOR THE PROPOSED ORION NO 5 PROSPECTING APPLICATION (AREA 1) ON THE FARMS KLIPGATSPAN, HUMANSRUS, KAFFIRS KOLK AND HOEKPLAAS,

Client:
ABS Africa (Pty) Ltd

Client information:
Paul Furniss
E – Mail: paul@abs-africa.com

HCAC - Heritage Consultants

Private Bag X 1049
Suite 34
Modimolle
0510

Tel: 082 373 8491
Fax: 086 691 6461
E-Mail: jaco.heritage@gmail.com

Report Author:

Mr. J. van der Walt

Project Reference:

2181107

Report date:

November 2018

DOCUMENT PROGRESS
Heritage Desktop Report

Document status

Document Version	v1.0		
Report Purpose	Draft for review ABS Africa (Pty) Ltd		
Report Ref. No.	2181107		
	Name	Signature	Date
Document Compilation	Mr. J. van der Walt		Nov 2018

Distribution List

Date	Report Reference number	Document Distribution	Number of Copies
2018/11/23	2181107	ABS Africa (Pty) Ltd	Electronic copy

Amendments on document

Date	Report Reference Number	Description of Amendment

Indemnity and Conditions Relating to this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and Heritage Contracts and Archaeological Consulting (HCAC) CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information becomes available from ongoing research or further work in this field, or pertaining to this investigation.

Although all possible care is taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the study. HCAC CC and its personnel will not be held liable for such oversights or for costs incurred as a result of such oversights.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

Copyright

EXECUTIVE SUMMARY

Site name and location: The proposed No 5 Prospecting project is located on the farms Klipgatspan, Humansrus, Kaffirs Kolk and Hoekplaas, 15km South of Copperton and 60km South-West of Prieska in the Northern Cape Province

1: 50 000 Topographic Map: 2322 AB & 2922 CD.

EIA Consultant: ABS Africa (Pty) Ltd.

Developer: Orion Exploration No.5

Heritage Consultant: Heritage Contracts and Archaeological Consulting CC (HCAC).
Contact person: Jaco van der Walt, Tel: +27 82 373 8491, Email: jaco.heritage@gmail.com.

Date of Report: 23 November 2018

Findings of the Assessment:

The scope of work comprises a heritage desktop report for a large prospecting right area comprising approximately 19 727 ha. Due to the geographical size of the exploration application and the fact that no intrusive activities will occur at this point of the application, it was deemed not feasible to conduct fieldwork at this point. Several large-scale heritage surveys conducted for renewable energy and mining projects and the archaeological character of the area is well described (e.g., Orton & Webley 2013 a and b, van der Walt 2012, 2013 & 2017) and this desktop study is informed by available data for the area. Some of the aforementioned studies to name a few, covered portions of the current study area and 127 heritage features is on record for the study area. Based on these studies the following resources can be expected in the study area as indicated below.

Standing structures older than 60 years are protected by Section 34 of the NHRA (Act 25 of 1999) and the destruction or demolition of structures older than 60 years will require relevant permits. Although it is not foreseen that non-intrusive exploration activities will impact on standing structures, features older than 60 years can be expected in the study area in the form of farmsteads.

With regard to the archaeological component of Section 35 this brief background study indicates that the general area under investigation has a wealth of heritage sites and a cultural layering dating back to the Stone Age with scatters and sites dating to the ESA, MSA and LSA. Based on the SAHRA paleontological sensitivity map the area is of moderate sensitivity and an independent paleontological assessment was conducted (Bamford 2018). This study concluded that a Fossil Chance Find Protocol should be added to the EMPr and no palaeontological site visit is required unless fossils are revealed once excavations and drilling has commenced. As far as the palaeontology is concerned a prospecting right should be granted. In terms of Section 36 no known graves occur in the study area. It should be noted that graves can occur anywhere on the landscape and precolonial graves are expected.

It is anticipated that any sites that occur within the project area will have a Generally Protected B (GP.B) or lower field rating and all sites should be mitigatable and no red flags have been identified. It is therefore recommended that non-invasive exploration can commence (based on approval from SAHRA) with the following conditions of authorisation incorporated:

- Before commencing invasive prospecting activities, the impact areas should be subjected to a heritage walk down.
- Inclusion of a chance find protocol (both archaeology and palaeontology) in the EMPr.

Contents

Figures

ABBREVIATIONS

AIA: Archaeological Impact Assessment
ASAPA: Association of South African Professional Archaeologists
BIA: Basic Impact Assessment
CRM: Cultural Resource Management
EAP: Environmental Assessment Practitioner
ECO: Environmental Control Officer
EIA: Environmental Impact Assessment*
EIA: Early Iron Age*
EMP: Environmental Management Plan
ESA: Early Stone Age
GPS: Global Positioning System
HIA: Heritage Impact Assessment
LIA: Late Iron Age
LSA: Late Stone Age
MEC: Member of the Executive Council
MIA: Middle Iron Age
MPRDA: Mineral and Petroleum Resources Development Act
MSA: Middle Stone Age
NEMA: National Environmental Management Act
PRHA: Provincial Heritage Resource Agency
SADC: Southern African Development Community
SAHRA: South African Heritage Resources Agency
SAHRIS: South African Heritage Resources Information System

**Although EIA refers to both Environmental Impact Assessment and the Early Iron Age both are internationally accepted abbreviations and must be read and interpreted in the context it is used.*

GLOSSARY

Archaeological site (remains of human activity over 100 years old)

Early Stone Age (2 million to 300 000 years ago)

Middle Stone Age (300 000 to 30 000 years ago)

Late Stone Age (30 000 years ago until recent)

Historic (approximately AD 1840 to 1950)

Historic building (over 60 years old)

Lithics: Stone Age artefacts

1. INTRODUCTION

HCAC was contracted by ABS Africa (Pty) Ltd to conduct a heritage study for the proposed Orion No 5-prospecting application. The proposed prospecting activities are located 15km South of Copperton and 60km South-West of Prieska in the Northern Cape Province. Orion Exploration No.5 intends to undertake prospecting activities for a variety of minerals on the farms, Klipgatspan, Humansrus, Kaffirs Kolk and Hoekplaas. (Figure 1).

The aim of the desktop report is to identify possible heritage resources within the project site. The study furthermore aims to assess the impact of the proposed project on non - renewable heritage resources and to submit appropriate recommendations with regards to the responsible cultural resources management measures that might be required to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve and develop them within the framework provided by Heritage legislation.

This report outlines the approach and methodology utilised for the Desktop report. The report includes information collected from various sources and consultations. Possible impacts are identified and mitigation measures are proposed in the following report. It is important to note that no field work was conducted as this will be done when the localities of the invasive exploration is fixed.

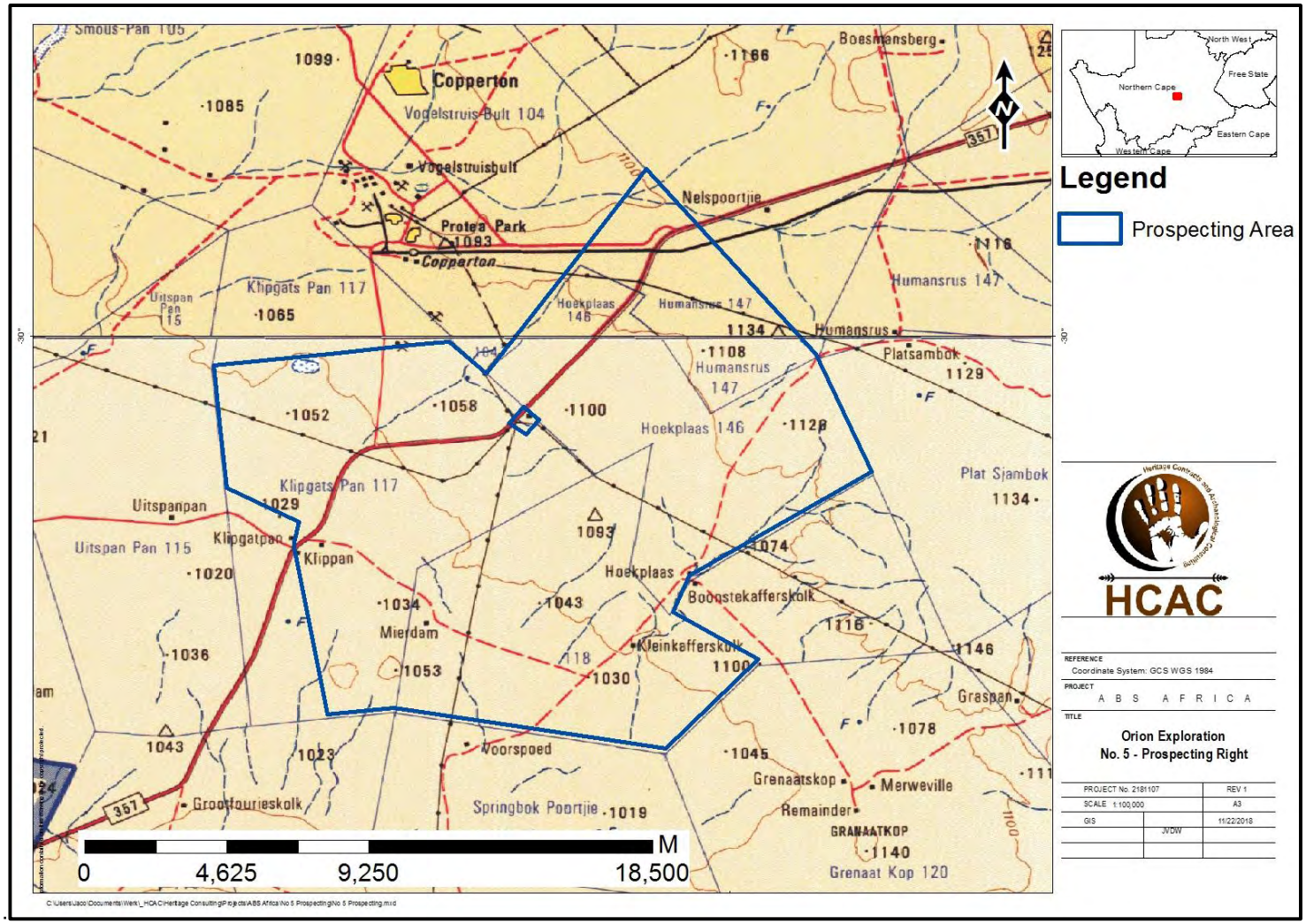


Figure 1. Regional Locality map of the site under investigation indicated in blue.

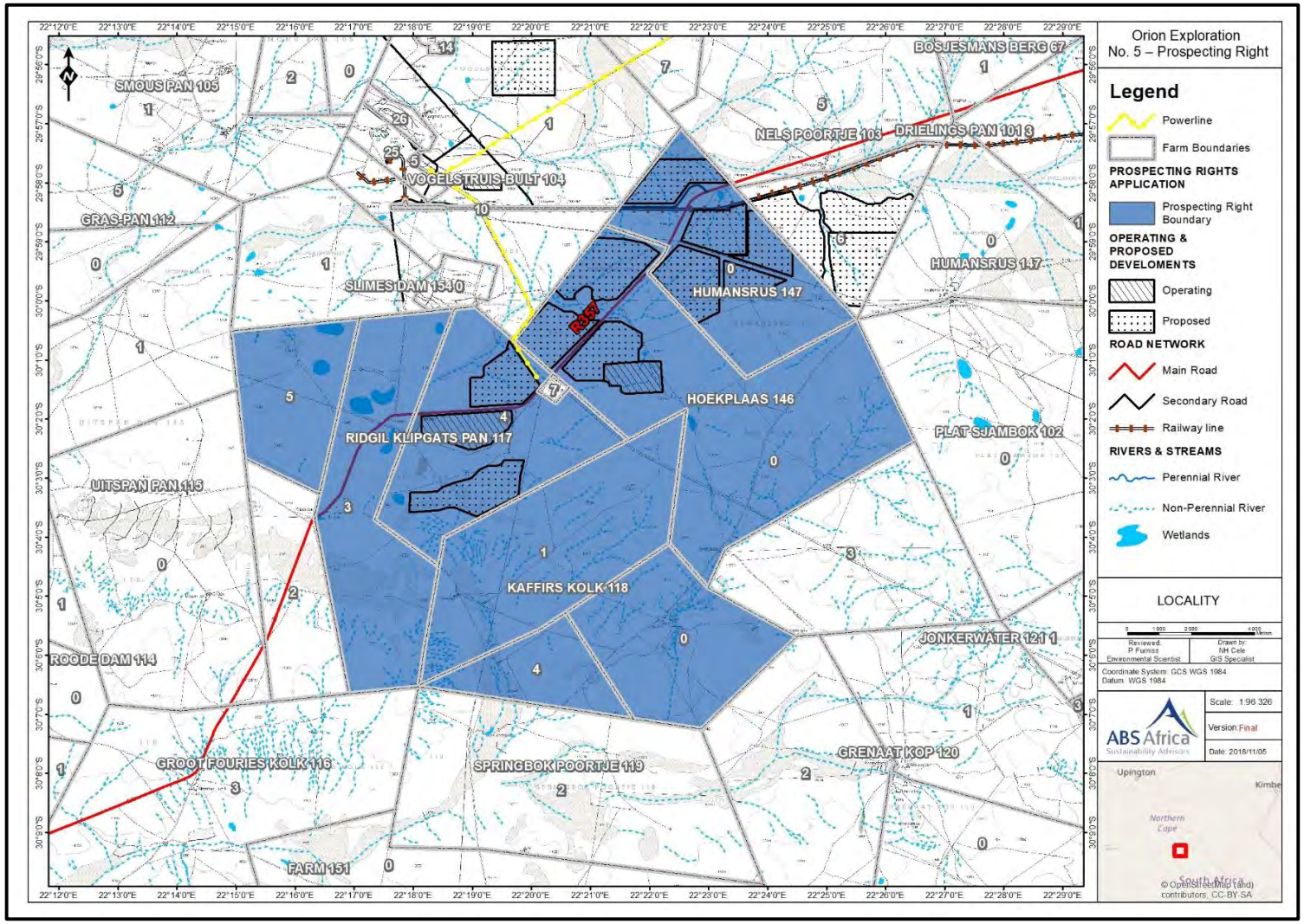


Figure 2. 1:50 000 Topographical map indicating the prospecting right boundary.

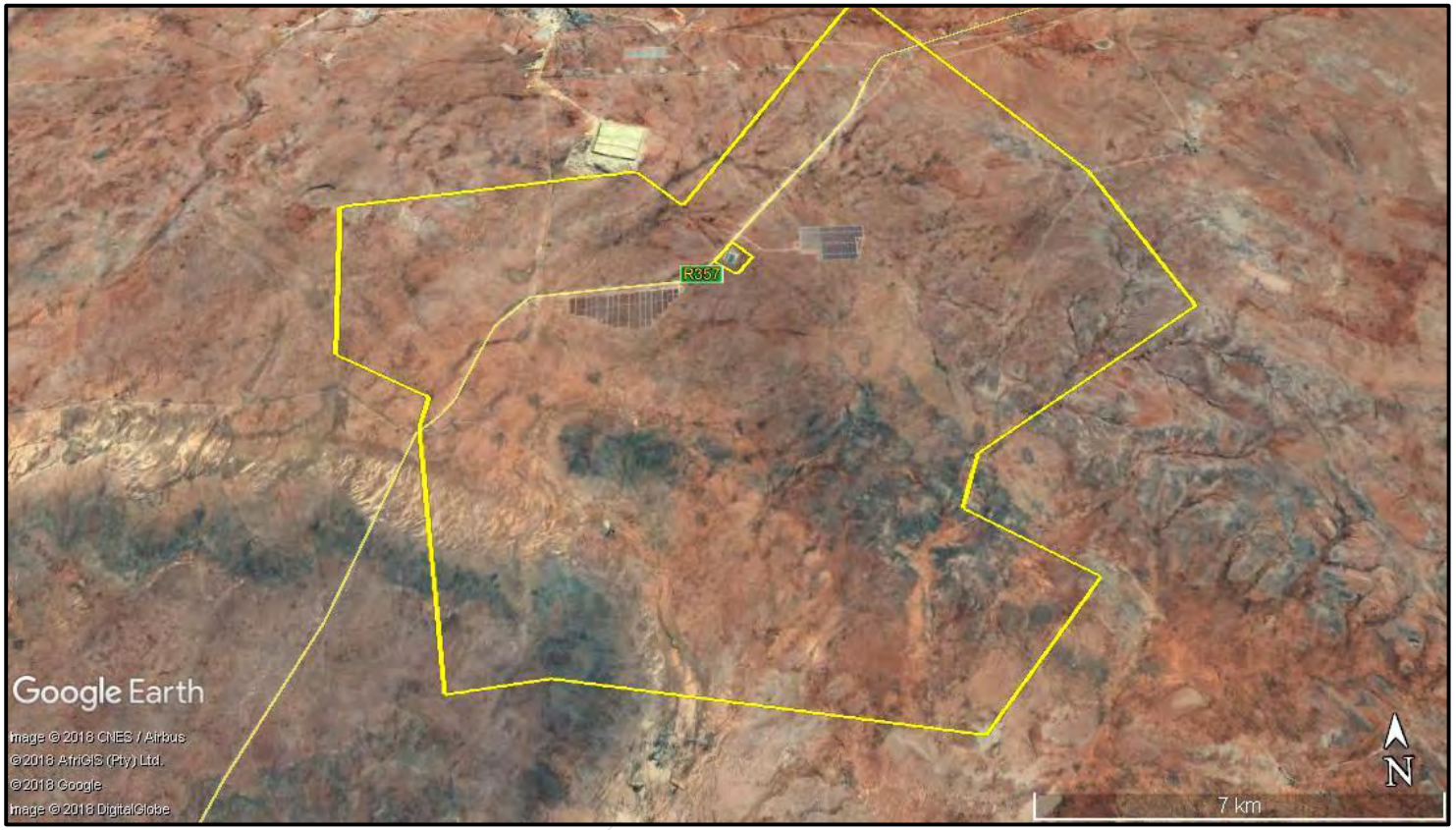


Figure 3. Google Earth image of the study area.

