
APPENDIX D: HERITAGE AND PALAEOLOGICAL ASSESSMENT

HERITAGE SCOPING REPORT

FOR THE PROPOSED ORION NO 5 PROSPECTING APPLICATION (AREA 2) ON
THE FARMS HEDLEY PLAINS, GRASPAN, SMOUSPAN, DOONIES PAN AND
MERRIESPAN., NORTHERN CAPE PROVINCE

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 Scoping 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

Copyright on all documents, drawings and records, whether manually or electronically produced, which form part of the submission and any subsequent report or project document, shall vest in HCAC CC.

The Client, on acceptance of any submission by HCAC CC and on condition that the Client pays to HCAC CC the full price for the work as agreed, shall be entitled to use for its own benefit:

- » The results of the project;
- » The technology described in any report; and
- » Recommendations delivered to the Client.

Should the Client wish to utilise any part of, or the entire report, for a project other than the subject project, permission must be obtained from HCAC CC to do so. This will ensure validation of the suitability and relevance of this report on an alternative project.

EXECUTIVE SUMMARY

Site name and location: The proposed No 5 Prospecting project on the farms Hedley Plains, Graspan, Smouspan, Doonies Pan and Merriespan, located 15km South of Copperton and 60km South-West of Prieska in the Northern Cape Province.

1: 50 000 Topographic Map: 2922 CC & 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 scoping report for a large prospecting right area comprising approximately 3 514 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) and this desktop study is informed by available data for the 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

Indemnity and Conditions Relating to this Report	3
EXECUTIVE SUMMARY	5
ABBREVIATIONS.....	9
GLOSSARY.....	9
1. INTRODUCTION	10
1.1 Terms of Reference.....	14
1.2 Nature of the development	15
1.3. The receiving environment	15
2. APPROACH AND METHODOLOGY	15
2.1 Literature review	15
2.2 Information collection.....	15
2.3 Public consultation.....	16
2.4 Google Earth and mapping survey	16
2.5 Genealogical Society of South Africa	16
2.6. Restrictions	16
3. LEGISLATION	17
3.1 Heritage Site Significance and Mitigation Measures	18
4. REGIONAL OVERVIEW	19
4.1 General Information.....	19
4.1.1. Database search	19
4.1.2. Public consultation.....	19
4.1.3. Google Earth and mapping survey.....	20
4.1.4. Genealogical Society of South Africa	20
5. BACKGROUND INFORMATION AVAILABLE ON THE STUDY AREA	20
5.1. Palaeontology of the study area	20
5.2. Archaeological Overview of the study area.....	21
5.3. Historical Overview.....	21
5.4 Historical maps and documents relating to the area under investigation.....	23
6. PROBABILITY OF OCCURRENCE OF SITES.....	38
7. ASSUMPTIONS AND LIMITATIONS	40
8. FINDINGS	40
8.1. Archaeology and Palaeontology.....	41
8.1.1 <i>Archaeological finds</i>	41
8.1.2 <i>Nature of Impact</i>	41
8.1.3 <i>Extent of impact</i>	41
8.1.4. Paleontological resources	41
8.2. Historical period.....	41
8.2.1 <i>Historical finds:</i>	41
8.2.2 <i>Nature of Impact</i>	41
8.2.3 <i>Extent of impact</i>	41
8.3. Burials and Cemeteries	42
8.3.1 Burials and Cemeteries	42
8.3.2 Nature of Impact.....	42
8.3.3 Extent of impact.....	42
9. POTENTIAL SIGNIFICANCE OF HERITAGE RESOURCES	43
10. CONCLUSIONS AND RECOMMENDATIONS	43
10.1. Chance Find Procedure – Archaeology.....	44
10.2. Monitoring Programme for Palaeontology – to commence once the drilling and prospecting begin.....	45
11. PLAN OF STUDY	46
12. LIST OF PREPARERS	47
13. STATEMENT OF COMPETENCY.....	47

14. STATEMENT OF INDEPENDENCE	47
15. REFERENCES	48

Figures

Figure 1. Regional Locality map of the site under investigation indicated in blue.	11
Figure 2. 1:50 000 Topographical map indicating the prospecting right boundary.	12
Figure 3. Google Earth image of the study area.	13
Figure 4. Known sites in relation to the study area.	19
Figure 5. The approximate study area indicated on the SAHRIS Paleontological map as of moderate significance.	20
Figure 6. 1970 Topographical map of the sites under investigation.	24
Figure 7. 1988 Topographical map of the sites under investigation.	25
Figure 8. 2005 Topographical map of the sites under investigation.	26
Figure 9. 2011 Topographical map of the sites under investigation.	28
Figure 10. 2018 Google Earth image showing the study area in relation to Upington, Prieska, the N10 and other sites. (Google Earth 2018)	29
Figure 11. Heritage Sensitivity map.	40

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 scoping 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, Hedley Plains, Graspan, Smouspan, Doonies Pan and Merriespan. (Figure 1).

The aim of the scoping report is to conduct a desktop study 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 scoping phase of the project. 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 part of the scoping phase but will be conducted as part of the impact assessment phase.