1.1 Terms of Reference

The main aim of this desktop report is to determine if any known heritage resources occur within the project site. The objectives of the desktop report were to:

- Conduct a desktop study:
  - Review available literature, previous heritage studies and other relevant information sources to obtain a thorough understanding of the archaeological and cultural heritage conditions of the area;
  - Identify known and recorded archaeological and cultural sites; and
  - Determine whether the area is renowned for any cultural and heritage resources, such as Stone Age sites, informal graveyards or historical homesteads.
- Compile a specialist Heritage Desktop Report in line with the requirements of the EIA Regulations, 2014, as amended on 07 April 2017.

The reporting is based on the results and findings of a desktop study, wherein potential issues associated with the proposed project will be identified, and those issues requiring further investigation through the IA Phase highlighted. Reporting will aim to identify the anticipated impacts, as well as cumulative impacts, of the operational units of the proposed project activity on the identified heritage resources for all 3 development stages of the project, i.e. construction, operation and decommissioning. Reporting will also consider alternatives should any significant sites be impacted on by the proposed project. This is done to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve and develop them within the framework provided by Heritage Legislation.

When the localities of the invasive prospecting activities are fixed, the following terms will apply:

Field study
Conduct a field study to: (a) locate, identify, record, photograph and describe sites of archaeological, historical or cultural interest; b) record GPS points of sites/areas identified as significant areas; c) determine the levels of significance of the various types of heritage resources affected by the proposed development

Reporting
Report on the identification of anticipated and cumulative impacts the operational units of the proposed project activity may have on the identified heritage resources for all 3 phases of the project; i.e., construction, operation and decommissioning phases. Consider alternatives, should any significant sites be impacted adversely by the proposed project. Ensure that all studies and results comply with the relevant legislation, SAHRA minimum standards and the code of ethics and guidelines of ASAPA.

To assist the developer in managing the discovered heritage resources in a responsible manner, and to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act No 25 of 1999).

1.2 Nature of the development

The following non-invasive prospecting methods are intended for this phase of the project:

Non-Invasive Prospecting Methods

- Compile a working plan on a scale of 1: 10,000, which would integrate all geological, geophysical and geochemical data, as well as farm tracks, fences and drainages, to cover the relevant portion of the prospect area.
- Geological mapping of a zone covering the approximate position of the old "sea floor".
- Geophysical Surveys.
- Reconnaissance soil sampling traverses followed by more detailed and systematic soil sampling and trenches.
- Geochemical Surveys- It is expected that more than 1,000 soil samples may be collected on traverse lines and analysed using a hand-held XRF. Trances might also be dug to determine geological contacts

1.3. The receiving environment

The proposed prospecting activities are located 15km South of Copperton and 60km South-West of Prieska in the Northern Cape Province of South Africa, on the following farms: Klipgatspan, Humansrus, Kaffirs Kolk and Hoekplaas. The vegetation is predominantly Bushmanland Arid Grassland vegetation in the Nama-Karoo biome (Mucina & Rutherford 2006) which consists of Karoo scrub and grass and a few isolated *Acacia Karoo* trees.

2. APPROACH AND METHODOLOGY

This desktop report was conducted as part of the first phase of the prospecting activities (non-invasive activities). The aim of the desktop report is to cover available data regarding archaeological and cultural heritage to compile a background history of the study area in order to identify possible heritage issues or fatal flaws that could possibly be associated with the project and should be avoided during development.

This was accomplished by means of the following phases (the results are represented in section 4 of this report):

2.1 Literature review

A review was conducted utilising data for information gathering from a range of sources on the archaeology and history of the area. The aim of this is to extract data and information on the area in question, looking at archaeological sites, historical sites and graves of the area.

2.2 Information collection

The South African Heritage Resources Information System (SAHRIS) was consulted to further collect data from CRM practitioners who undertook work in the area to provide the most comprehensive account of the history of the area where possible. In addition, the archaeological database housed at the University of the Witwatersrand was consulted.

2.3 Public consultation

No public consultation was conducted during this phase by the author.

2.4 Google Earth and mapping survey

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological sites might be located.

2.5 Genealogical Society of South Africa

The database of the genealogical society was consulted to collect data on any known graves in the area.

2.6. Restrictions

This study did not assess the impact on intangible resources of the project. Based on available data and resources as outlined in the report additional information that becomes available at a later stage might change the outcome of assessment. No field work was conducted.

3. LEGISLATION

For this project, the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is of importance and the following sites and features are protected:

a. Archaeological artefacts, structures and sites older than 100 years;
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography;
c. Objects of decorative and visual arts;
d. Military objects, structures and sites older than 75 years;
e. Historical objects, structures and sites older than 60 years;
f. Proclaimed heritage sites;
g. Grave yards and graves older than 60 years;
h. Meteorites and fossils; and
i. Objects, structures and sites or scientific or technological value.

The national estate includes the following:

a. Places, buildings, structures and equipment of cultural significance;
b. Places to which oral traditions are attached or which are associated with living heritage;
c. Historical settlements and townscapes;
d. Landscapes and features of cultural significance;
e. Geological sites of scientific or cultural importance;
f. Archaeological and palaeontological importance;
g. Graves and burial grounds;
h. Sites of significance relating to the history of slavery; and
i. Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.).

Section 34 (1) of the Act deals with structures that are older than 60 years. Section 35(4) of this Act deals with archaeology, palaeontology and meteorites. Section 36(3) of the Act, deals with human remains older than 60 years. Unidentified/unknown graves are also handled as older than 60 years until proven otherwise.

3.1 Heritage Site Significance and Mitigation Measures

The presence and distribution of heritage resources define a Heritage Landscape. In this landscape, every site is relevant. In addition, because heritage resources are non-renewable, heritage surveys need to investigate an entire project area. In all initial investigations, however, the specialists are responsible only for the identification of resources visible on the surface.

This section describes the evaluation criteria used for determining the significance of archaeological and heritage sites. National and Provincial Monuments are recognised for conservation purposes. The following interrelated criteria were used to establish site significance:

- The unique nature of a site;
- The integrity of the archaeological/cultural heritage deposit;
- The wider historic, archaeological and geographic context of the site;
- The location of the site in relation to other similar sites or features;
- The depth of the archaeological deposit (when it can be determined or is known);
- The preservation condition of the site; and
- Potential to answer present research questions.

The criteria above will be used to place identified sites within the South African Heritage Resources Agency's (SAHRA's) (2006) system of grading of places and objects that form part of the national estate. This system is approved by the Association of South African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region.

FIELD RATING	***GRADE***	***SIGNIFICANCE***	***RECOMMENDED MITIGATION***
National Significance (NS)	Grade 1	-	Conservation; national site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; provincial site nomination
Local Significance (LS)	Grade 3A	High significance	Conservation; mitigation not advised
Local Significance (LS)	Grade 3B	High significance	Mitigation (part of site should be retained)
Generally Protected A (GP.A)	-	High/medium significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium significance	Recording before destruction
Generally Protected C (GP.C)	-	Low significance	Destruction

4. REGIONAL OVERVIEW

4.1 General Information

4.1.1. Database search

Previous heritage studies were conducted in the greater study area (SAHRIS) by Van Ryneveld (2006) and Orton (2015) and Kaplan and Wiltshire (2011). All the studies recorded ESA, MSA and LSA artefacts scattered over the landscape with MSA and LSA sites centred on pans and watercourses. Studies by Van der Walt (2012, 2013, 2017) concurred with these findings and also recorded widespread Stone Age scatters and some discreet MSA and LSA sites. Interestingly the farms under investigation or parts thereof were subjected to HIA studies for other projects and is summarised below:

Author	Year	Project	Findings
Orton, J.	2011	Heritage impact assessment for a proposed photovoltaic energy plant on the farm Hoekplaas near Copperton, Northern Cape	Stone Age scatters and stone walled enclosures.
Orton, J. & Webley,L.	2013a	Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on Farm Hoekplaas 146, Copperton, Northern Cape	Archaeological resources were found to be widespread across the site but the majority are of low value. A few sites, located predominantly around the pans, were of higher value and would require mitigation if they cannot be protected. Particularly important in this regard is an MSA site with fossil bone located at a quarried pan alongside the main road. One area at PV11 has extensive archaeological resources and is best avoided
Orton, J. & Webley, L.	2013b	Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on The Remainder of Farm Klipgats Pan 117, Copperton, Northern Cape	Archaeological resources were found to be widespread across the site but the majority are of low value. A few sites, located predominantly around the pans and on the hill in the south, were of higher value and would require mitigation if they cannot be protected. One area, the northern part of Alternative 1 PV2, has extensive archaeological resources and is best avoided.
De Kock, SE & Narainne, GJR.	2016	Integrated Heritage Impact Assessment In Terms Of Section 38(8) Of The National Heritage Resources Act, 1999 (Act 25 Of 1999) Proposed Development Of Humansrus Solar PV Facility 4 On The Farm Humansrus 147, Prieska District And Pixley Ka Seme District Municipality, Northern Cape Province	The archaeological survey identified an amorphous distribution of Early and Middle Stone Age artefacts randomly scattered across the landscape. No Later Stone Age sites, such as those mitigated by Orton (2014) on the adjoining farm of Klipgats Pan 117, were observed.

The above-mentioned studies recorded the following sites located within the study area as described in Table 1.

Table 1. Known heritage features in the study area

Site Number	Site Name	Grading	Coordinates		Description
HUM147/024	Humansrus	IIIc	-29,979568	22,362691	Discrete pavement with some medium density ESA. 1 x weathered biface. (2013- 2017)
HOEK030	Hoekplaas	IIIc	-30,062694	22,37475	Low density background scatter across this hill. The area is very rocky. There are large numbers of particularly large artefacts and most of this material is probably ESA. No doubt the hill provided a good source of stone materials for flaking.
HUM147/008	Humansrus	IIIc	-29,966748	22,365059	Pan areas with low density general scatter. Bedrock outcrops. Possibly all ESA.
HUM147/009	Humansrus	IIIc	-29,967567	22,363588	Pan areas with low density general scatter. Bedrock outcrops. Possibly all ESA.
HUM147/010	Humansrus	IIIc	-29,968212	22,362571	Pan areas with low density general scatter. Bedrock outcrops. Possibly all ESA.
HUM147/023	Humansrus	IIIc	-29,977933	22,359834	Discrete pavement with some medium density ESA. 1 x weathered biface.
KGP2014/006	KGP2014/006	IIIa	-30,032728	22,314541	LSA site with quartz, quartzite, cryptocrystalline silica (CCS), a CCS adze, 1 hammer stone / upper grindstone, a fragment of Unio caffer (freshwater mussel shell) and much ostrich eggshell.
KGP2014/008	KGP2014/008	IIIb	-30,035314	22,309609	LSA site with quartz, quartzite and ostrich eggshell, two probable lower grindstones.
KGP2014/009	KGP2014/009	IIIb	-30,034618	22,309413	LSA scatter with quartz, quartzite and a hammer stone, tooth fragment, ostrich eggshell. Fairly low density but enough to be meaningful.
KGP2014/011	KGP2014/011	IIIc	-30,033262	22,308308	Ephemeral LSA site among bushes with quartz, quartzite, ostrich eggshell.
HOEK032	Hoekplaas	IIIb	-30,029444	22,39575	LSA scatter with CCS, quartz, quartzite, bladelets in a sandy area with bushes near the pan. Might be subsurface material present here.
HOEK035	Hoekplaas	IIIc	-30,028861	22,395417	LSA scatter and some background scatter inside the edge of the pan in a sandy area. Quite widespread.
HOEK036	Hoekplaas	IIIc	-30,029139	22,3955	LSA scatter in a sandy area inside the edge of the pan. Quartz, CCS, quartzite, bladelets, one large thumbnail scraper.
HOEK031	Hoekplaas	IIIb	-30,029389	22,395389	LSA scatter with CCS, quartz, quartzite, bladelets tooth fragment. Dense scatter in a gravel-free area inside the edge of the pan.
HOEK033	Hoekplaas	IIIb	-30,029194	22,395917	LSA scatter among calcrete nodules. CCS, quartz, quartzite. Extensive scatter.
HOEK034	Hoekplaas	IIIb	-30,028972	22,395806	LSA scatter among calcrete nodules. CCS, quartz, quartzite. Extensive scatter.
KLGP071	KLIPGATS	IIIc	-30,025333	22,323889	Ephemeral LSA scatter of CCS, quartzite and quartz around southern edge of pan.
KLGP075	KLIPGATS	IIIc	-30,011944	22,319556	Quartzite and CCS background scatter in gravel area on crest of calcrete ridge slope. Also, an ephemeral LSA quartz and OES scatter in a proximate sandy patch.
KLGP069	KLIPGATS	IIIb	-30,025028	22,326639	LSA scatter with good spatial integrity. Includes quartz, quartzite, CCS and OES. 15 m diameter in a sandy area alongside a shallow pan.

KLGP074	KLIPGATS	IIIc	-30,021111	22,323972	Ephemeral LSA scatter of quartz and quartzite alongside shallow pan. Some OES nearby as well.
KGP2014/016	KGP2014/016	IIIb	-30,039893	22,312095	LSA scatter with quartz and ostrich eggshell.
KLGP076	KLIPGATS	IIIc	-30,01275	22,316583	Mixed LSA (CCS and OES) and background (quartzite and CCS) scatter in sandy area with gravel near shallow pan.
KLGP077	KLIPGATS	IIIc	-30,012778	22,316167	Light LSA scatter of CCS, quartz and OES plus a scatter of grey quartzite which is probably mostly background scatter in pan. Bone frag
KLGP078	KLIPGATS	IIIc	-30,012806	22,315944	LSA scatter of quartz, quartzite, CCS and OES in shallow pan with gravel. Quite diffused and 15 to 20 m in diameter.
KLGP079	KLIPGATS	IIIc	-30,012861	22,315667	LSA scatter of quartz, quartzite and CCS in sandy area in shallow pan. Quite widespread and about 20 m diameter.
KLGP080	KLIPGATS	IIIc	-30,012389	22,315778	LSA scatter of quartz and quartzite in sandy area with gravel near edge of shallow pan. Diffuse scatter.
KGP2014/010	KGP2014/010	IIIc	-30,033028	22,3085	Ephemeral LSA site among bushes with quartz, quartzite, ostrich eggshell.
KGP2014/014	KGP2014/014	IIIc	-30,04325	22,300444	Ephemeral LSA scatter among bushes with quartzite and 2 lower grindstones.
KGP2014/004	KGP2014/004	IIIb	-30,035864	22,312127	LSA scatter of pottery and background scatter of stone artefacts alongside ephemeral pan. At last 12 sherds (1 rim), mixed grass and mineral (grit) temper. Context is poor but soil containing sherds should be sieved.
KGP2014/012	KGP2014/012	IIIc	-30,032917	22,308111	Ephemeral LSA site with quartz, quartzite.
KGP2014/013	KGP2014/013	IIIb	-30,0325	22,308544	Ephemeral LSA site among bushes with quartz, quartzite, hornfels, CCS, ostrich eggshell.
KGP2014/018	KGP2014/018	IIIc	-30,038694	22,305361	Small scatter of fresh quartzite flakes, all same material, presumably LSA.
KGP2014/019	KGP2014/019	IIIc	-30,038111	22,326611	LSA scatter with quartzite and CCS in sandy patch behind bushes.
KGP2014/020	KGP2014/020	IIIc	-30,036611	22,321333	Ephemeral LSA quartz scatter around an ephemeral pan.
KPGP005	Klipgats	IIIc	-30,032833	22,302306	Background scatter, mixed age, quartz and quartzite LSA artefacts and older material.
HOEK001	Hoekplaas	IIIc	-29,994833	22,349722	Discrete quartzite scatter with all artefacts of same type of rock which looks fresh. Likely LSA
KLGP002	Klipgats_Pan	IIIb	-30,028333	22,315417	Discrete LSA quartz scatter with some quartzite and some ostrich eggshell. Approximately 9 m diameter. Quartz and ostrich eggshell both fresh.
HOEK004	Hoekplaas	IIIc	-30,015361	22,364361	Small LSA CCS, quartz and quartzite scatter in an open sandy area.
KLGP003	Klipgats_Pan	IIIb	-30,027528	22,320056	LSA quartz, quartzite and CCSÂ scatter with lots of ostrich eggshell. One upper grindstone.
HOEK005	Hoekplaas	IIIc	-30,015472	22,364556	More LSA CCS, quartz and quartzite scatter in an open sandy area.
KLGP004	Klipgats_Pan	IIIc	-30,025528	22,322639	Scatter of ostrich eggshell. LSA. Some quartzite but this may be background scatter.
HOEK006	Hoekplaas	IIIc	-30,015917	22,364778	LSA scatter of CCS, quartz, quartzite and ostrich eggshell in sandy (but bushy) area. Also, a lower grindstone and a hammer stone / upper grindstone

KPGP017	Klipgats	IIIc	-30,037528	22,313861	Ostrich eggshell scatter with background scatter SA and LSA in ephemeral pan.
HOEK007	Hoekplaas	IIIc	-30,016444	22,365	LSA scatter of CCS, quartz and quartzite in sandy area with some gravel.
KLGP005	Klipgats_Pan	IIIc	-30,053139	22,3215	Scatter of ostrich eggshell and one possible backed quartz flake. LSA.
HOEK008	Hoekplaas	IIIb	-30,016361	22,3655	LSA scatter of CCS, quartz and quartzite and including one CCS backed point.
HOEK010	Hoekplaas	IIIb	-30,015389	22,366583	LSA CCS, quartz, quartzite and hornfels scatter including one hornfels backed point.
HOEK012	Hoekplaas	IIIc	-30,015111	22,366389	LSA scatter of CCS, quartz and quartzite in sandy area with some calcrete fragments.
HOEK013	Hoekplaas	IIIc	-30,013444	22,365194	Ephemeral LSA scatter of CCS, quartz and quartzite in a sandy area.
HOEK013	Hoekplaas	IIIc	-30,024778	22,357778	Ephemeral LSA scatter of CCS, quartz and quartzite in a sandy area.
HOEK015	Hoekplaas	IIIc	-30,030639	22,364778	LSA scatter of CCS, quartz, quartzite and ostrich eggshell. Some bone noted and one CCSÂ end scraper. Also, background scatter in the area.
KLGP009	Klipgats_Pan	IIIc	-30,059583	22,309944	Ephemeral LSA quartz scatter on sand.
HOEK017	Hoekplaas	IIIc	-30,024611	22,371389	Ephemeral LSA scatter of CCS, quartz and quartzite in a sandy area.
KLGP010	Klipgats_Pan	IIIb	-30,059778	22,309611	Dense LSA quartz, quartzite and CCS scatter on sand. One CCS scraper. Bone fragments, one mandible.
HOEK018	Hoekplaas	IIIc	-30,012111	22,364583	Ephemeral LSA quartzite, as well as background scatter in a sandy area.
HOEK020	Hoekplaas	IIIc	-29,9895	22,356583	LSA scatter in a sandy area in an ephemeral pan. Quartz, quartzite and CCS and some ostrich eggshell (OES) nearby.
KLGP011	Klipgats_Pan	IIIb	-30,059972	22,308944	LSA quartz and CCS scatter in sandy area. One CCS scraper.
KLGP012	Klipgats_Pan	IIIc	-30,061056	22,307944	LSA quartz, quartzite, hornfels and CCS scatter on top of hill among gravel. Also, some pink glass in this area.
KLGP013	Klipgats_Pan	IIIc	-30,060556	22,309806	Ephemeral LSA scatter of quartz, CCS, pink glass and a square iron nut.
KLGP014	Klipgats_Pan	IIIb	-30,060639	22,309917	Small stone circle. Nearby are LSA quartz and CCS artefacts, OES, burnt bone fragments, glass and ceramics including a stopper.
KLGP015	Klipgats_Pan	IIIc	-30,060972	22,310167	LSA quartz, quartzite and CCS scatter and small metal fragment of an old harmonica.
KLGP023	Klipgats_Pan	IIIc	-30,026306	22,320722	Ephemeral LSA quartz and CCS scatter.
KLGP024	Klipgats_Pan	IIIc	-30,026472	22,319861	Low density LSA quartz, CCS, quartzite scatter of 20 m diameter.
KLGP025	Klipgats_Pan	IIIc	-30,027694	22,310444	Ephemeral LSA quartz, CCS, quartzite and ostrich eggshell scatter of 20 m diameter alongside ephemeral pan.
KLGP026	Klipgats_Pan	IIIc	-30,027028	22,310194	Ephemeral LSA scatter of Quartzite, CCS and ostrich eggshell. Includes a distal tip of a hand-axe which is all that is left after using the hand-axe as a core.
KLGP027	Klipgats_Pan	IIIc	-30,028111	22,309333	Ephemeral LSA scatter of quartzite, quartz and ostrich eggshell.
KLGP029	Klipgats_Pan	IIIc	-30,029	22,313722	Ephemeral scatter of ostrich eggshell. LSA.
KLGP030	Klipgats_Pan	IIIc	-30,029222	22,314556	Ephemeral LSA scatter of quartz, quartzite and CCS.
KLGP028	Klipgats_Pan	IIIc	-30,027889	22,31	Small, discrete LSA quartz scatter of 3 m diameter

KLGP031	Klipgats_Pan	IIIc	-30,029583	22,315639	Ephemeral LSA scatter of quartzite, quartz and ostrich eggshell.
KLGP032	Klipgats_Pan	IIIc	-30,015139	22,313167	LSA scatter of quartz, quartzite and CCS in ephemeral pan area.
KLGP033	Klipgats_Pan	IIIc	-30,014917	22,311667	Scatter of LSA quartz, quartzite, CCS and ostrich eggshell in ephemeral pan area. Also includes a crystal quartz backed triangle.
KLGP034	Klipgats_Pan	IIIc	-30,061889	22,308417	Ephemeral LSA quartz scatter.
KLGP035	Klipgats_Pan	IIIc	-30,062889	22,307667	LSA scatter of quartz, CCS, quartzite and ostrich eggshell in sandy area. One CCS thumbnail scraper.
KLGP036	Klipgats_Pan	IIIc	-30,062917	22,307333	LSA scatter of CCS, quartz and quartzite in sandy area.
KLGP037	Klipgats_Pan	IIIc	-30,062778	22,306944	LSA scatter of CCS, quartz, quartzite and ostrich eggshell in sandy area.
KLGP038	Klipgats_Pan	IIIc	-30,062417	22,305778	Ephemeral scatter of LSA quartz and CCS.
KLGP040	Klipgats_Pan	IIIb	-30,063639	22,305583	Large LSA scatter of quartz, quartzite, CCS and hornfels with bone and ostrich eggshell. Large number of stone artefacts.
KLGP041	Klipgats_Pan	IIIc	-30,063639	22,305278	Scatter of ostrich eggshell with few artefacts. LSA.
KLGP042	Klipgats_Pan	IIIc	-30,063778	22,305056	LSA scatter of quartz, quartzite and hornfels on crest of hill. Also ostrich eggshell and a possible glass flake.
KLGP043	Klipgats_Pan	IIIc	-30,063083	22,305139	Extensive, low density scatter of LSA quartz, quartzite, CCS and hornfels.
KLGP044	Klipgats_Pan	IIIc	-30,06375	22,30625	LSA quartz and ostrich eggshell scatter on river bank.
KLGP046	Klipgats_Pan	IIIc	-30,056917	22,295361	Ephemeral LSA scatter of quartz, quartzite and CCS.
KLGP047	Klipgats_Pan	IIIa	-30,067806	22,308306	Very high density and extensive LSA scatter of quartz, quartzite, CCS and ostrich eggshell. Also, bone frags. Ostrich eggshell flask mouth and some decorated fragments on one patch, more decorated fragments on another patch. Points around the edges.
KLGP049	Klipgats_Pan	IIIc	-30,067806	22,307889	LSA quartz scatter with a lower grindstone / hammer stone. Also, ostrich eggshell.
KLGP050	Klipgats_Pan	IIIc	-30,067583	22,307861	LSA quartz and quartzite scatter.
KLGP052	Klipgats_Pan	IIIb	-30,066444	22,308583	LSA scatter of quartz, quartzite and CCS. Quartzite unifacial artefact.
KLGP053	Klipgats_Pan	IIIc	-30,066083	22,308306	Small scatter of LSA quartz, CCS and quartzite.
KLGP055	Klipgats_Pan	IIIc	-30,065361	22,307806	LSA scatter of quartz and CCS with some bone.
KLGP056	Klipgats_Pan	IIIc	-30,065333	22,307611	LSA scatter of quartz, CCS, quartzite and ostrich eggshell.
KLGP062	Klipgats_Pan	IIIc	-30,066694	22,3085	LSA scatter of quartz, quartzite, CCS and ostrich eggshell. One CCS thumbnail scraper.
KLGP063	Klipgats_Pan	IIIb	-30,066611	22,308583	Dense LSA scatter of quartz, CCS, quartzite and ostrich eggshell
KLGP064	Klipgats_Pan	IIIc	-30,028861	22,315	LSA quartzite, quartz and ostrich eggshell scatter. All same pale grey quartzite and there is lots of ostrich eggshell. Also, a CCS hammer stone. Site about 10 m diameter
KLGP065	Klipgats_Pan	IIIc	-30,014806	22,315306	Small, discrete scatter of green CCS in a 1 m diameter area. LSA.
HOEK021	Hoekplaas	IIIc	-29,992889	22,352417	Mixture of background scatter and an LSA scatter amongst taller bushes in a shallow water course. Includes quartz, quartzite, porphyry, CCS, ceramic, glass. Mitigate in the densest LSA area only

HOEK022	Hoekplaas	IIIc	-29,993139	22,351639	LSA scatter among bushes in shallow water course. Includes quartz, quartzite, CCS, OES.
HOEK024	Hoekplaas	IIIc	-30,037028	22,379722	LSA scatter of quartz, quartzite, CCS and OES at edge of grassy pan. Also, quartzite background scatter here.
HOEK025	Hoekplaas	IIIc	-30,037083	22,380333	LSA scatter of quartz, quartzite, CCS and OES near grassy pan.
HOEK026	Hoekplaas	IIIc	-30,037583	22,381972	LSA scatter of quartz, quartzite, CCS and OES near grassy pan. Also, some background scatter here.
HOEK027	Hoekplaas	IIIc	-30,036167	22,379833	LSA scatter of quartz, quartzite and CCS on edge of pan.
HOEK028	Hoekplaas	IIIb	-30,036139	22,379556	Good LSA scatter of quartz, quartzite and CCSÂ inside edge of grassy pan. Fairly continuous scatter at this distance in from edge of grassy pan.
HOEK029	Hoekplaas	IIIc	-30,036361	22,379417	Good LSA scatter of quartz, quartzite and CCSÂ inside edge of grassy pan. Fairly continuous scatter at this distance in from edge of grassy pan. Similar to the above but mostly quartzite.
KLGP082	KLIPGATS	IIIb	-30,026361	22,319917	Dense distribution of artefacts on a sandy plain. Grey and black quartzite flakes, flaked quartz cobbles. Although some flakes look recently flaked, there is some MSA present. Extends over an area 5m x 5m.
HUM147/058	Humansrus	IIIc	-29,995847	22,399498	A triangular (convergent) MSA flake
HUM147/059	Humansrus	IIIc	-29,994905	22,398923	A triangular (convergent) MSA flake
HUM147/060	Humansrus	IIIc	-29,994501	22,397664	A triangular (convergent) MSA flake, A few banded ironstone flakes.
KPGP004	Klipgats	IIIc	-30,033333	22,302417	Background scatter, mixed age, several MSA blades.
HUM147/001	Humansrus	IIIc	-29,958403	22,375361	Area of pan with MSA scatter sporadically around the edges.
HUM147/113	Humansrus	IIIc	-29,991994	22,394655	Fine-grained rock. MSA. An artefact which looks like a large adze
HUM147/002	Humansrus	IIIc	-29,95872	22,37599	Area of pan with MSA scatter sporadically around the edges.
HUM147/003	Humansrus	IIIc	-29,958973	22,376137	Area of pan with MSA scatter sporadically around the edges. Â 1 x unifacial point. Small biface artefact.
HUM147/004	Humansrus	IIIc	-29,964675	22,375751	Light MSA scatter at the edge of the pan. Slightly concentrated at GPS point but scattered throughout in low density.
HUM147/005	Humansrus	IIIc	-29,965701	22,376155	Light MSA scatter at the edge of the pan. Slightly concentrated at GPS point but scattered throughout in low density.
HOEK045	Hoekplaas	IIIc	-30,036778	22,379389	Very dense distribution of artefacts on the inside margins of the same pan in chert, quartz, quartzite and CCS. MSA artefacts are present.
MIER002	Mierdam	IIIa	-30,07039	22,35148	Stone tools were identified to occur specifically in areas where there are outcrops or low hills and most commonly date to the Middle Stone Age, although one site also included material that can be dated to the Later Stone Age.
KPGP001	Klipgats	IIIc	-30,032333	22,302333	Background scatter, mixed age (MSA and LSA).
KPGP010	Klipgats	IIIc	-30,03475	22,312139	Background scatter in ephemeral pan, MSA with some possible LSA.
HOEK002	Hoekplaas	IIIa	-30,003889	22,356111	This site is revealed in the eroded edge of a pan which has been quarried for road material. There is a layer of pebbles and artefacts about 0,3 m to 0.5Â m below surface and is a reburied lag deposit. The assemblage is blade-rich MSA quartzite

KLGP001	Klipgats_Pan	IIIb	-30,014778	22,31525	Dense background scatter among cobbles and gravel but including a scatter of MSA material in one stone type. Some LSA around too. One ESA hand-axe. Materials include quartzite, CCS, silcrete, quartz and others
HOEK003	Hoekplaas	IIIa	-30,0035	22,356	This site is revealed in the eroded edge of a pan which has been quarried for road material. There is a layer of pebbles and artefacts about 0,3 m to 0,5 m below surface and is a reburied lag deposit. The assemblage is blade-rich MSA quartzite
HOEK041	Hoekplaas	IIIc	-29,991861	22,362111	Background scatter. Some very weathered hornfels artefacts including one handaxe. Spread of relatively recently flaked quartzite flakes nearby, probably LSA superimposed on MSA and ESA.
HOEK049	Hoekplaas	IIIc	-30,024167	22,396056	On inside margin of the pan, another scatter of artefacts. Both MSA and LSA present. Many pieces on quartz, chert also some jasper.
HUM147/020	Humansrus	IIIc	-29,96993	22,368399	Extensive grey quartzite outcrop area with stone scatter. Low density ESA/MSA but made on variety of raw materials. [1996-1998]
HUM147/063	Humansrus	IIIc	-29,99127	22,399481	Next to the powerline servitude several bedrock boulders with dense distribution of stone artefacts. Concentration of weathered ESA on hornfels. Crude handaxe. Smaller quartzite flakes probably MSA. Some banded ironstone cores, 1 blade in hornfel
PRIES001	Prieska	IIIb	-30,09346	22,34082	Stone tools were identified to occur specifically in areas where there are outcrops or low hills and most commonly date to the Middle Stone Age, although one site also included material that can be dated to the Later Stone Age.
PRIES002	Prieska	IIIb	-30,07039	22,35148	Stone tools were identified to occur specifically in areas where there are outcrops or low hills and most commonly date to the Middle Stone Age, although one site also included material that can be dated to the Later Stone Age.
MIER001	Mierdam	IIIa	-30,09346	22,34082	Stone tools were identified to occur specifically in areas where there are outcrops or low hills and most commonly date to the Middle Stone Age, although one site also included material that can be dated to the Later Stone Age.

4.1 2. Public consultation

No public consultation was conducted by the heritage consultant for the desktop study.

4.1.3. Google Earth and mapping survey

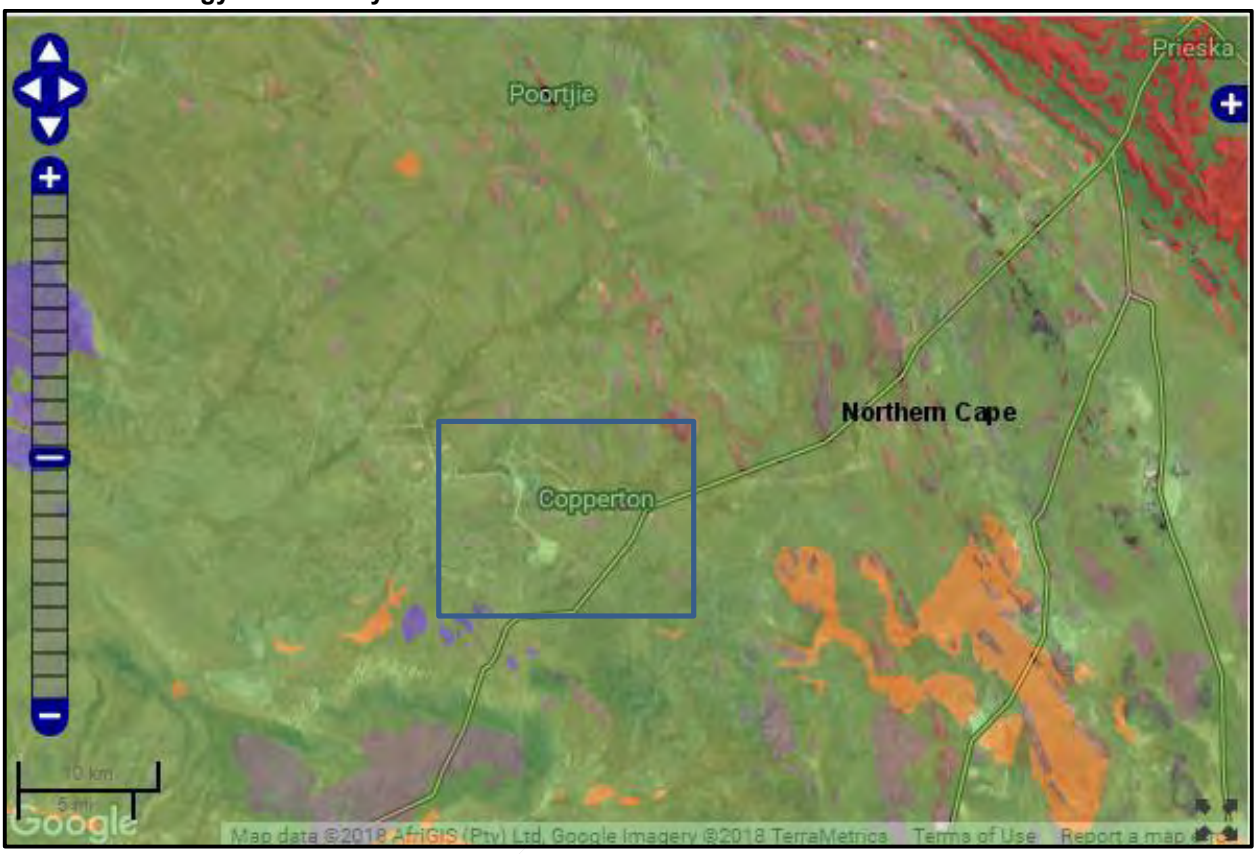
Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological sites might be located.

4.1.4. Genealogical Society of South Africa

No grave sites are on record for the study area.

5. BACKGROUND INFORMATION AVAILABLE ON THE STUDY AREA

5.1. Palaeontology of the study area



Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 4. The approximate study area indicated on the SAHRIS Paleontological map as of moderate significance.

5.2. Archaeological Overview of the study area.

Beaumont *et al.* (1995: 240) observed that "thousands of square kilometres of Bushmanland are covered by a low-density lithic scatter". These artefacts are generally very well weathered and mostly pertain to the ESA and MSA. Occasional LSA artefacts are also noted. What is noteworthy of the Northern Cape archaeological record is the presence of pans which frequently display associated archaeological material. Of interest, is the work of Kiberd (2001, 2005, 2006) who excavated Bundu Pan, some 25 to 30 km northwest of Copperton. The site yielded ESA, MSA and LSA horizons and the artefacts were accompanied by warthog and equid teeth to name a few (Beaumont *et al.* 1995).