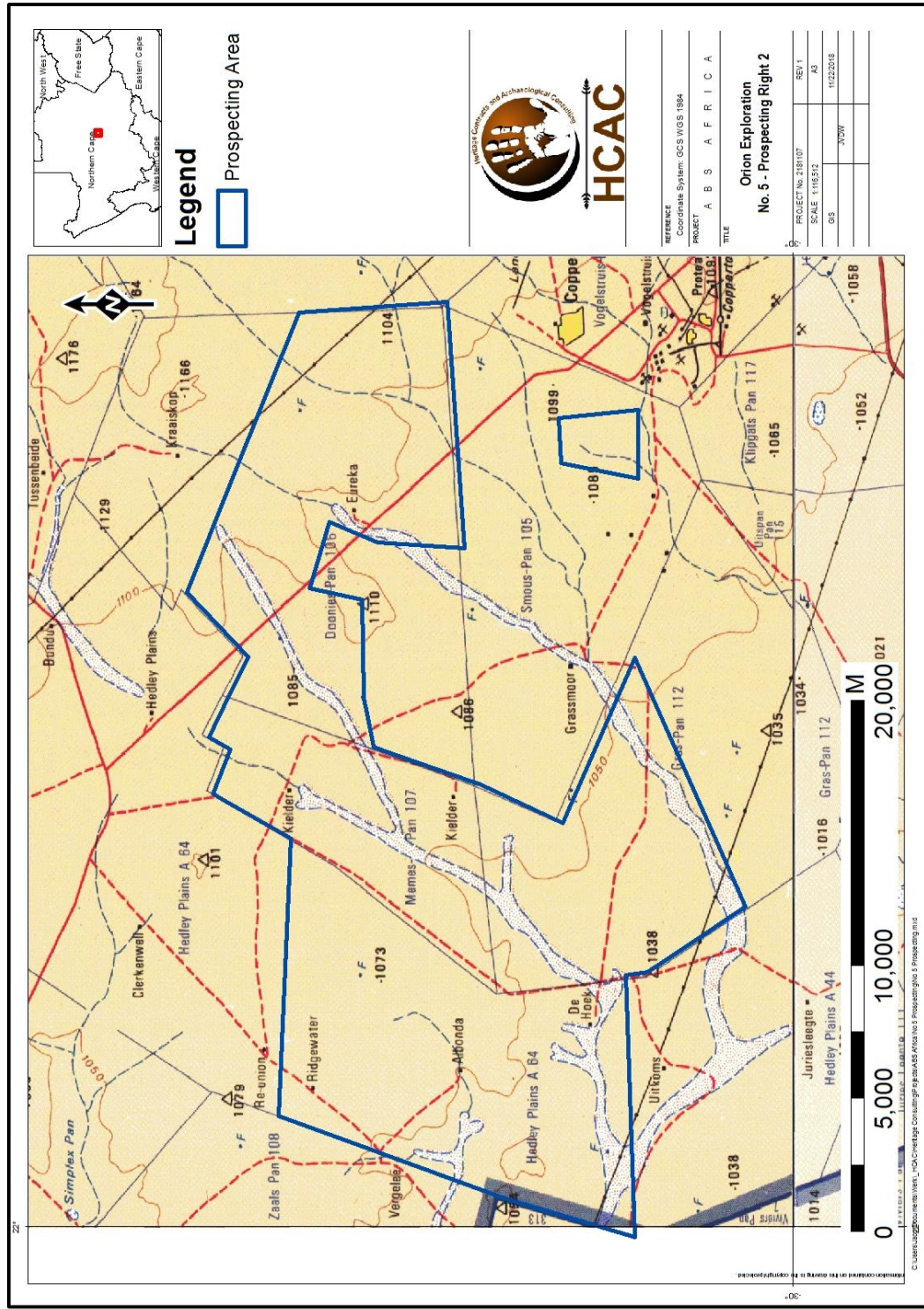


Figure 1. Regional Locality map of the site under investigation indicated in blue.

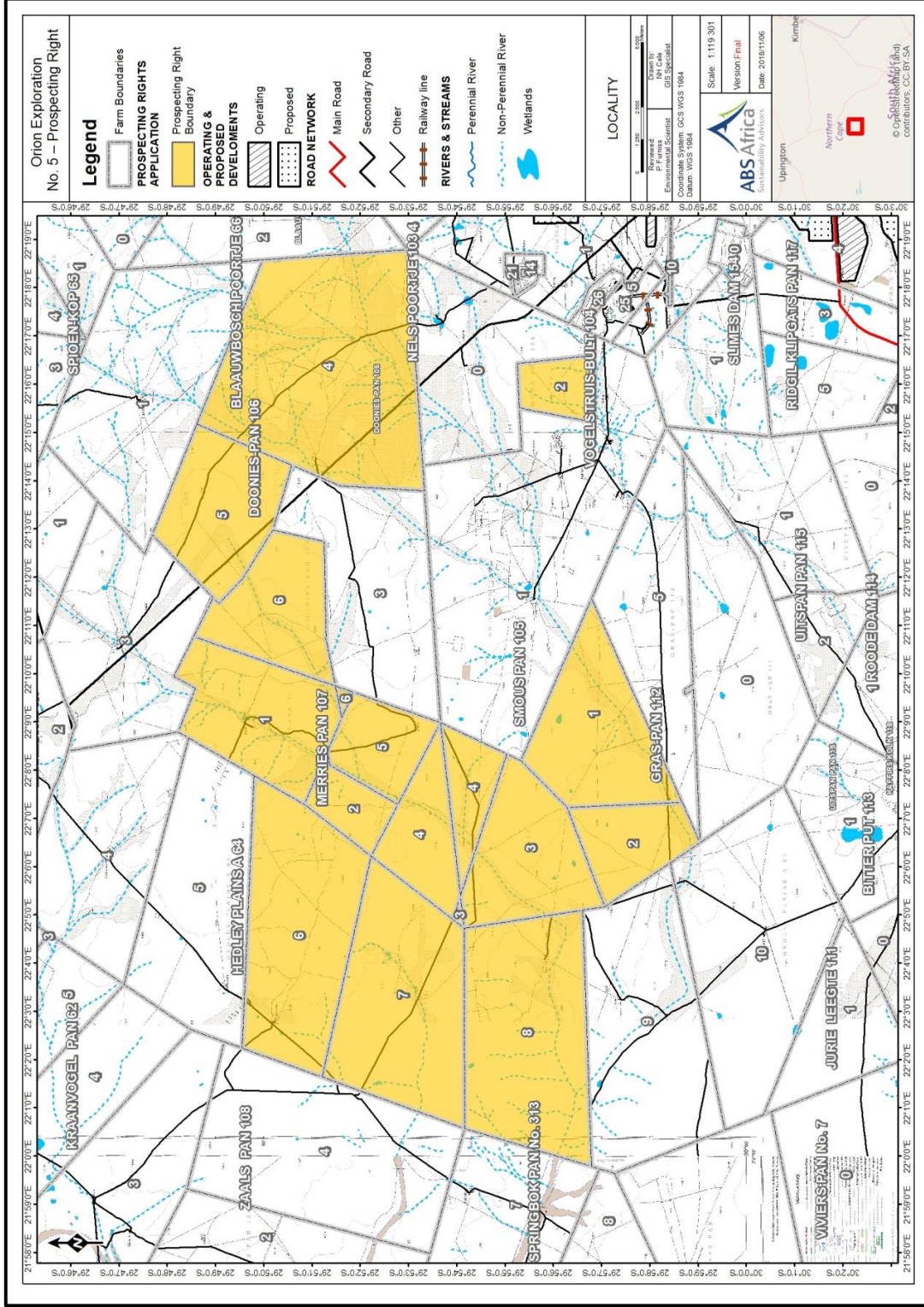


Figure 2. 1:50 000 Topographical map indicating the prospecting right boundary.