Orton (2011) noted that to the northwest, west and southwest of Copperton sites have been investigated by Beaumont and colleagues (1995), Smith (1995) and Parsons (2003, 2004, 2007, 2008) yielding LSA deposits. Work on these sites led to a distinction between hunter-gatherer and herder sites, based on stone artefact assemblages (Beaumont *et al.* 1995). All these Later Stone Age sites have very few, if any, organic items on them. The only organic material found on sites like these is fragments of ostrich eggshell probably belonging to broken water containers. Such flasks have been widely recorded across the Northern Cape (Morris 1994).

The archaeological importance of pans in the area are now well documented (Kiberd 2006, Kaplan & Wiltshire 2011, Orton 2012) and if any occur in the study area they could be of significance. Van der Walt (2012) recorded low densities of ESA, MSA and LSA scatters and these occurrences were given a field rating of low archaeological significance. However, several discrete MSA and LSA sites were also documented.

Most of the material expected for the study area is MSA in nature consisting of large flakes, radial and bipolar cores, points, end scrapers, large utilized and retouched blade tools, and utilized and retouched flakes.

5.3. Historical Overview

In order to understand the historical context of a certain area, it is necessary to consider the geographic and climatic nature of the region in question. The town of Copperton is located in a region in South Africa known as the Upper Karoo. One gets a good idea of what the natural landscape in the Upper Karoo was like between the late 1700s and early 1800s when reading the transcripts of some of the early European travellers who passed through the area. One C. J. Skead compiled a book in which many of these texts are assembled. In November 1900, the traveller W. Somerville wrote about the Groot Riviers Poort, or Prieskapoort, 10km south of Prieska and therefore not very far from Copperton. He noted that grasslands and thorn trees covered the landscape, but that no tree was to be seen. When he neared the Orange River, he noted that the banks were covered with wood, but only along the margin of the river. These were mainly willow and karee trees. Along the tributary streams were thorn trees (Skead 2009: 87).

Exactly one year later, One P. B. Borcherds wrote about the Grootrivierpoort at Prieska, making similar remarks about the flora as Somerville did. He also noted that the *poort* at the entrance to the Orange River was known by the "natives" under the name of t'Gariep. When this traveller passed along the banks of the Orange River near Prieska in the same year, he made notes on the Bushmen, who were still present in the area at that time.

Regarding the manufacturing of bows and arrows by the Bushmen, he noted that the wood of the bow was of a type of tree commonly known as *caree boomen,* which was very tough and pliable. The arrows were made of a type of reed fairly common along all springs and river flowing there, known as *fluitjies riet*.

The Bushmen apparently used the poison of venomous plants and poison extracted from the fangs of snakes to smear on their arrow points. These people also found sustenance in a type of small bulb, commonly called *mans uitjies* by the Khoikhoi, which were described to be the size of small marbles and not unpleasant in taste (Skead 2009: 87-88).

In September 1822, W. J. Burchell passed through Prieska, as well as the area to the south and southwest thereof. Some 50km southwest of Prieska, he found a large muddy dam, which was situated in a very extensive hollow flat. This would become a lake in the rainy season. There was apparently still some clean water to be found. The area around this was hard and dry, and plentifully strewed with stones and low shrubs. Burchell passed through Prieska to the Orange River in the same month. He noted that none of the bushes exceeded a foot in height. Nearer to the Orange River, the travelling party found a group of Khoikhoi camped in a grove.

By 1903, Copperton was located in an area in which the annual rainfall measured between 10 and 20 inches, and was therefore quite arid. The study area is located in a summer rainfall region. By the early 1900s, the Prieska district, in which Copperton would be located, could not be considered a very agriculturally active area. Only between 25 and 50 sheep were kept per square mile, and only between 2 and 5 heads of cattle. The area where Copperton was later founded would have been too dry and too far from the Orange River to allow for the growing of crops (Burton 1903: 40; 256).

In an article in the Patriot, dated December 1995, some background information is given on the history of the town of Copperton. This town is not very old, as it was only developed in 1972 with the establishment of a copper mine in the area. The mine closed in 1992, and Copperton was sold to a private person, on the condition that the houses in the town would be demolished. About 300 houses were broken down, when it was decided that some homes would be kept in order to develop a retirement town. These houses were apparently solidly built, with stone walls and corrugated roofs. It was noted that the area was very sparsely populated, and that the farmers in the area farmed with sheep. Next to the Orange River, maize and grapes were planted. It was noted that the closest hospitals were located at Prieska, some 35 to 40 minutes' drive from Copperton, and linked with a tarred road (Anon 1995: 4).

5.4 Historical maps and documents relating to the area under investigation

The site under investigation is located on both sides of the R357, about eight kilometres to the south of Copperton and about 47 kilometres south west of Prieska in the Northern Cape Province. This study area comprises the following properties:

- Klipgats Pan 117: Portions 3, 4 & 5
- Kaffirs Kolk 118: Portions 1, 4 & RE
- Hoekplaas 146: RE
- Humansrus 147: RE

Firstly, historical topographical maps will be provided, in order to show how the area developed over time. In the second section, references for relevant documents found at the National Archives will be provided, should a more in-depth study be done in the future.

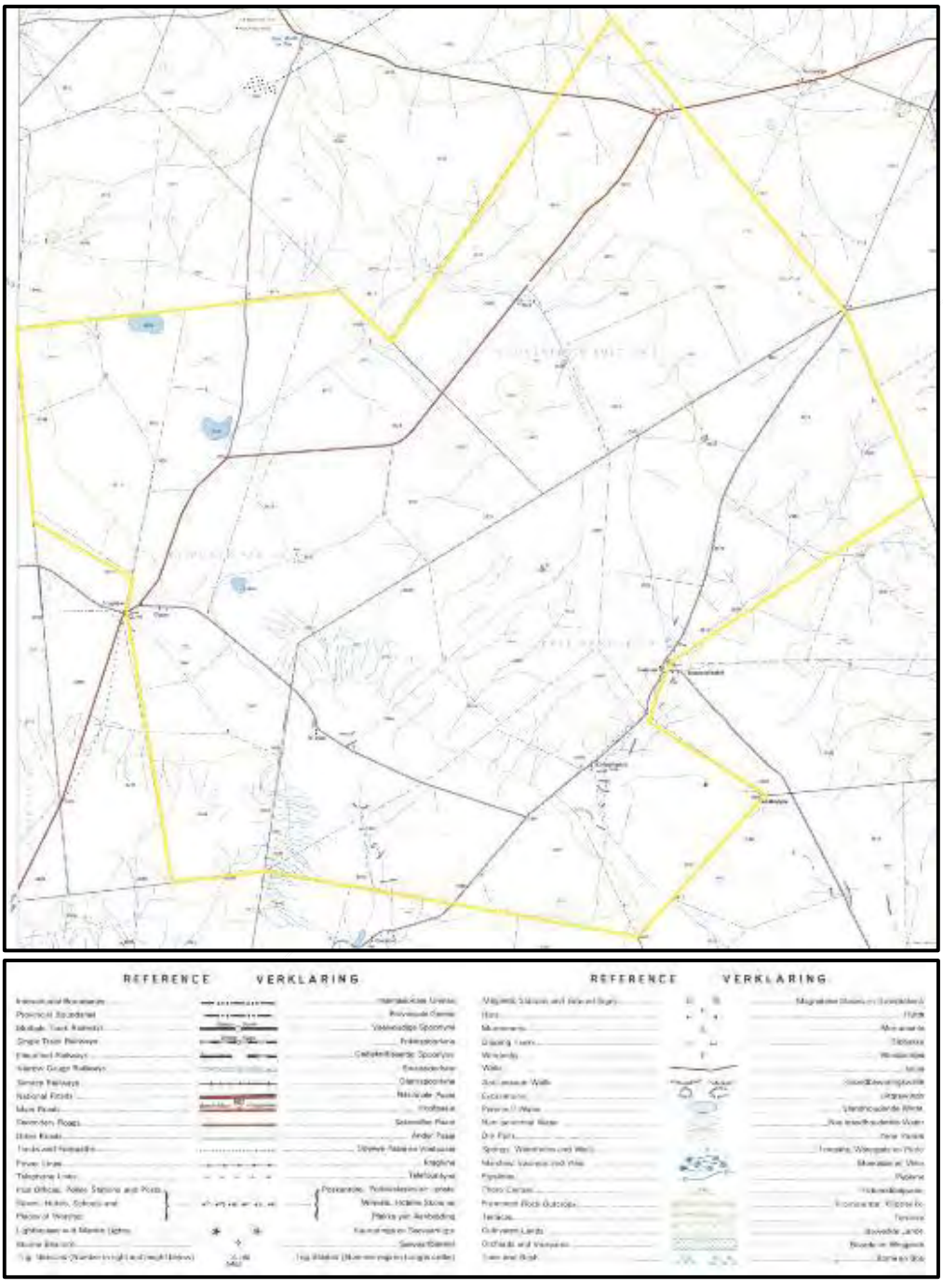


Figure 5. 1970 Topographical map of the sites under investigation.

The approximate study area is indicated with a yellow border (Figure 5). Developments on specific parts of the study area will now be discussed. **Klipgats Pan 117 portions**: A main road, some minor roads, a service railway and a number of tracks / footpaths went through the property; three dams and a number of streams are visible; two buildings and a small dam with anti-erosion walls can be seen at Klippan (centre west); some individual wind mills, a ruin and a water reservoir can be seen in other parts of the property. **Vogelstruis Bult 104 portions:** A main road, a secondary road and three tracks / footpaths went through this area; one can see three small dams and a number of streams; a number of individual wind mills can be seen. **Kaffirs Kolk 118 portions:** Several streams, a service railway, a number of minor roads and tracks / footpaths went through the property; two buildings, a wind mill and several anti-erosion walls can be seen near Mierdam (west); two buildings, a wind mill and several anti-erosion walls can be seen near Kleinkafferskolk (east); to the north east of the latter site, two buildings, a water reservoir, a cultivated land and a small dam with an anti-erosion wall are visible at Hoekplaas; individual wind mills, anti-erosion walls, small dams, a cultivated land and water reservoirs can be seen in other parts of the property. (Topographical Map 1970; Topographical Map 1970).

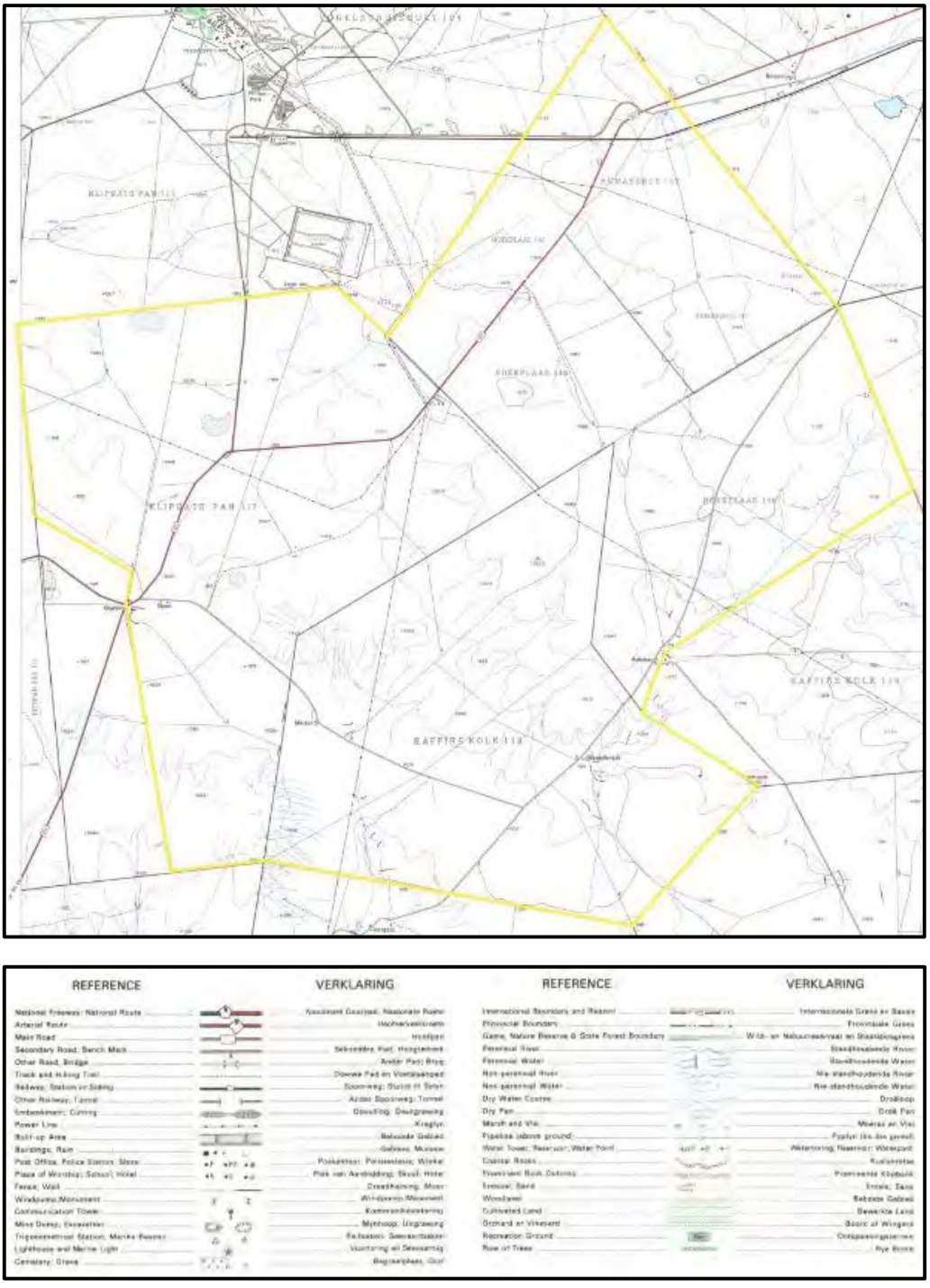


Figure 6. 1988 Topographical map of the sites under investigation.

Developments on specific parts of the study area based on the 1988 Topographic map, will now be discussed (Figure 6). **Klipgats Pan 117 portions**: A main road, a secondary road, a minor road and a number of tracks / footpaths went through the property; three dams and a number of streams are visible; three buildings, a wind mill and a small dam with anti-erosion walls can be seen near Klippan (centre west); some individual buildings, wind mills, a ruin and a water reservoir can be seen in other parts of the property. **Humansrus RE:** A main road, a secondary road, a railway, a power line and a number of tracks / footpaths went through this area; one can see a small dry pan and and a number of streams; a number of individual wind mills, excavation sites and water reservoirs can be seen. **Hoekplaas 146:** A number of streams, a main road and two tracks / footpaths went through the property; two buildings, a water reservoir, a cultivated land and a small dam with an anti-erosion wall are visible at the Hoekplaas site; three small dams, a number of wind mills and a section of cultivated land are visible in different parts of the property. **Kaffirs Kolk 118 portions:** Several streams, a power line, a number of minor roads and tracks / footpaths went through the property; two buildings, a wind mill and several anti-erosion walls can be seen near Mierdam (west); two buildings, a wind mill and several anti-erosion walls can be seen near Kleinkafferskolk (east); individual wind mills, anti-erosion walls and small dams can be seen in other parts of the property. (Topographical Map 1988; Topographical Map 1988)

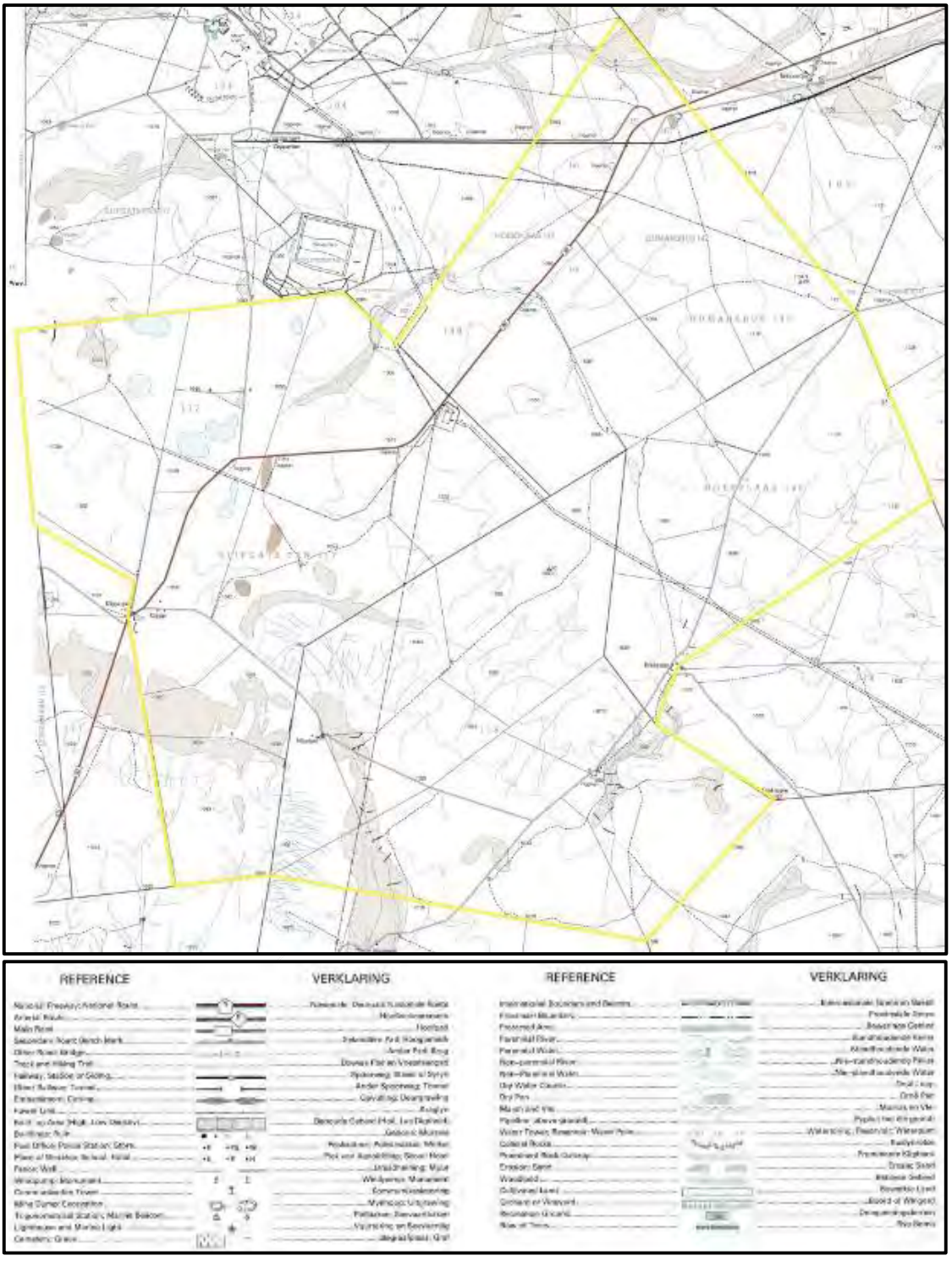


Figure 7. 2005 Topographical map of the sites under investigation.

The approximate study area is indicated with a yellow border (Figure 7). Developments on specific parts of the study area will now be discussed. **Klipgats Pan 117 portions**: A main road, a power line and a number of minor roads and tracks / footpaths went through the property; several dams (some dry, some non-perennial) and a number of streams are visible; three buildings, a wind mill and a small dam with anti-erosion walls can be seen near Klippan (centre west); in the eastern part of the property one can see a development with roads and eight buildings; individual wind mills, a water reservoir and diggings can be seen in other parts of the property. **Humansrus RE:** A number of streams, a main road, a secondary road, a railway, a power line and a number of tracks / footpaths went through this area; a large, dry riverbed is visible in the northern part of the property; a number of individual wind mills, diggings and water reservoirs can be seen. **Hoekplaas 146:** A number of streams, a main road and several tracks / footpaths went through the property; two buildings, a water reservoir and a small dam with an anti-erosion wall are visible at the Hoekplaas site; three small dams, a dry pan and a number of wind mills are visible in different parts of the property. **Kaffirs Kolk 118 portions:** Several streams, a power line, a number of minor roads and tracks / footpaths went through the property; four buildings, a wind mill and several anti-erosion walls can be seen near Mierdam (west); three buildings, a wind mill, diggings and several anti-erosion walls can be seen near the area where Kleinkafferskolk was previously located; large dry pans, individual wind mills and anti-erosion walls can be seen in other parts of the property. (Topographical 2005; Topographical Map 2005)

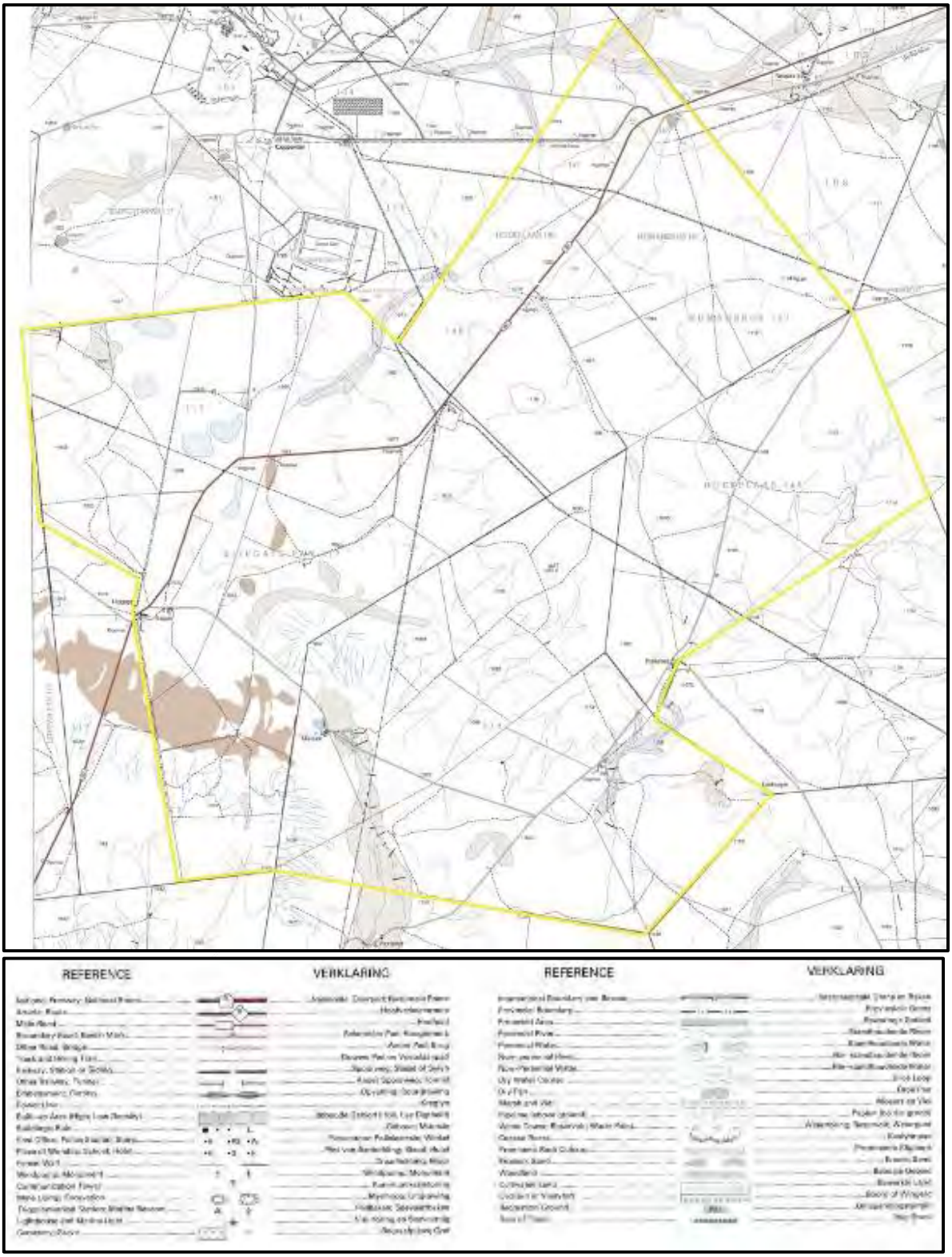


Figure 8. 2011-2014 Topographical map of the sites under investigation.

The following developments can be seen (Figure 8): **Klipgats Pan 117 portions**: A main road, a number of power lines, minor roads and tracks / footpaths went through the property; several dams (some dry, some non-perennial), erosion sites and a number of streams are visible; nine buildings, a ruin, a wind mill, two water reservoirs and two small dams with anti-erosion walls can be seen near Klippan (centre west); in the eastern part of the property one can see a development with roads and four buildings; individual wind mills and a water reservoir can be seen in other parts of the property. **Humansrus RE:** A number of streams, a main road, a secondary road, and old rail route, a minor road, a power line and a number of tracks / footpaths went through this area; a large, dry riverbed is visible in the northern part of the property; a number of individual wind mills, diggings and water reservoirs can be seen. **Hoekplaas 146:** A number of streams, a main road and several tracks / footpaths went through the property; two buildings, a ruin, a water reservoir and a small dam with an anti-erosion wall are visible at the Hoekplaas site; four small dams, diggings and a number of wind mills are visible in other parts of the property. **Kaffirs Kolk 118 portions:** Several streams, a power line, a number of minor roads and tracks / footpaths went through the property; three buildings, a ruin, orchards, a dam and several anti-erosion walls can be seen near Mierdam (west); three buildings, a wind mill, diggings and several anti-erosion walls can be seen near the area where Kleinkafferskolk was previously located; large dry pans, individual buildings, wind mills, water reservoirs and anti-erosion walls can be seen in other parts of the property. (Topographical 2011; Topographical Map 2014)

Figure 9. 2018 Google Earth image showing the study area in relation to Upington, Prieska, the N10 and other sites. (Google Earth 2018)

The following Documents at the National Archives and Records Service of South Africa (NARSSA) can be consulted in future for a more in-depth study

Klipgats Pan 117:

DEPOT KAB (Cape Town Archives Repository
SOURCE PAE
TYPE LEER
VOLUME_NO 832
SYSTEM 10
REFERENCE P128/118/ER
PART 1
DESCRIPTION PRIESKA **KLIPGATSPAN** PRIMARY SCHOOL. INSPECTION REPORT.
STARTING 1929
ENDING 1936

DEPOT KAB (Cape Town Archives Repository
SOURCE PAE
TYPE LEER
VOLUME_NO 1064
SYSTEM 11
REFERENCE P128/118
PART 1
DESCRIPTION PRIESKA **KLIPGATSPAN** PRIMARY SCHOOL ADMINISTRATIVE AND PERSONNEL AFFAIRS.
STARTING 1930
ENDING 1934

DEPOT KAB (Cape Town Archives Repository
SOURCE PAE
TYPE LEER
VOLUME_NO 1064
SYSTEM 11
REFERENCE P128/118
PART 2
DESCRIPTION PRIESKA **KLIPGATSPAN** PRIMARY SCHOOL ADMINISTRATIVE AND PERSONNEL AFFAIRS.
STARTING 1935
ENDING 1941

DEPOT KAB (Cape Town Archives Repository
SOURCE PAE
TYPE LEER
VOLUME_NO 832
SYSTEM 10

REFERENCE P128/118/ER
PART 2
DESCRIPTION PRIESKA **KLIPGATSPAN** PRIMARY SCHOOL. INSPECTION REPORT.
STARTING 1938
ENDING 1940

Kaffirs Kolk 118:

DEPOT KAB (Cape Town Archives Repository
SOURCE LND
TYPE LEER
VOLUME_NO 1/255
SYSTEM 01
REFERENCE L747
PART 1
DESCRIPTION **"KAFFIRSKOLK",** PRIESKA DIVISION: LEASE OF FOR 10 YEARS REQUESTING.
STARTING 1887
ENDING 1887

DEPOT KAB (Cape Town Archives Repository
SOURCE LND
TYPE LEER
VOLUME_NO 1/259
SYSTEM 01
REFERENCE L846
PART 1
DESCRIPTION ARREAR QUITRENT UNDER ACT 14/78 DUE ON LOT 4823, "KAFFIRSKOLK" **AND** "T'GARDEN": RESUMPTION OF RECOMMENDING.
STARTING 1887
ENDING 1887

DEPOT SAB (Pretoria National Archives Repository)
SOURCE MNW
TYPE LEER
VOLUME_NO 919
SYSTEM 01
REFERENCE MM505/28
PART 1
DESCRIPTION BOVENSTE **KAFFIRSKOLK** PORTION **KAFFIRSKOLK** AND "T" GOEDEN PRIESKA - DISPOSAL LAND SETTLEMENT ACT
STARTING 1928
ENDING 1928

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4410
SYSTEM 01
REFERENCE E13678
PART 3
DESCRIPTION PRIESKA BOVENSTE **KAFFIRS KOLK** GEDEELTE VAN DIE PLAAS **KAFFIRS KOLK** EN T'GOEDEN JC CILLIERS EN AC CILLIERS JUNIOR.
STARTING 1939
ENDING 1949

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4411
SYSTEM 01
REFERENCE E13678
PART 4
DESCRIPTION PRIESKA BOVENSTE **KAFFIRS KOLK** SYNDE GEDEELTE VAN DIE PLAAS **KAFFIRS** KOLK EN T'GOEDEN - JC CILLIERS EN AC CILLIERS.
STARTING 1949
ENDING 1963
REMARKS RH CILLIERS.

Vogelstruis Bult 104:

DEPOT KAB (Cape Town Archives Repository
SOURCE LND
TYPE LEER
VOLUME_NO 1/339
SYSTEM 01
REFERENCE L3959
PART 1
DESCRIPTION LOT 4824, **"VOGELSTRUIS BULT",** PRIESKA: APPLICATIONS FOR.
STARTING 1889
ENDING 1890

DEPOT KAB (Cape Town Archives Repository
SOURCE LND
TYPE LEER
VOLUME_NO 1/772
SYSTEM 01

REFERENCE L13094
PART 1
DESCRIPTION PRIESKA, **VOGELSTRUIS BULT:** ANNUAL QUITRENT, RE.
STARTING 1900
ENDING 1901

DEPOT KAB (Cape Town Archives Repository
SOURCE LDR
TYPE LEER
VOLUME_NO 127
SYSTEM 01
REFERENCE F22/1192
PART 1
DESCRIPTION LAND BOARD REPRESENTATIVE. ANNEX **VOGELSTRUIS BULT,** PRIESKA.
STARTING 1930
ENDING 1930

DEPOT SAB (Pretoria National Archives Repository)
SOURCE BAO
TYPE LEER
VOLUME_NO 2730
SYSTEM 01
REFERENCE C31/3/2730
PART 1
DESCRIPTION ENKELKWARTIERE. PLUTO MINING AND PROSPECTING COMPANY **VOGELSTRUISBULT PRIE**SKA.
STARTING 19700421
ENDING 19731019
REMARKS A12/3/6/P61/4.

DEPOT KAB (Cape Town Archives Repository
SOURCE KUS
TYPE LEER
VOLUME_NO 4/834
SYSTEM 01
REFERENCE 7/2/1/E2503
PART 1
DESCRIPTION ONDERWYS. PRIMERE, JUNIOR EN SENIOR SEKONDERE SKOLE. DAARSTELLING, NAAMSVERANDERING EN SLUITING. **VOGELSTRUISBULT** LAERSKOOL, **PRIESKA.**
STARTING 19700000
ENDING 19800000

DEPOT KAB (Cape Town Archives Repository
SOURCE KUS
TYPE LEER
VOLUME_NO 4/834
SYSTEM 01
REFERENCE 7/2/1/E2503
PART 2
DESCRIPTION ONDERWYS. PRIMERE, JUNIOR EN SENIOR SEKONDERE SKOLE. DAARSTELLING,
NAAMSVERANDERING EN SLUITING. **VOGELSTRUISBULT** LAERSKOOL, **PRIESKA.**
STARTING 19810000
ENDING 19850000

DEPOT KAB (Cape Town Archives Repository
SOURCE KUS
TYPE LEER
VOLUME_NO 4/835
SYSTEM 01
REFERENCE 7/2/1/E2503
PART 3
DESCRIPTION ONDERWYS. PRIMERE, JUNIOR EN SENIOR SEKONDERE SKOLE. DAARSTELLING, NAAMSVERANDERING EN SLUITING. **VOGELSTRUISBULT** LAERSKOOL, **PRIESKA.**
STARTING 19860000
ENDING 19880000

Hoekplaas 146:

No documents found

Humansrus 147:

No documents found

6. PROBABILITY OF OCCURRENCE OF SITES

Based on the above information, it is possible to determine the probability of finding archaeological and cultural heritage sites within the study area to a certain degree. For the purposes of this section of the report the following terms are used – low, medium and high probability. Low probability indicates that no known occurrences of sites have been found previously in the general study area. Medium probability indicates some known occurrences in the general study area are documented and can therefore be expected in the study area. A high probability indicates that occurrences have been documented close to or in the study area and that the environment of the study area has a high degree of probability for the occurrence of sites.

» Archaeological and Cultural Heritage Landscape

NOTE: *Archaeology is the study of human material and remains (by definition) and is not restricted in any formal way as being below the ground surface*.

*Archaeologica*l remains dating to the following periods can be expected within the study areas:

» Stone Age finds
ESA: *High Probability*
MSA*: High Probability*
LSA: High Probability
LSA –Herder: Medium to high Probability

» Iron Age finds
EIA: *Low Probability*
MIA*: Low Probability*
LIA: Low Probability

» Historical finds
Historical period: *Low-Medium Probability*
Historical dumps: *Low Probability*
Structural remains: *Medium - High Probability*

» Living Heritage
For example, rainmaking sites: *Low Probability*

» Burial/Cemeteries
Burials over 100 years: *High Probability*
Burials younger than 60 years*: Medium to high Probability*

Subsurface excavations including prospecting, ground levelling, landscaping, and foundation preparation can expose any number of these resources.

7. ASSUMPTIONS AND LIMITATIONS

The study area was not subjected to a field survey at this stage in the environmental process, it is recommended that this will be done when the actual exploration localities are fixed. It is assumed that information obtained for the wider area is applicable to the study area. Additional information could become available in future that could change the results of this report. It is assumed that the EAP will upload all relevant documents to the SAHRIS.

8. FINDINGS

Based on previous studies conducted in the study area 127 heritage features were identified as indicated in Figure 10 and Table 1.