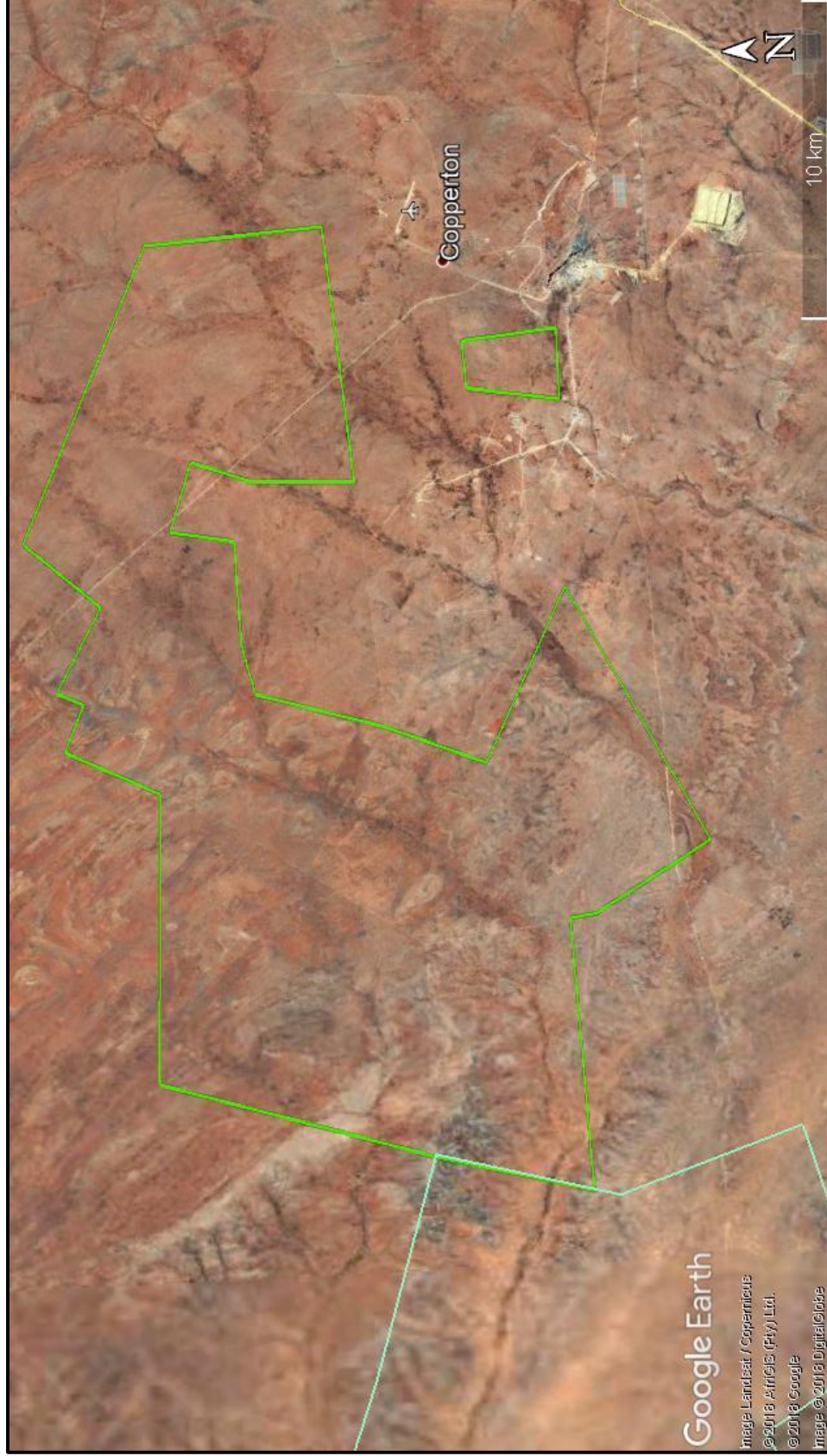


Figure 3. Google Earth image of the study area.

1.1 Terms of Reference

The main aim of this scoping report is to determine if any known heritage resources occur within the project site. The objectives of the scoping 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 Scoping Report in line with the requirements of the EIA Regulations, 2014, as amended on 07 April 2017.

The reporting of the scoping component 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.

During the EIA phase, the following terms 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. Tranches might also be dug to determine geological contacts

1.3. The receiving environment

The proposed prospecting activities are located on the following farms Hedley Plains, Graspan, Smouspan, Doonies Pan and Merriespan, located 15km South of Copperton and 60km South-West of Prieska in the Northern Cape Province. 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 scoping report was conducted as part of the first phase of the prospecting activities (non-invasive activities). The aim of the scoping phase 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 of 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

According to SAHRIS several heritage studies were conducted in the greater study area (Van Ryneveld (2006); Orton (2011 & 2015), Orton & Webley (2013a & b), 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. Although the current area under investigation does not seem to have been covered by heritage surveys the wealth of recorded sites to the south and southwest of the area (Figure 4) indicates that a similar high frequency of sites can be expected in the study area. A Early Stone Age site occurred in the study area but was mitigated and subsequently destroyed.

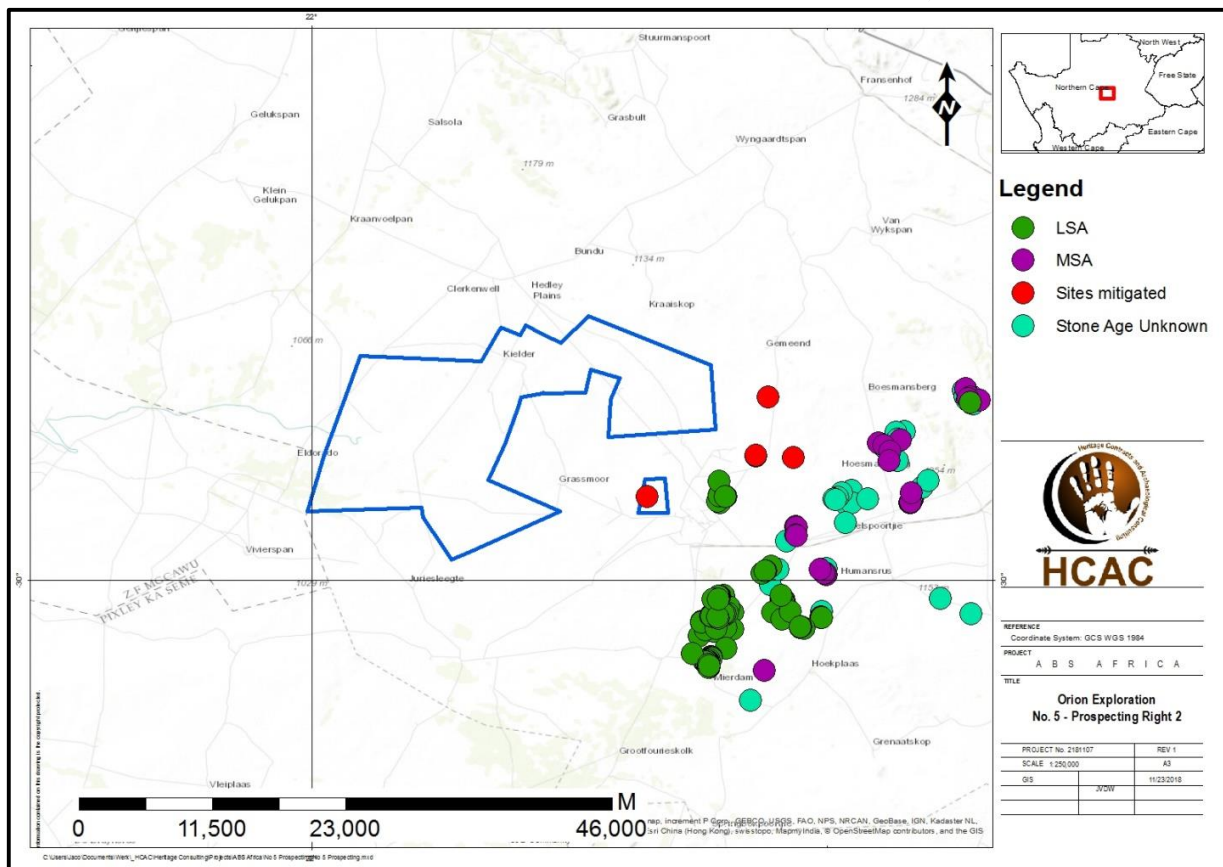


Figure 4. Known sites in relation to the study area.

4.1.2. Public consultation

No public consultation was conducted by the heritage consultant during the scoping phase.

4.1.3. Google Earth and mapping survey

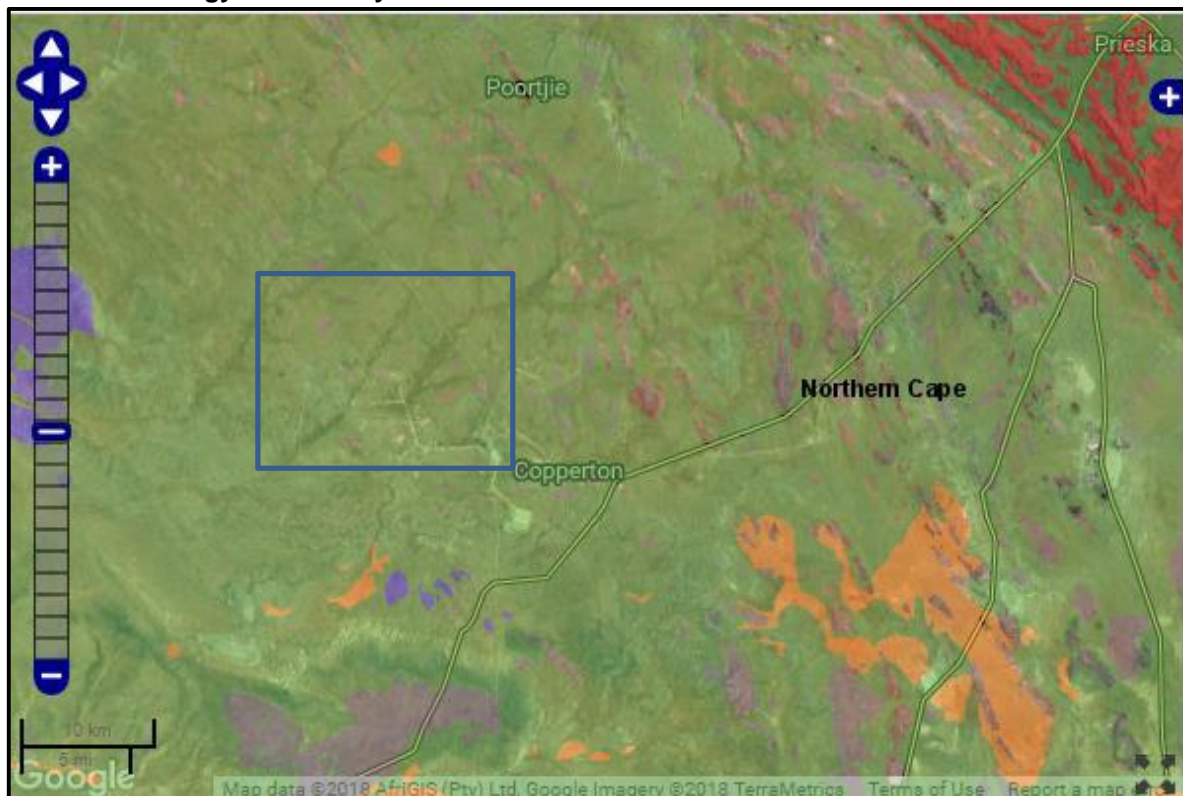
Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological sites might be located.

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 5. 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. Borchers 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’Gariiep. 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 strewn 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 sites under investigation are located just to the west of Copperton, about 10 kilometres to the north west of the R357 and 45 kilometres south west of Prieska in the Northern Cape Province. This study area comprises of the following properties:

- Merriespan 107: Portions 1, 2, 3, 4, 5 & 6
- Gras Pan 112: Portions 1, 2, 3 & 4
- Hedley Plains A 64: Portions 6, 7 & 8
- Smous Pan 105: Portion 2
- Doonies Pan 106: Portions 4, 5 & 6

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.