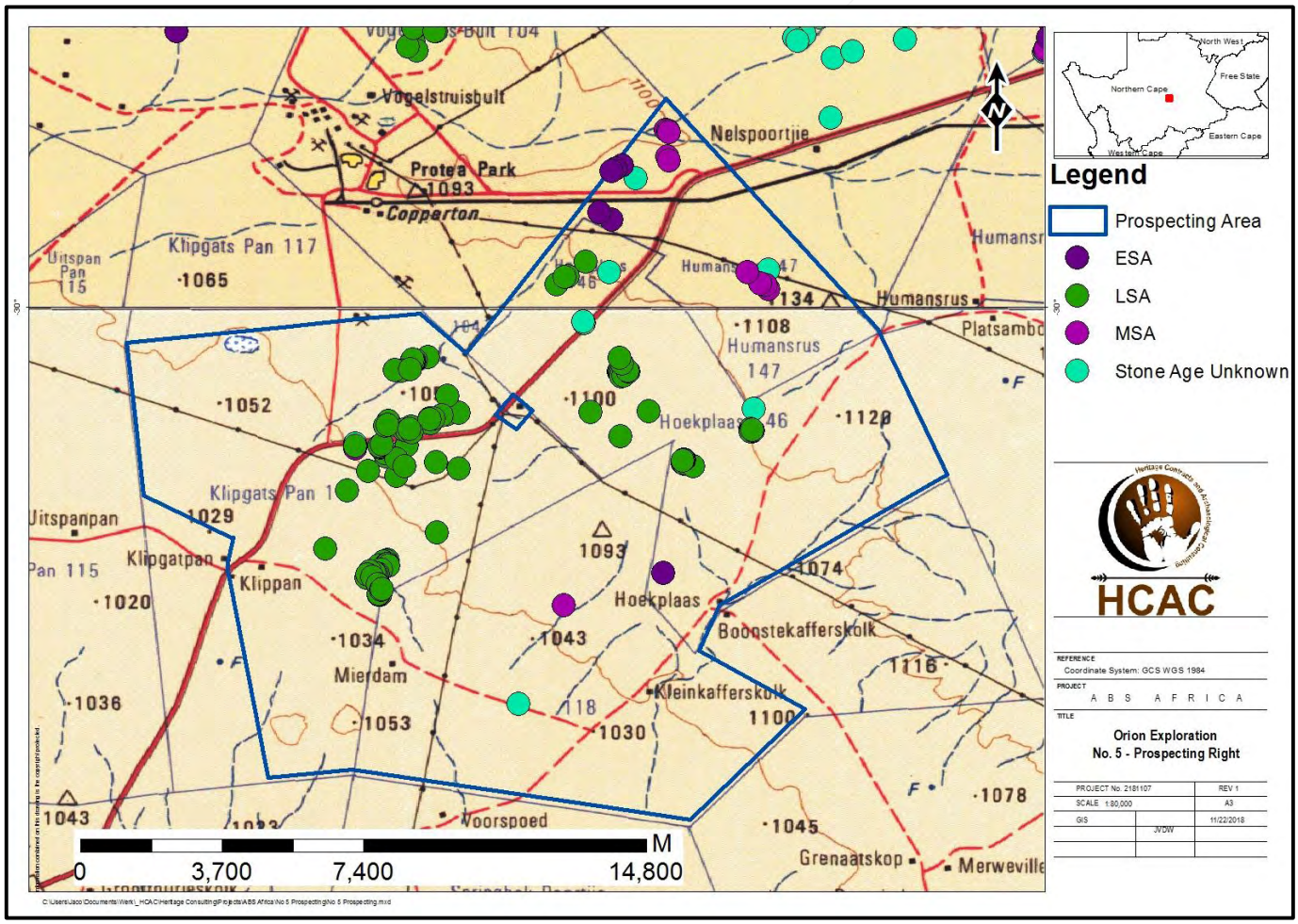


Figure 10. Heritage Sensitivity map

8.1. Archaeology and Palaeontology

8.1.1 Archaeological finds

Based on CRM studies conducted in the area ESA, MSA and LSA scatters as well as distinct sites can be expected. No Impacts to heritage resources is envisaged during the non-invasive prospecting activities but invasive activities can alter/ destroy heritage resources.

8.1.2 Nature of Impact

The invasive phase of the project could directly impact on surface and subsurface archaeological sites.

8.1.3 Extent of impact

The project could have a low to medium impact on a local scale.

8.1.4. Paleontological resources

Bamford (2018) conducted an independent paleontological study and found that the proposed site lies on the Late Carboniferous-Early Permian Dwyka Group tillites, sands, shales, mudstones. Although fossils have not been reported from this site there is a small chance that typical (but very infrequent) early *Glossopteris* flora plants could occur in the sediments just below the surface. Surface exposures are likely to be very weathered. Therefore, a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required unless fossils are revealed once excavations and drilling has commenced. As far as the palaeontology is concerned a prospecting right should be granted (Bamford 2018).

8.2. Historical period

8.2.1 Historical finds:

Historical finds include middens, structural remains and the cultural landscape. Impacts to heritage resources will occur primarily during invasive activities and no impacts are expected during the initial non-invasive activities.

8.2.2 Nature of Impact

The non-invasive activities will not have an impact on heritage resources, but invasive activities could alter/ destroy non-renewable resources.

8.2.3 Extent of impact

The project could have a low impact on a local scale.

8.3. Burials and Cemeteries

8.3.1 Burials and Cemeteries

There are no graves on record for the study area but graves and informal cemeteries can be expected anywhere on the landscape

8.3.2 Nature of Impact

The invasive prospecting activities during later phases of the proposed project could directly impact on marked and unmarked graves.

8.3.3 Extent of impact

The project could have a low to medium impact on a local scale.

Impact on Heritage resources

During the non-invasive prospecting no impacts are foreseen on heritage resources. The future invasive prospecting activities of the proposed project could directly impact on graves, archaeological sites and historical sites.

Issue	Nature of Impact	Extent of Impact	No-Go Areas
Disturbance and destruction of archaeological sites, historical sites and graves.	Invasive exploration activities could cause irreversible damage or destroy heritage resources and depletion of the archaeological record of the area.	Low to Medium on a local scale.	TBC after field work

Description of expected significance of impact

Significance of sites, mitigation and significance of possible impact can only be determined after a field survey has been conducted, but based on previous work in the area Stone Age finds and graves can be expected.

Gaps in knowledge & recommendations for further study

Large sections of the study area have been subjected to heritage resource surveys and it is assumed that information obtained for the wider region is applicable to the study area. It is recommended that prior to invasive prospecting, impact areas should subject to a field study to confirm the presence of heritage resources after which mitigation measures will be recommended (if needed).

9. POTENTIAL SIGNIFICANCE OF HERITAGE RESOURCES

Based on the current information obtained for the area at a desktop level it is anticipated that any sites that occur within the proposed development area will have a Generally Protected B (GP.B) or lower field rating and all sites should be mitigatable. No red flags have been identified.

10. CONCLUSIONS AND RECOMMENDATIONS

The scope of work comprises a heritage desktop report for a large prospecting right area comprising approximately 19 727 ha. Due to the geographical size of the exploration application and the fact that no intrusive activities will occur at this point of the application, it was deemed not feasible to conduct fieldwork at this point. Several large-scale heritage surveys were conducted for renewable energy and mining projects and the archaeological character of the area is now well described (e.g., Orton & Webley 2013 a and b, van der Walt 2012, 2013 & 2017). This desktop study is informed by available data for the area. Some of the aforementioned studies, covered portions of the current study area and 127 heritage features is on record for the study area. Based on these studies the following resources can be expected in the study area as indicated below.

» Paleontological resources

The proposed site lies on the Late Carboniferous-Early Permian Dwyka Group tillites, sands, shales, mudstones. Although fossils have not been reported from this site there is a small chance that typical (but very infrequent) early *Glossopteris* flora plants could occur in the sediments just below the surface. A Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required unless fossils are revealed once excavations and drilling has commenced (Bamford 2018).

» Widespread Stone Age scatters and sites (ESA; MSA and LSA)

Every site is relevant to the Heritage Landscape, but it is anticipated that few sites in the study area could have conservation value. The impact of non-invasive exploration on these features are considered negligible how ever known sites should be avoided during planning stages for intrusive exploration.

» Historical finds and Cultural landscape

Some structures could occur that are older than 60 years. No impact on structures older than 60 years is foreseen during prospecting activities, however if structures are to be impacted destruction/ alteration permits will have to be applied for.

» Burials and cemeteries

Formal and informal cemeteries as well as pre-colonial graves occur widely across Southern Africa. It is generally recommended that these sites are preserved *in situ* and within a development. These sites can however be relocated if conservation is not possible, but this option must be seen as a last resort and is not advisable. The presence of any grave sites must be confirmed during a field survey and the public consultation process when exploration localities are fixed.

» General

It is anticipated that any sites that occur within the project area will have a Generally Protected B (GP.B) or lower field rating, all sites should be mitigatable, and no red flags have been identified. It is therefore recommended that non-invasive exploration can commence (based on approval from SAHRA) with the following conditions of authorisation in the EMPr:

- Before commencing invasive prospecting activities, the impact areas should be subjected to a heritage walk down.
- Inclusion of a chance find protocol (both archaeology and palaeontology) as outlined below.

10.1. Chance Find Procedure – Archaeology

The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find and therefor chance find procedures should be put in place as part of the EMP. A short summary of chance find procedures is discussed below.

This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below.

- If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager.
- It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find and confirm the extent of the work stoppage in that area.
- The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA.

10.2. Monitoring Programme for Palaeontology – to commence once the drilling and prospecting begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling or excavations commence.
2. When drilling or excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, wood, bone, coal) should be put aside in a suitably protected place. This way the prospecting activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 5, 6). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then the site inspections by the palaeontologist will not be necessary. Annual reports by the palaeontologist must be sent to SAHRA.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

11. PLAN OF STUDY

With cognisance of the recorded archaeological sites in the wider area as well as within the study area and in order to comply with the National Heritage Resources Act (Act 25 of 1999) it is recommended that once the impact areas for invasive prospecting activities has been confirmed these areas should be subjected to a heritage walkdown. During this study sites of archaeological, historical or places of cultural interest must be located, identified, recorded, photographed and described. During this study, the levels of significance of recorded heritage resources must be determined and mitigation proposed should any significant sites be impacted upon, ensuring that all the requirements of the SAHRA are met.

11.1 Reasoned Opinion

If the above recommendations are adhered to, HCAC is of the opinion that the impact of non-invasive exploration on heritage resources is negligible. Once exploration sites are fixed the impacts resulting from this can be mitigated. This will be confirmed through the field visit in the next phase of the project.

If during the any stage of the project, any archaeological finds are made (e.g. graves, stone tools, and skeletal material), the operations must be stopped, and the archaeologist must be contacted for an assessment of the finds. Due to the subsurface nature of archaeological material and graves the possibility of the occurrence of unmarked or informal graves and subsurface finds cannot be excluded.

12. LIST OF PREPARERS

Jaco van der Walt (Archaeologist and project manager).

Liesl Bester (Archival Specialist)

13. STATEMENT OF COMPETENCY

The author of the report is a member of the Association of Southern African Professional Archaeologists and is also accredited in the following fields of the Cultural Resource Management (CRM) Section, member number 159: Iron Age Archaeology, Colonial Period Archaeology, Stone Age Archaeology and Grave Relocation. Jaco is also an accredited CRM Archaeologist with SAHRA and AMAFA.

Jaco has been involved in research and contract work in South Africa, Botswana, Mozambique, Zimbabwe, Tanzania and the DRC and conducted well over 300 AIAs since he started his career in CRM in 2000. This involved several mining operations, Eskom transmission and distribution projects and infrastructure developments. The results of several of these projects were presented at international and local conferences.

14. STATEMENT OF INDEPENDENCE

I, Jaco van der Walt as duly authorised representative of Heritage Contracts and Archaeological Consulting CC, hereby confirm my independence as a specialist and declare that neither I nor the Heritage Contracts and Archaeological Consulting CC have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which the client was appointed as Environmental Assessment practitioner, other than fair remuneration for work performed on this project.

SIGNATURE: _____

15. REFERENCES

Bamford, M.K. 2018. Palaeontological Impact Assessment for the proposed prospecting rights application on farm Klipgats Pan near Copperton, North West Province

Beaumont, P.B., Smith, A.B. & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In: Smith, A.B. (ed.) Einiqualand: studies of the Orange River frontier: 236-264. Cape Town: University of Cape Town Press.

De Kock, SE & Narainne, GJR. 2016 Integrated Heritage Impact Assessment In Terms Of Section 38(8) Of The National Heritage Resources Act, 1999 (Act 25 Of 1999) Proposed Development Of Humansrus Solar PV Facility 4 On The Farm Humansrus 147, Prieska District And Pixley Ka Seme District Municipality, Northern Cape Province

Kaplan, J & N, Wiltshire. 2011. Archaeological Impact Assessment Of A Proposed Wind Energy Facility, Power Line And Landing Strip In Copperton, Siyathemba Municipality, Northern Cape Prepared for: Aurecon South Africa (Pty) Ltd

Kiberd, P. 2001. Bundu Farm: a Middle and Later Stone Age pan site, Northern Cape, South Africa: preliminary results of fieldwork. Nyame Akuma 55: 51-55.

Kiberd, P. 2005. Bundu Farm and the transition from Earlier to Middle Stone Age in the Northern Cape, South Africa. Unpublished M.Phil dissertation. Southampton: University of Southampton.

Kiberd, P. 2006. Bundu Farm: a report on archaeological and palaeoenvironmental assemblages from a pan site in Bushmanland, Northern Cape, South Africa. South African Archaeological Bulletin 61: 189-201.

Morris, D. 1994. An ostrich eggshell cache from the Vaalbos National Park, Northern Cape,South Africa. Southern African Field Archaeology 3: 55-58.

Mucina, L. & Rutherford, M.C. 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute. Pretoria.

Orton, J. 2011. Heritage impact assessment for a proposed photovoltaic energy plant on the farm Klipgats Pan near Copperton, Northern Cape.

Orton, J. 2012. Heritage Impact Assessment For A Proposed Photovoltaic Energy Plant On The Farm Hoekplaas Near Copperton,Northern Cape

Orton, J. 2016. Heritage Impact Assessment For Four Proposed Borrow Pits On Remainder Of Farm Vogelstruisbult 104/1, Prieska Magisterial District, Northern Cape.

Orton, J. & Webley,L. 2013a Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on Farm Hoekplaas 146, Copperton, Northern Cape

Orton, J. & Webley, L. 2013b Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on The Remainder of Farm Klipgats Pan 117, Copperton, Northern Cape

Parsons, I. 2003. Lithic expressions of Later Stone Age lifeways in the Northern Cape. South African Archaeological Bulletin 58: 33-37.

Parsons, I. 2004. Stone circles in the Bloubos landscape, Northern Cape. Southern African Humanities 16: 59-69.

Parsons, I. 2007. Hunter-gatherers or herders? Reconsidering the Swartkop and Doornfontein Industries, Northern Cape Province, South Africa. Before Farming 2007/4: Article 3.

Parson, I. 2008. Five Later Stone Age artefact assemblages from the interior Northern Cape

Province. South African Archaeological Bulletin 63: 51-60.

Van der Walt, J. 2012a. Scoping report for Garob Wind Farm. Unpublished report.

Van der Walt, J. 2012b. AIA for Garob Wind Farm. Unpublished report.

Van der Walt, J. 2016. Archaeological Impact Assessment for The Proposed Garob Borrow Pit, Northern Cape Province.

Van Ryneveld, K. 2006. Archaeological Impact Assessment – Vogelstruis Bult 104,Prieska District, Northern Cape, South Africa. Report prepared for Amber Mountain Investments. National Museum Bloemfontein.

Smith, A.B. 1995. Archaeological observations along the Orange River and its hinterland. In:Smith, A.B. (ed.) Einiqualand: studies of the Orange River frontier: 236-264.Rondebosch: UCT Press.

Additional Sources:

Anon. 1991. Copperton to become 2nd 'Orania' for rightwingers. *Weekend Argus*, 16 November 1991, p. 5.

Anon. 1991. Myndorp in Noord-Kaap ontwikkel vir volkstaters. *Die Burger*, 16 November 1991, p. 2.

Anon. 1995. Copperton – Privaat dorp in die Noordkaap. *Patriot*, 21 Desember 1995, p. 4.

Burton, A. R. E. 1903. *Cape Colony for the Settler*. Cape Town: J. C. Juta & Co.

Skead, C. J. 2009. *Historical plant incidence in southern Africa. A collection of early travel records in southern Africa.* Pretoria: South African National Biodiversity Institute.

Palaeontological Impact Assessment for the proposed prospecting rights application on farm Klipgats Pan near Copperton, Northern Cape Province

Desktop Study

For

Heritage Consultants

22 November 2018

Prof Marion Bamford
Palaeobotanist
P Bag 652, WITS 2050
Johannesburg, South Africa
Marion.bamford@wits.ac.za

Expertise of Specialist

The Palaeontologist Consultant is: Prof Marion Bamford
Qualifications: PhD (Wits Univ, 1990); FRSSAf, ASSAf
Experience: 30 years research; 22 years PIA studies

Declaration of Independence

This report has been compiled by Professor Marion Bamford, of the University of the Witwatersrand, sub-contracted by Heritage Consultants, Modimolle, South Africa. The views expressed in this report are entirely those of the author and no other interest was displayed during the decision making process for the Project.

Specialist: Prof Marion Bamford

Signature: 

Executive Summary

A palaeontological Impact Assessment was requested for the prospecting rights application for the farm Klipgats Pan, southwest of Copperton, Prieska area, the old Prieska Copper Mine. To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed development of a sand mining area.

The proposed site lies on the Late Carboniferous-Early Permian Dwyka Group tillites, sands, shales, mudstones. Although fossils have not been reported from this site there is a small chance that typical (but very infrequent) early *Glossopteris* flora plants could occur in the sediments just below the surface. Surface exposures are likely to be very weathered. Therefore a Fossil Chance Find Protocol should be added to the EMPr. Based on this information it is recommended that no palaeontological site visit is required unless fossils are revealed once excavations and drilling has commenced. As far as the palaeontology is concerned a prospecting right should be granted.

Table of Contents

1. Background

A Prospecting Right and Environmental Authorisation (EA) for prospecting activities in the vicinity of the historical Prieska Copper Mine (PCM) is in progress, in terms of the National Environmental Management Act 107 of 1998 and the Mineral and Petroleum Resources Development Act 28 of 2002. The following farms relate to the prospecting right application:

Table 1: Klipgats Pan cluster of farms for the EA

Farm Name	Farm No	Subdivision No
Klipgats Pan	117	5
Kaffirs Kolk	118	1
Kaffirs Kolk	118	4
Klipgats Pan	117	4
Hoekplaas	146	RE
Kaffirs Kolk	118	RE
Humansrus	147	RE
Klipgats Pan	117	3

A Palaeontological Impact Assessment was requested for the Klipgats Pan Prospecting Rights Application. To comply with the South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), a desktop Palaeontological Impact Assessment (PIA) was completed for the proposed project.