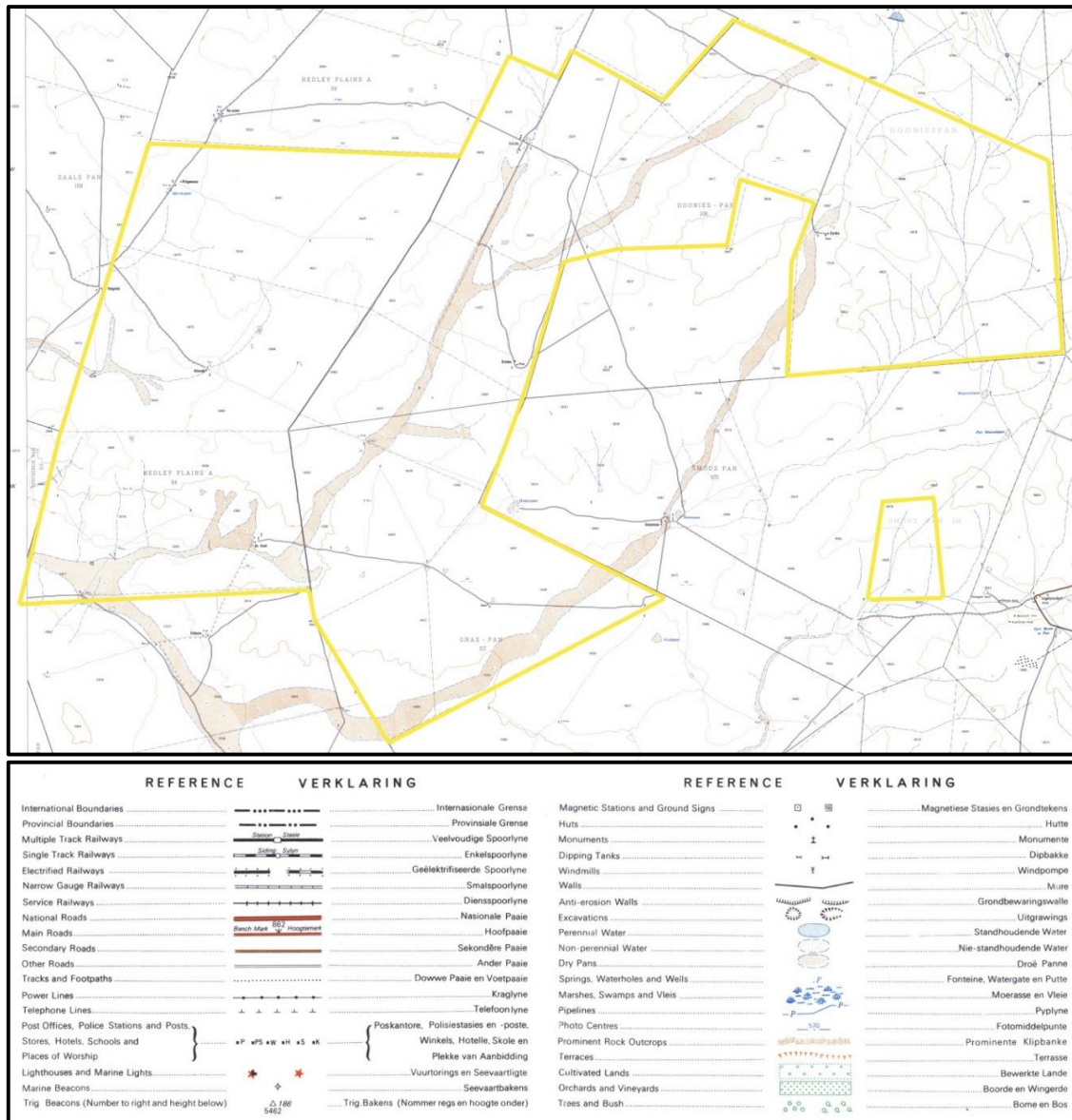


Figure 6. 1970 Topographical map of the sites under investigation.

The approximate study area is indicated with a yellow border. A large dry river / pan went through most of the properties under investigation. Developments on specific parts of the study area will now be discussed. Hedley Plains A 64 (western) portions: A number of minor roads and tracks / footpaths went through the properties; two buildings, a wind mill, a small dry pan and a water reservoir are visible at Ridgewater; two buildings, a wind mill and a water reservoir can be seen at Albonda; four buildings and a wind mill can be seen at De Hoek; a number of individual wind mills, anti-erosion walls and water reservoirs can be seen at various locations. Merries Pan 107 portions: A number of minor roads and tracks / footpaths went through the properties; at Kielder (north) one can see six buildings, a wind mill and a small dry pan; at Kielder (south) one can see two buildings (one of which was a shed) and a wind mill; a number of individual wind mills are also visible in this section. Gras Pan 112 portions: A minor road and a number of tracks / footpaths went through the properties; one can see a kraal, individual buildings, water reservoirs and wind mills spread out over this section. Doonies Pan 106 portions (east): A service railway,

as well as a number of tracks / footpaths went through the properties; at Eureka, two buildings (one of which was a shed) and a wind mill are visible; a number of individual wind mills can be seen at various locations. Smous Pan portion (south east of the larger study area): A track / footpath went through the study area. (Topographical Map 1970; Topographical Map 1970)

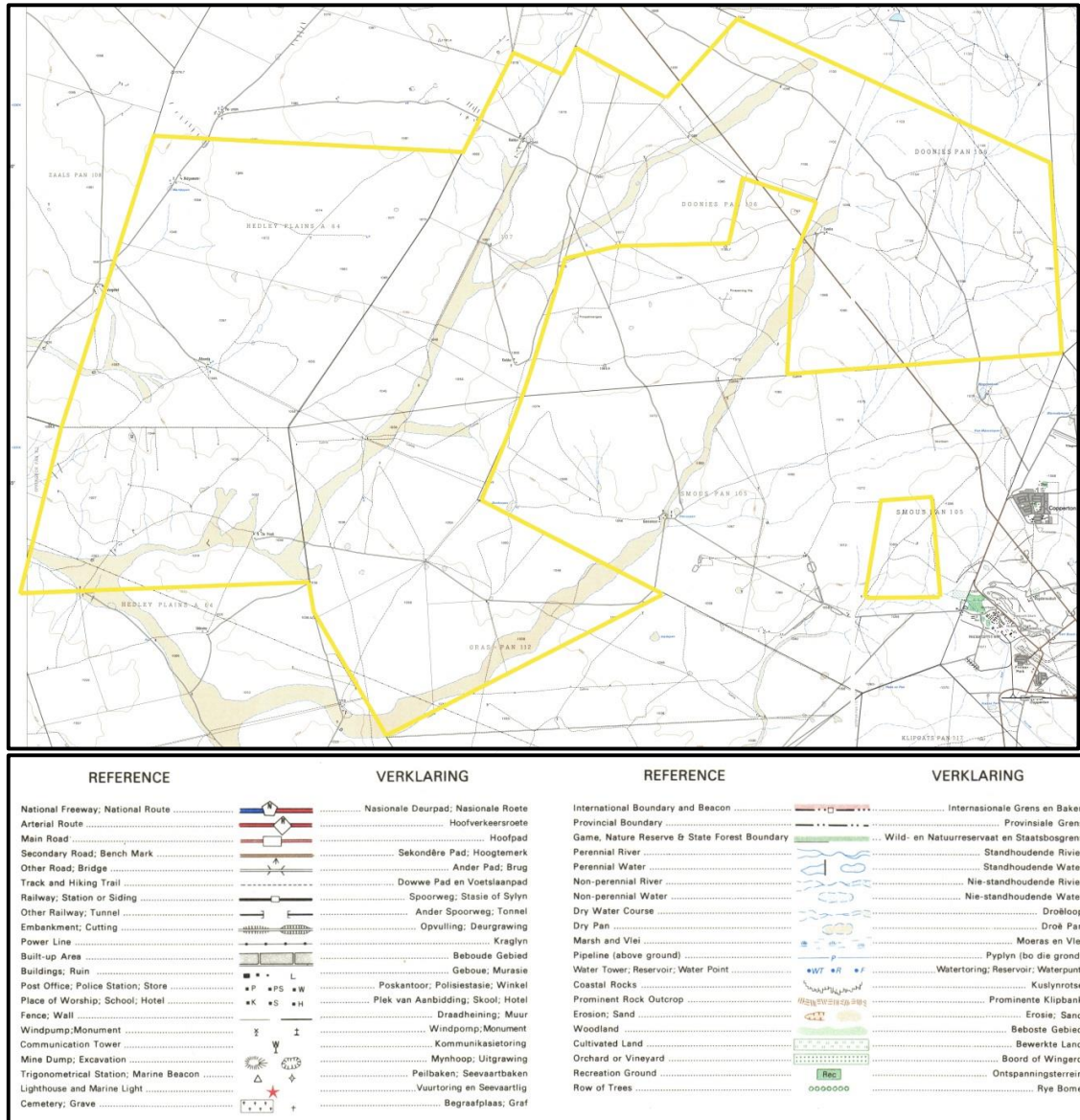


Figure 7. 1988 Topographical map of the sites under investigation.

The approximate study area is indicated with a yellow border. A large dry river / pan went through most of the properties under investigation. Developments on specific parts of the study area will now be discussed. Hedley Plains A 64 (western) portions: A number of minor roads and several tracks / footpaths went through the properties; three buildings, a wind mill, a water reservoir and a small dry dam are visible at Ridgewater; two buildings, a wind mill, a small cultivated land and a water reservoir can be seen at Albonda; five buildings, a small cultivated land and a wind mill can be seen at De Hoek; a number of individual buildings, small dams, wind mills, water reservoirs and anti-erosion walls can be seen at

various locations. Merries Pan 107 portions: A number of minor roads and tracks / footpaths went through the properties; at Kielder (north) one can see ten buildings, a small cultivated land, a wind mill and a small dry dam; at Kielder (south) one can see two buildings and a wind mill; a number of individual wind mills are also visible in this section. Gras Pan 112 portions: A minor road and several tracks / footpaths went through the properties; one can see individual buildings, wind mills and small, dry pans at various places in this section. Doonies Pan 106 portions (east): A secondary road, a power line, as well as a number of minor roads and several tracks / footpaths went through the properties; at Eureka, three buildings and a wind mill are visible, and one can see an excavation further to the south west; a number of individual wind mills can be seen at various locations. Smous Pan portion (south east of the larger study area): A number of tracks / footpaths went through the study area; one wind mill and one diggings site are visible on the property. (Topographical Map 1988; Topographical Map 1988)

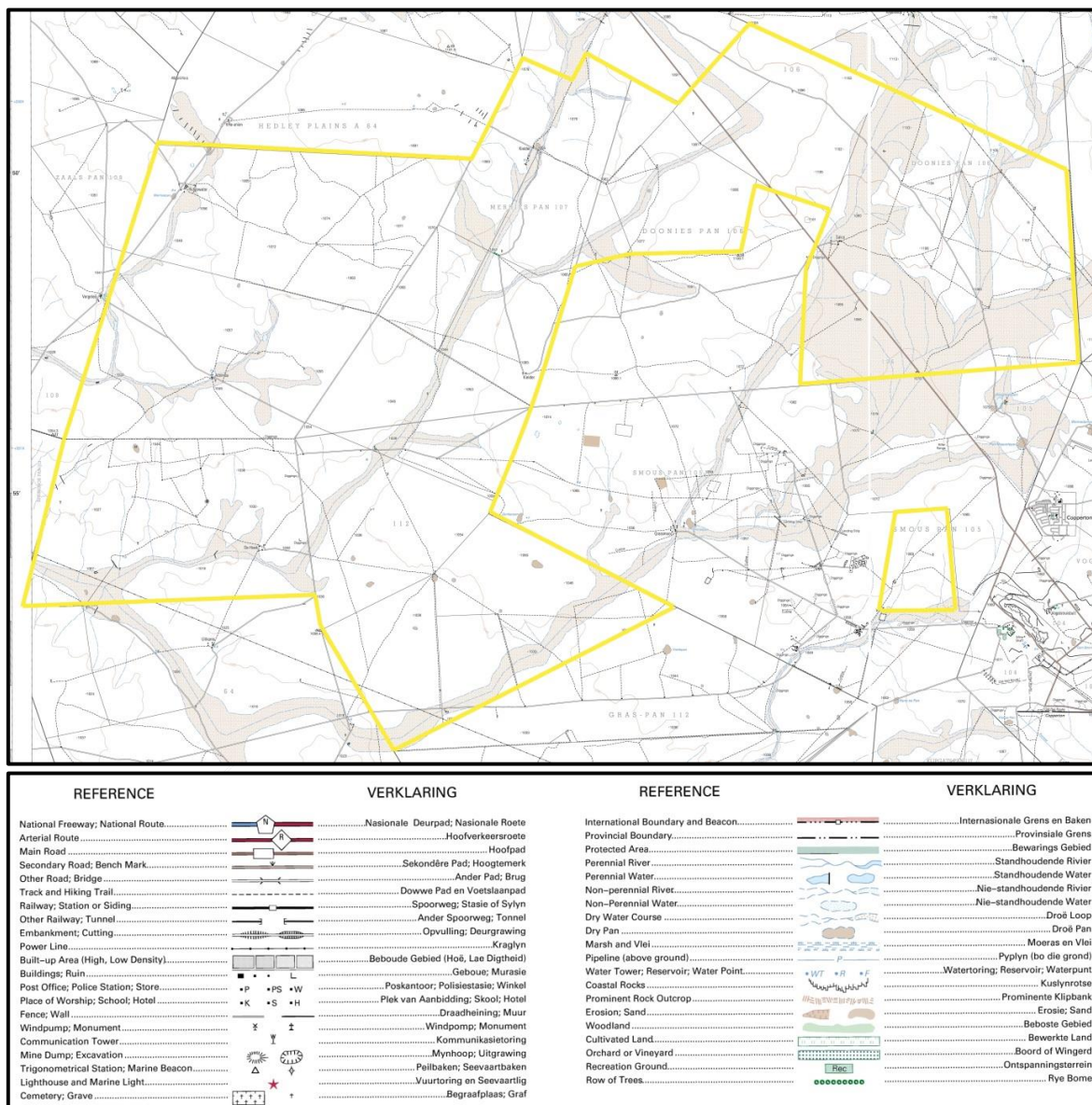


Figure 8. 2005 Topographical map of the sites under investigation.

The approximate study area is indicated with a yellow border. A large dry river / pan went through all of the properties under investigation (especially the eastern part of Doonies Pan 106). Developments on specific parts of the study area will now be discussed. Hedley Plains A 64 (western) portions: A number of minor roads and several tracks / footpaths went through the properties; eight buildings, a wind mill and a water reservoir are visible at Ridgewater; two buildings, a wind mill and a water reservoir can be seen at Albonda; three buildings and a wind mill can be seen at De Hoek; a number of individual buildings, wind mills, small dams, water reservoirs, anti-erosion walls and diggings can be seen at various locations. Merries Pan 107 portions: A number of minor roads and several tracks / footpaths went through the properties; at Kielder (north) one can see six buildings, a wind mill and a water reservoir; at Kielder (south) one can see one building and a wind mill; a number of individual wind mills are also visible in this section. Gras Pan 112 portions: A number of minor roads and several tracks / footpaths went through the properties; one can see individual buildings, water reservoirs, wind mills and areas of erosion at various places in this section. Doonies Pan 106 portions (east): A secondary road, as well as a number of minor roads and several tracks / footpaths went through the properties; at Salco, four buildings, a wind mill, a water reservoir and a diggings site are visible; a number of wind mills and small dams can be seen at various locations. Smous Pan portion (south east of the larger study area): A number of tracks / footpaths went through the area; one wind mill and one diggings site is visible on the property. (Topographical 2005; Topographical Map 2005)