Table 2: Specialist report requirements in terms of Appendix 6 of the EIA Regulations (2014)

A specialist report prepared in terms of the Environmental Impact Regulations of 2014 must contain:	Relevant section in report
Details of the specialist who prepared the report	Appendix B
The expertise of that person to compile a specialist report including a curriculum vitae	Appendix B
A declaration that the person is independent in a form as may be specified by the competent authority	Page 1
An indication of the scope of, and the purpose for which, the report was prepared	Section 1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	N/A
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 2
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section ii **Error! Reference source not found.**
An identification of any areas to be avoided, including buffers	N/A

A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 4
Any mitigation measures for inclusion in the EMPr	N/A
Any conditions for inclusion in the environmental authorisation	N/A
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 8
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised	N/A
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	N/A
A description of any consultation process that was undertaken during the course of carrying out the study	N/A
A summary and copies if any comments that were received during any consultation process	N/A
Any other information requested by the competent authority.	N/A

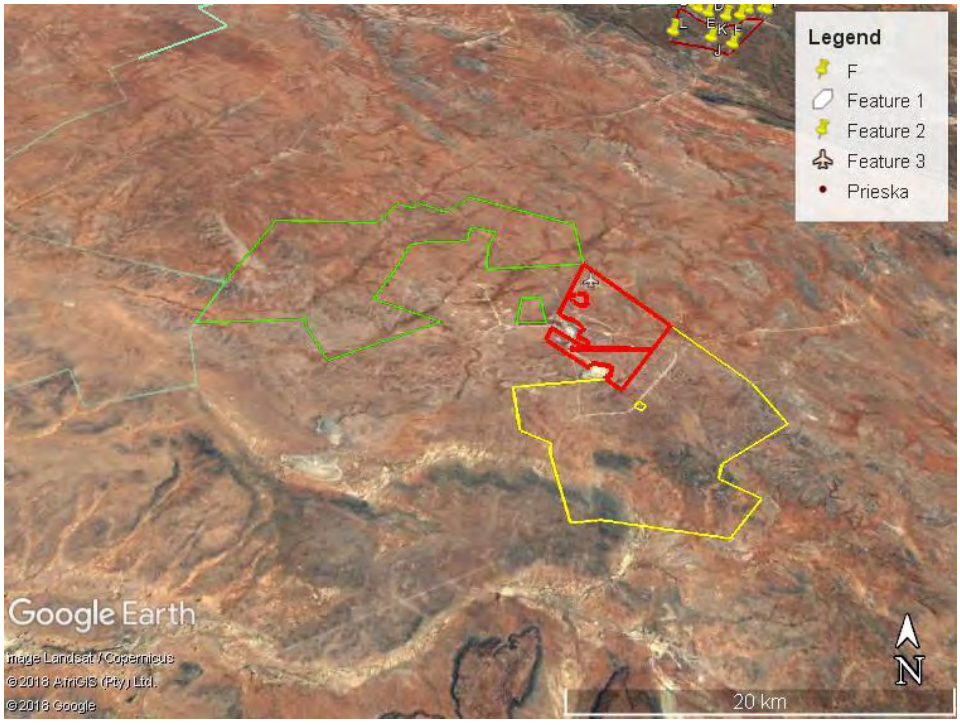


Figure 1: Google Earth map of the proposed area for the Klipgats Pan Prospecting Rights Application shown in the yellow outline. Map supplied by Heritage Consultants.

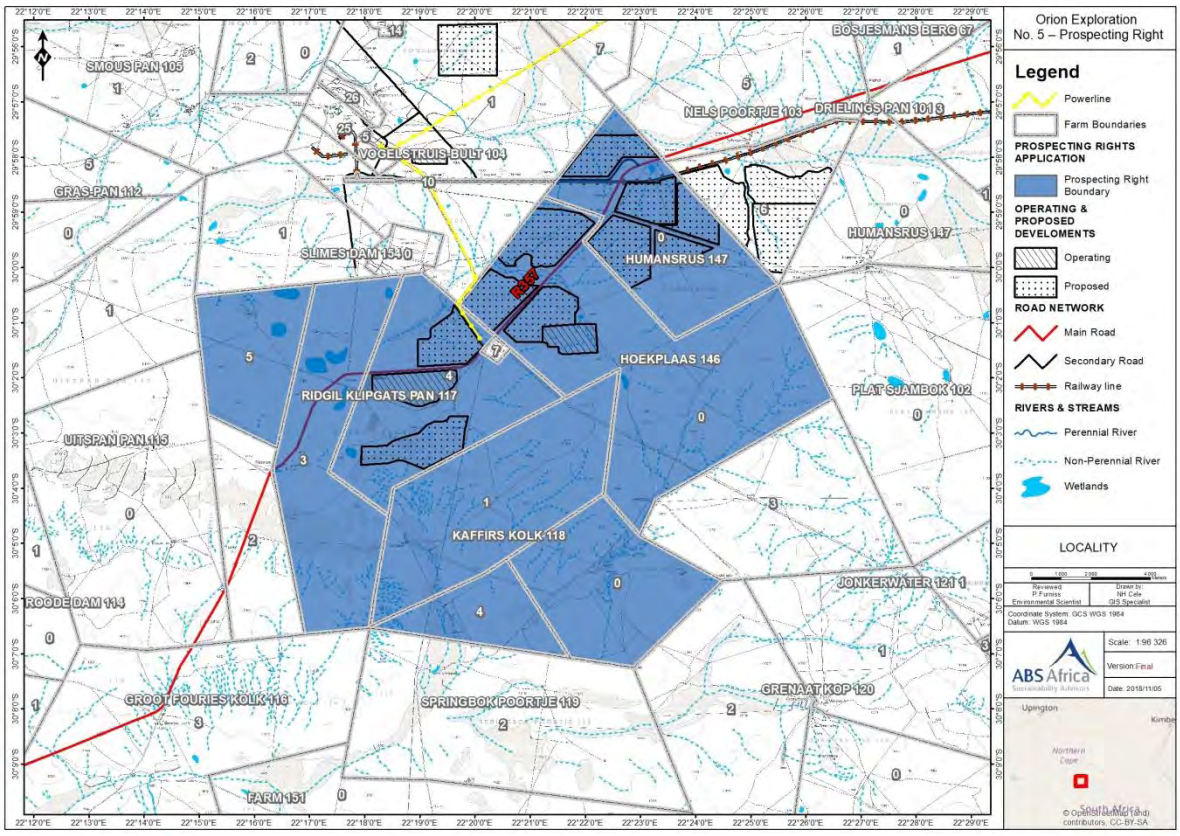


Figure 2: Site map for the Klipgats Pan prospecting rights area shown in blue.

2. Methods and Terms of Reference

The Terms of Reference (ToR) for this study were to undertake a PIA and provide feasible management measures to comply with the requirements of SAHRA.
The methods employed to address the ToR included:

1. Consultation of geological maps, literature, palaeontological databases, published and unpublished records to determine the likelihood of fossils occurring in the affected areas. Sources included records housed at the Evolutionary Studies Institute at the University of the Witwatersrand and SAHRA databases;
2. Where necessary, site visits by a qualified palaeontologist to locate any fossils and assess their importance (*not applicable to this assessment*);
3. Where appropriate, collection of unique or rare fossils with the necessary permits for storage and curation at an appropriate facility (*not applicable to this assessment*); and
4. Determination of fossils' representivity or scientific importance to decide if the fossils can be destroyed or a representative sample collected (*not applicable to this assessment*).

3. Geology and Palaeontology

i. Project location and geological context

The oldest rocks in the area are those of the Keimos Suite and they are a group of syn- to post-tectonic granitoids that have intruded into the igneous and metamorphic rocks of the Namaqua-Natal Province. There are also outcrops of the quartzites of the Uitdraai Formation and the Dagbreek Formation. The rocks of the Prieska Copper Mine are known as the Copperton Volcanic Centre (Cornell et al., 2006) and include the Copperton Formation, the Kielder Formation, topped by the Dagbreek Formation.

Overlying this ancient rocks are sediments of the Dwyka Group and the Prince Albert Formation of the Ecca Group, both early Karoo Supergroup deposits from the receding glaciers and inland sea (Late Carboniferous to Early Permian in age). To the north and east much of the land surface is covered by alluvium, sands, silcretes and limestones that are much younger, from the Quaternary.

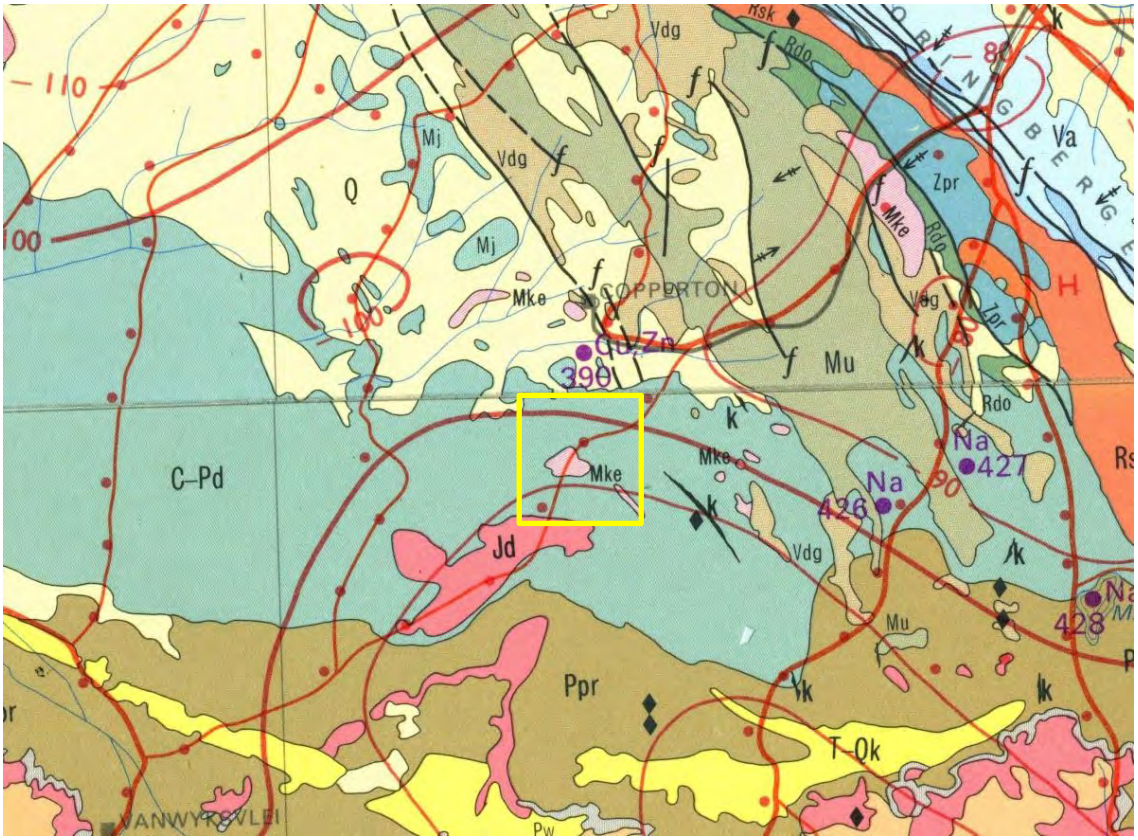


Figure 3: Geological map of the area around Copperton with the proposed site for the Klipgats Pan prospecting shown within the yellow rectangle. Abbreviations of the rock types are explained in Table 3. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

Table 3: Explanation of symbols for the geological map and approximate ages (Barbolini et al., 2016; Johnson et al., 2006; Cornell et al., 2006). SG = Supergroup; Fm = Formation.

Symbol	Group/Formation	Lithology	Approximate Age
Q	Quaternary	Alluvium, sand, calcrete	Neogene, ca 25 Ma to present
T-Qk	Tertiary-Quaternary	Sand, limestone	
Jd	Jurassic dykes	Dolerite dykes, intrusive	Jurassic, approx. 180 Ma
Ppr	Prince Albert Fm, Ecca Group, Karoo SG	Shale	290-283.5 Ma
C-Pd	Dwyka Group, Karoo SG	Tillite, sandstone, mudstone, shale	>290 Ma
Vdg	Dagbreek Fm, Vaalkoppies Group, Kaaien Terrane	Schist, quartzite, amphibolite	Ca 1800 – 2120 Ma
Mu	Uitdraai Fm, Brulpan Group, Kaaien Terrane	quartzite	Ca 1930 Ma
Mke	Keimos Suite, Kakamas Terrane	granite	Ca 1080-1090 Ma ??

ii. Palaeontological context

The palaeontological sensitivity of the area under consideration is presented in Figure 4. The site for prospecting is in the Dwyka Group tillites, sandstone, mudstone and shales, and these potentially could preserve fossils. Around 300-290 Ma the climate in southern Africa was still relatively cool, but there were well developed Carboniferous floras in the northern hemisphere. In South Africa, however, much of the land surface was covered by ice sheets. As they melted they dropped the moraine trapped in the ice, together with limited plant matter from the vegetation that gradually recovered and colonised the land surface. Terrestrial vertebrates had not evolved at this time. The late Carboniferous flora comprised *Glossopteris* leaves and seeds, wood, and other plants such as lycopods, sphenophytes and ferns.

The Dwyka Group is made up of seven facies that were deposited in a marine basin under differing environmental settings of glacial formation and retreat (Visser, 1986, 1989; Johnson et al., 2006). In the north these are called the Mbizane Formation, and the Elandsvlei Formation in the south. Described below are the seven facies (Johnson et al., 2006 p463-465):

The massive diamictite facies comprises highly compacted diamictite that is clast-poor in the north. It was deposited in subaqueous or subglacial positions.
The stratified diamictite comprises alternating diamictite, mudrock, sandstone and conglomerate beds. They are interpreted as being rapidly deposited, sediment gravity flows but with some possible reworking of the subglacial diamictites.
The massive carbonate-rich diamictite facies is clast-poor and was formed by the rainout of debris, with the carbonate probably originating by crystallisation from interstitial waters.

The conglomerate facies ranges from single layer boulder beds to poorly sorted pebble and granule conglomerates. The boulder beds are interpreted as lodgement deposits whereas the poorly sorted conglomerates are a product of water-reworking of diamicton by high-density sediment gravity flows.
The sandstone facies were formed as turbidite deposits.
The mudrock with stones facies represents rainout deposits in the distal iceberg zone.
The **mudrock facies** consists of dark-coloured, commonly carbonaceous mudstone, shale or silty rhythmite that was formed when the mud or silt in suspension settled. This is the only fossiliferous facies of the Dwyka Group.

The Dwyka *Glossopteris* flora outcrops are very sporadic and rare. Of the seven facies that have been recognised in the Dwyka Group fossil plant fragments have only been recognised from the mudrock facies. They have been recorded from around Douglas only (Johnson et al., 2006; Anderson and McLachlan 1976) although the Dwyka Group exposures are very extensive. Jurassic Dolerites do not contain fossils as they are igneous intrusives.

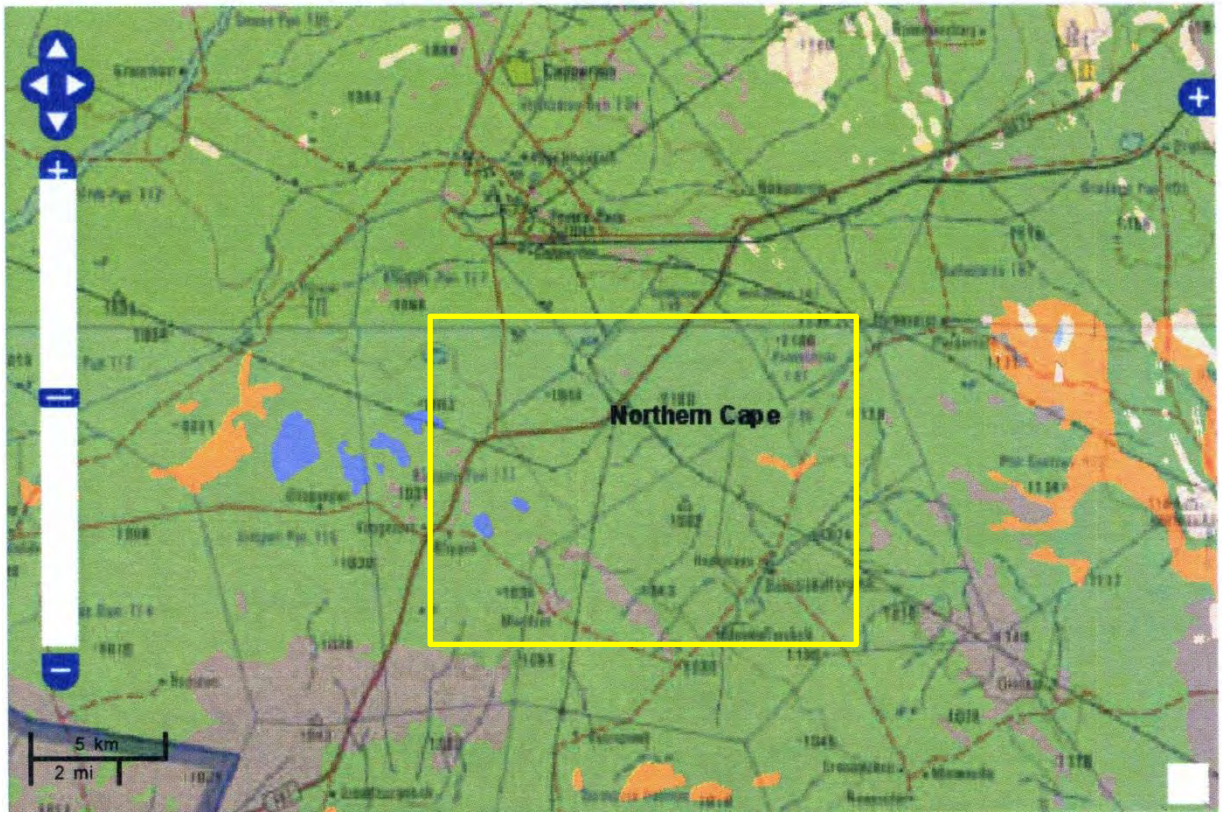


Figure 3: SAHRIS palaeosensitivity maps for the site for the proposed prospecting rightd application, around the Farm Klipgats Pan shown within the yellow rectangle. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

From the SAHRIS map above the area is indicated as moderately sensitive (green; Figure 4) so a desktop assessment is being reported upon here. No fossils have been reported from the Copperton area but these is a very small chance that fossil plant fragments could occur in the prospecting area, but relatively close to the surface because the underlying strata, that are the target of the project, are too old for fossils. Fossils are not likely to be seen on the land surface because of extensive weathering and previous farming or mining activities.

4. Impact assessment

An assessment of the potential impacts to possible palaeontological resources considers the criteria encapsulated in Table :

TABLE 4A: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA		
Criteria for ranking of the SEVERITY/NATURE of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national
PROBABILITY (of exposure to impacts)	**H**	Definite/ Continuous
	M	Possible/ frequent
	L	Unlikely/ seldom

TABLE 4B: IMPACT ASSESSMENT

PART B: ASSESSMENT		
SEVERITY/NATURE	**H**	-
	M	-
	L	Loose sands do not preserve plant fossils; so far there are no records from the Dwyka Group of plant or animal fossils in this region so it is very unlikely that fossils occur on the site. The impact would be very unlikely.
	L+	-
	M+	-
	H+	-
DURATION	**L**	-
	M	-

PART B: ASSESSMENT		
	H	Where manifest, the impact will be permanent.
SPATIAL SCALE	**L**	Since only the possible fossils within the area would be fossil plants from the *Glossopteris* flora in the shales, the spatial scale will be localised within the site boundary.
	M	-
	H	-
PROBABILITY	**H**	**-**
	M	**-**
	L	It is unlikely that any fossils would be found in the loose sand that will be drilled through but there may be plant fragments in the underlying shales or mudstones. There will be no fossils in the rocks that are being targeted for the mining operation as they are too old. Nonetheless a chance find protocol should be added to the eventual EMPr.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. Overlying rocks of the Dwyka Group, namely the mudstones or shales might preserve fossil plants but the target rocks for the project are much too old to contain fossils and igneous in origin. Furthermore, the material to be mined is loose sand and this does not preserve fossils. Since there is an extremely small chance that fossils from the Late Carboniferous Dwyka Group may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is extremely low.

5. Assumptions and uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales and sands are typical for the country and do contain fossil plant, insect, invertebrate and vertebrate material. The sands of the Quaternary period would not preserve fossils.

6. Recommendation

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the loose sands of the Quaternary. There is very small chance that fossil plant fragments may occur in the Dwyka Group shales and mudstones so a Chance Find Protocol should be added to the EMPr: if fossils are found once drilling and prospecting has commenced then they should be rescued and a palaeontologist called to assess and collect a representative sample.

7. References

Anderson, A.M., 1981. The *Umfolozia* arthropod trackways in the Permian Dwyka and Ecca Series of South Africa. Journal of Palaeontology 55, 84-108.

Anderson, A.M., McLachlan, I.R., 1976. The plant record in the Dwyka and Ecca Series (Permian) of the south-western half of the great Karoo Basin, South Africa. Palaeontologia africana 19, 31-42.

Anderson, J.M., Anderson, H.M., 1985. Palaeoflora of Southern Africa: Prodromus of South African megafloras, Devonian to Lower Cretaceous. A.A. Balkema, Rotterdam. 423 pp.

Barbolini, N., Bamford, M.K., Rubidge, B., 2016. Radiometric dating demonstrates that Permian spore-pollen zones of Australia and South Africa are diachronous. Gondwana Research 37, 241-251.

Cornell, D.H., Thomas, R.J., Moen, H.F.G., Reid, D.L., Moore, J.M., Gibson, R.L., 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 325-379.

Johnson, M.R., van Vuuren, C.J., Visser, J.N.J., Cole, D.I., Wickens, H.deV., Christie, A.D.M., Roberts, D.L., Brandl, G., 2006. Sedimentary rocks of the Karoo Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. Pp 461 – 499.

Van der Westhuizen, W.A., de Bruiyn, H., Meintjes, P.G., 2006. The Ventersdorp Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). The Geology of South Africa. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 187-208.

Visser, J.N.J., 1986. Lateral lithofacies relationship sin the glacigene Dwyka Formationin the western and central parts of the Karoo Basin. Transactions of the Geological Society of South Africa 89, 373-383.

Visser, J.N.J., 1989. The Permo-Carboniferous Dwyka Formation of southern Africa: deposition by a predominantly subpolar marine icesheet. Palaeogeography, Palaeoclimatology, Palaeoecology 70, 377-391.

8. Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the drilling and prospecting begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling or excavations commence.
2. When drilling or excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, wood, bone, coal) should be put aside in a suitably protected place. This way the prospecting activities will not be interrupted.
3. Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (for example see Figure 5, 6). This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then the site inspections by the palaeontologist will not be necessary. Annual reports by the palaeontologist must be sent to SAHRA.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Appendix A – Examples of Dwyka fossils

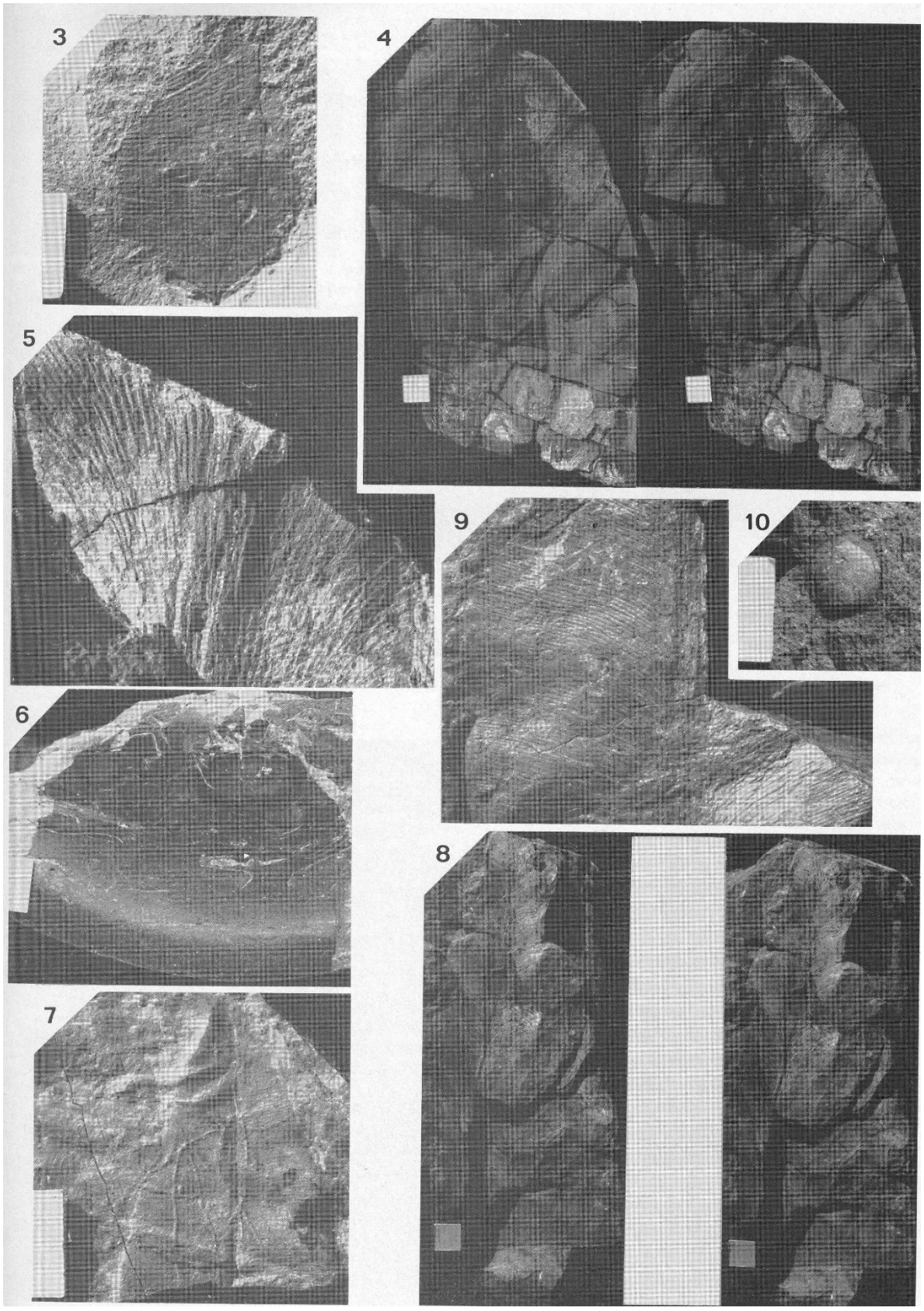


Figure 6: Fossil plants from the Dwyka Group near Douglas (From Anderson and McLachlan, 1976, (figures 3-10)).

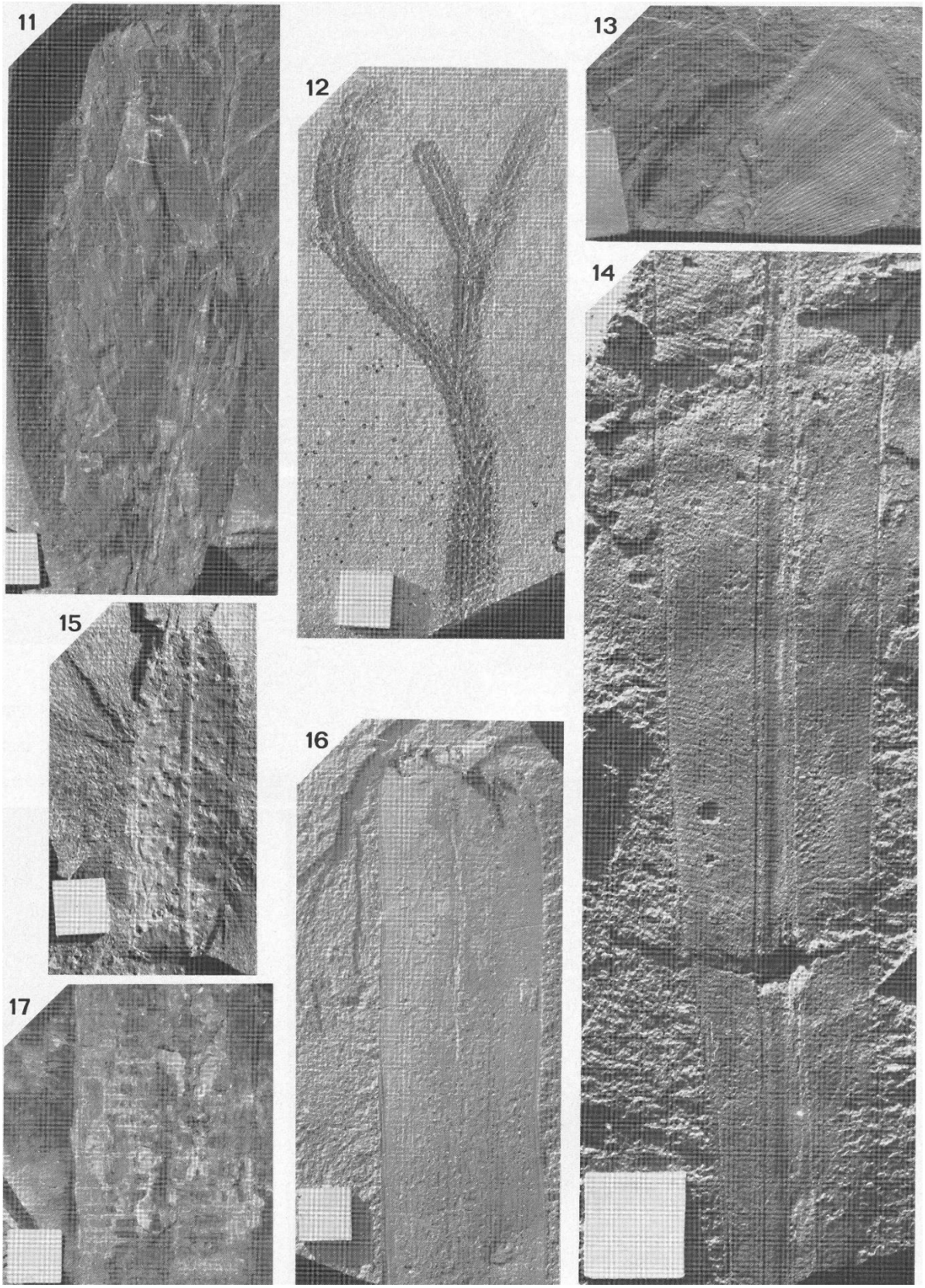


Figure 6: More examples of fossil plants from the Dwyka group near Douglas (from Anderson and McLachlan, 1976, figures 11-17).

Appendix B – Details of specialist

Curriculum vitae (short) - Marion Bamford PhD
October 2018

I) Personal details

Surname	:	**Bamford**
First names	:	**Marion Kathleen**
Present employment	:	Professor; Director of the Evolutionary Studies Institute. Member Management Committee of the NRF/DST Centre of Excellence Palaeosciences, University of the Witwatersrand, Johannesburg, South Africa-
Telephone	:	+27 11 717 6690
Fax	:	+27 11 717 6694
Cell	:	082 555 6937
E-mail	:	marion.bamford@wits.ac.za ; marionbamford12@gmail.com

ii) Academic qualifications

Tertiary Education: All at the University of the Witwatersrand:
1980-1982: BSc, majors in Botany and Microbiology. Graduated April 1983.
1983: BSc Honours, Botany and Palaeobotany. Graduated April 1984.
1984-1986: MSc in Palaeobotany. Graduated with Distinction, November 1986.
1986-1989: PhD in Palaeobotany. Graduated in June 1990.

iii) Professional qualifications

Wood Anatomy Training (overseas as nothing was available in South Africa):
1994 - Service d'Anatomie des Bois, Musée Royal de l'Afrique Centrale, Tervuren, Belgium, by Roger Dechamps
1997 - Université Pierre et Marie Curie, Paris, France, by Dr Jean-Claude Koeniguer
1997 - Université Claude Bernard, Lyon, France by Prof Georges Barale, Dr Jean-Pierre Gros, and Dr Marc Philippe

iv) Membership of professional bodies/associations

Palaeontological Society of Southern Africa – 1984 to present
Royal Society of Southern Africa - Fellow: 2006 onwards
Academy of Sciences of South Africa - Member: Oct 2014 onwards
International Association of Wood Anatomists - First enrolled: January 1991
International Organization of Palaeobotany – 1993+

Botanical Society of South Africa
South African Committee on Stratigraphy – Biostratigraphy - 1997 - 2016
SASQUA (South African Society for Quaternary Research) – 1997+
PAGES - 2008 –onwards: South African representative
ROCEEH / WAVE – 2008+
INQUA – PALCOMM – 2011+onwards

vii) Supervision of Higher Degrees

All at Wits University

Degree	Graduated/completed	Current
Honours	6	1
Masters	8	1
PhD	10	3
Postdoctoral fellows	9	3

viii) Undergraduate teaching
Geology II – Palaeobotany GEOL2008 – average 65 students per year
Biology III – Palaeobotany APES3029 – average 25 students per year
Honours – Evolution of Terrestrial Ecosystems; African Plio-Pleistocene Palaeoecology; Micropalaeontology – average 2-8 students per year.

ix) Editing and reviewing
Editor: Palaeontologia africana: 2003 to 2013; 2014 – Assistant editor
Guest Editor: Quaternary International: 2005 volume
Member of Board of Review: Review of Palaeobotany and Palynology: 2010 –
Cretaceous Research: 2014 -

Review of manuscripts for ISI-listed journals: 25 local and international journals

x) Palaeontological Impact Assessments

Selected – list not complete:

- Thukela Biosphere Conservancy 1996; 2002 for DWAF
- Vioolsdrift 2007 for Xibula Exploration
- Rietfontein 2009 for Zitholele Consulting
- Bloeddrift-Baken 2010 for TransHex
- New Kleinfontein Gold Mine 2012 for Prime Resources (Pty) Ltd.
- Thabazimbi Iron Cave 2012 for Professional Grave Solutions (Pty) Ltd
- Delmas 2013 for Jones and Wagener
- Klipfontein 2013 for Jones and Wagener
- Platinum mine 2013 for Lonmin
- Syferfontein 2014 for Digby Wells
- Canyon Springs 2014 for Prime Resources
- Kimberley Eskom 2014 for Landscape Dynamics

- Yzermyne 2014 for Digby Wells
- Matimba 2015 for Royal HaskoningDV
- Commissiekraal 2015 for SLR
- Harmony PV 2015 for Savannah Environmental
- Glencore-Tweefontein 2015 for Digby Wells
- Umkomazi 2015 for JLB Consulting
- Ixia coal 2016 for Digby Wells
- Lambda Eskom for Digby Wells
- Alexander Scoping for SLR
- Perseus-Kronos-Aries Eskom 2016 for NGT
- Mala Mala 2017 for Henwood
- Modimolle 2017 for Green Vision
- Klipoortjie and Finaalspan 2017 for Delta BEC
- Ledjadja borrow pits 2018 for Digby Wells
- Lungile poultry farm 2018 for CTS
- Olienhout Dam 2018 for JP Celliers
- Isondlo and Kwasobabili 2018 for GCS
- Kanakies Gypsum 2018 for Cabanga
- Nababeep Copper mine 2018
- Glencore-Mbali pipeline 2018 for Digby Wells
-

xi) Research Output

Publications by M K Bamford up to June 2018 peer-reviewed journals or scholarly books: over 120 articles published; 5 submitted/in press; 8 book chapters.
Scopus h index = 26; Google scholar h index = 28;
Conferences: numerous presentations at local and international conferences.

xii) NRF Rating

NRF Rating: B-2 (2016-2020)
NRF Rating: B-3 (2010-2015)
NRF Rating: B-3 (2005-2009)
NRF Rating: C-2 (1999-2004)

info@abs-africa.com

+27 11 805 0061

www.abs-africa.com

ABS Africa

Sustainability Advisors