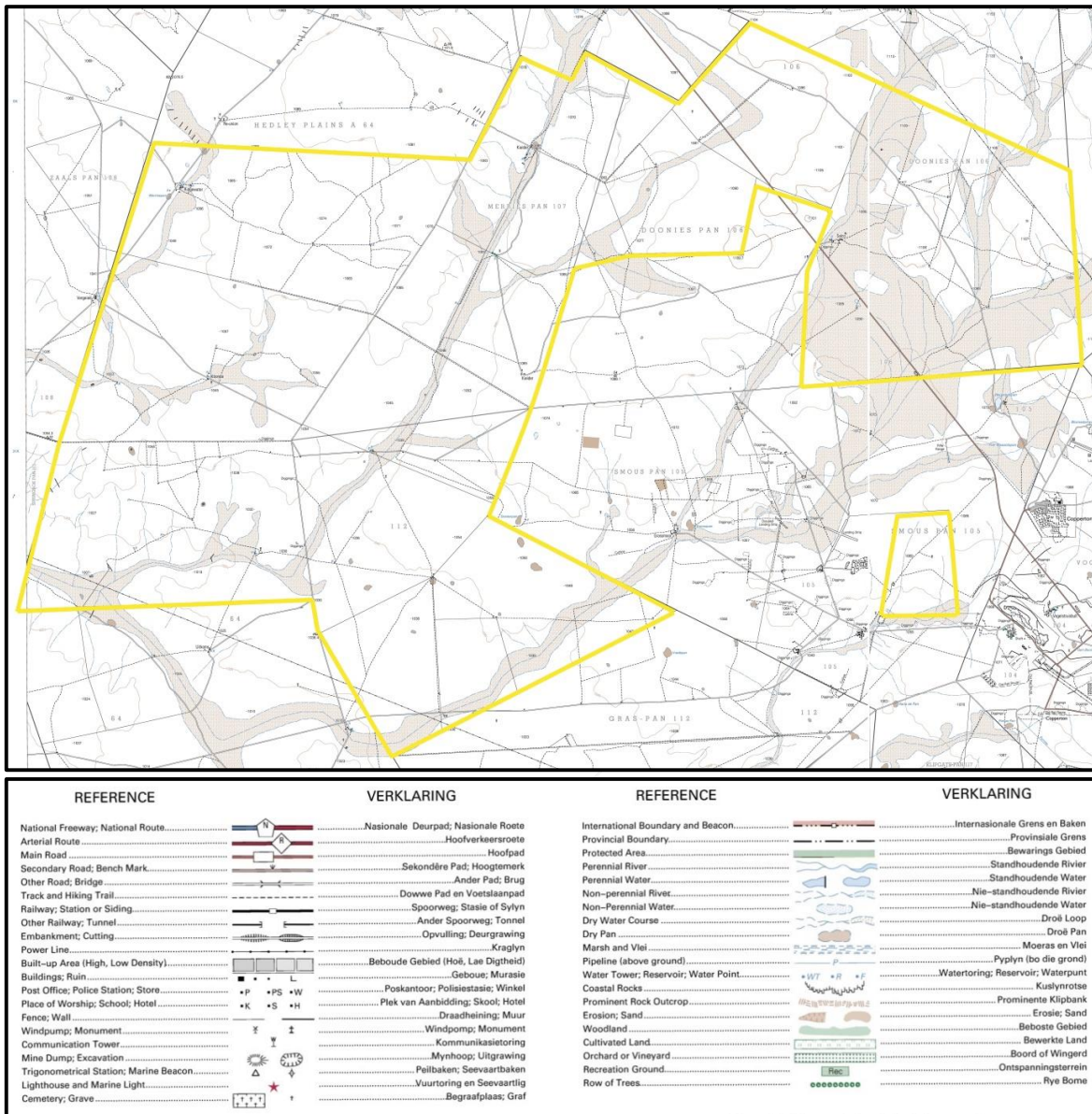


Figure 9. 2011 Topographical map of the sites under investigation.

The approximate study area is indicated with a yellow border. A large dry river / pan went through all of the properties under investigation (especially the eastern part of Doonies Pan 106). Developments on specific parts of the study area will now be discussed. Hedley Plains A 64 (western) portions: A number of minor roads and several tracks / footpaths went through the properties; six buildings, a wind mill and three water reservoirs are visible at Ridgewater; two buildings, a wind mill and two water reservoirs can be seen near Albonda; a number of individual buildings, wind mills, water reservoirs and diggings can be seen at various locations. Merries Pan 107 portions: A number of minor roads and several tracks / footpaths went through the properties; at Kielder (north) one can see seven buildings, a wind mill and two water reservoirs; at Kielder (south) one can see two buildings and a wind mill; a number of individual wind mills and water reservoirs are also visible in this section. Gras Pan 112 portions: A number of minor roads and several tracks / footpaths went through the properties; one can see individual buildings, water

reservoirs, wind mills and a small excavation at various places in this section. Doonies Pan 106 portions (east): A secondary road, as well as a number of minor roads and several tracks / footpaths went through the properties; at Salco, six buildings, a small dam, a wind mill, a water reservoir and a diggings site are visible; a number of individual buildings, wind mills and water reservoirs can be seen at various locations. Smous Pan portion (south east of the larger study area): A number of tracks / footpaths went through the study area; one wind mill and one diggings site are visible on the property. (Topographical 2011; Topographical Map 2011)

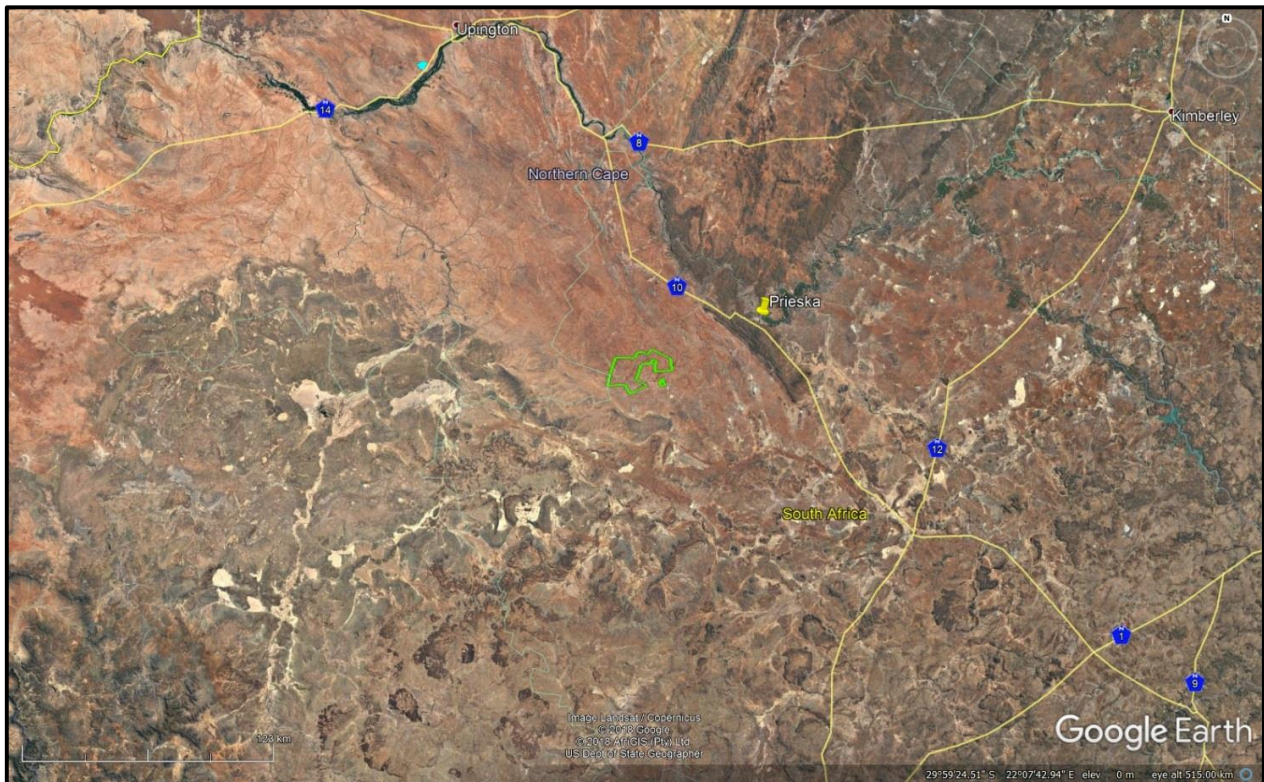


Figure 10. 2018 Google Earth image showing the study area in relation to Upington, Prieska, the N10 and other sites. (Google Earth 2018)

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

Merriespan 107:

No documents found

Gras Pan 112:

DEPOT KAB (Cape Town Archives Repository)
SOURCE LND
TYPE LEER
VOLUME_NO 1/287
SYSTEM 01
REFERENCE L1576
PART 1

DESCRIPTION APPLICATION FOR RELIEF ON FARM "GRAS PAN", HOPE TOWN, BY
MESSRS. VAN VUUREN.
STARTING 1887
ENDING 1887

DEPOT SAB (Pretoria National Archives Repository)
SOURCE MNW
TYPE LEER
VOLUME_NO 169
SYSTEM 01
REFERENCE MM688/13
PART 1

DESCRIPTION DUTCH REFORMED CHURCH. PROSPECTING BY - FOR DIAMONDS ON
GRASPAN WARRENTON DISTRICT. REQUEST BY MINES DEPARTMENT CAPE TOWN FOR
PAPERS DEALING WITH THE ABOVE.
STARTING 1913
ENDING 1913

DEPOT SAB (Pretoria National Archives Repository)
SOURCE MNW
TYPE LEER
VOLUME_NO 169
SYSTEM 01
REFERENCE MM688/13
PART 1

DESCRIPTION DUTCH REFORMED CHURCH. PROSPECTING BY - FOR DIAMONDS ON
GRASPAN WARRENTON DISTRICT. REQUEST BY MINES DEPARTMENT CAPE TOWN FOR
PAPERS DEALING WITH THE ABOVE.
STARTING 1913
ENDING 1913

DEPOT TBK (Cape Town Records Centre)
SOURCE PAS(-/A)
TYPE LEER
VOLUME_NO 2/341
SYSTEM 01
REFERENCE 115/A193
PART 1

DESCRIPTION VRYBURG DIVISIONAL COUNCIL PROPOSED CLOSING OF PUBLIC ROAD
COMMENCING ON FARM MIMMIESFONTEIN TO FARMS MONJANA AND MABEDI
ADJOINING FARMS SPITSKOP, MIDDELKOP, GRAS PAN TO VAALBOSCHVLAKTE.
STARTING 1948
ENDING 1948

DEPOT SAB (Pretoria National Archives Repository)
SOURCE URU
TYPE LEER
VOLUME_NO 2986
SYSTEM 01
REFERENCE 1510
PART 1
DESCRIPTION ISSUE OF CROWN GRANT IN RESPECT OF GOEDVERWACHT, PTN OF GRAS
PAN, DIV VRYBURG, CAPE PROVINCE.
STARTING 1952
ENDING 1952

Hedley Plains A 64:

DEPOT KAB (Cape Town Archives Repository)
SOURCE ACLT
TYPE LEER
VOLUME_NO 796
SYSTEM 01
REFERENCE 21664/3
PART 1
DESCRIPTION CARNARVON. TEMPORARY LEASE OF REMAINDER OF NIEUWEDAM,
VLEIPLAAS ANNEX, PORTION OF VIVIERSPAN, NOW HUGUENOT, HEDLEY PLAINS.
STARTING 19320000
ENDING 19480000

DEPOT SAB
SOURCE LDE
TYPE LEER
VOLUME_NO 3483
SYSTEM 01
REFERENCE 1882/652
PART 1
DESCRIPTION PRIESKA KENHARDT AND CARNARVON HEDLEY PLAINS SETTLEMENT
FENCING FILE FENCE BETWEEN YSTERDOORNKOLK AND VADERLANDS PAN.
STARTING 1942
ENDING 1944
REMARKS 7743/696 - PURCHASE FILE 21664 - GENERAL FILE 1882/652/1 - FENCE BETWEEN
SETTLERS AND BOVENEND KEEL-AF-SNY LEEGTE YSTERDOORNKOLK
1882/652/2 - FENCE BETWEEN DROOGEPANPUTS AND POORTJE.

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE

TYPE LEER
VOLUME_NO 3485
SYSTEM 01
REFERENCE 1882/676
PART 1
DESCRIPTION KENHART BOUNDARY FENCE BETWEEN PRIVATE FARM WITKOPJIS CROWN
LAND - KLAARPRAAT (HEDLEY PLAINS) MRS. JM VISSER.
STARTING 1944
ENDING 1948

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4851
SYSTEM 01
REFERENCE S22570/1
PART 1
DESCRIPTION PRIESKA. GEDEELTE 10 VAN DIE PLAAS HEDLEY PLAINS "A". CFJ SNYMAN.
STARTING 1946
ENDING 1950
REMARKS 22570 APPLIKASIE LEER.

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4849
SYSTEM 01
REFERENCE 225671/1
PART 1
DESCRIPTION PRIESKA. GEDEELTE 7 VAN DIE PLAAS HEDLEY PLAINS A JJ JACOBS SESSIE
AAN JJ JACOBS.
STARTING 1946
ENDING 1952
REMARKS APPLIKASIE LEER 22567.

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4850
SYSTEM 01
REFERENCE 22569/1
PART 1
DESCRIPTION PRIESKA. GEDEELTE 9 VAN DIE PLAAS HEDLEY PLAINS "A". AGJ VAN DER
MERWE.
STARTING 1946

ENDING 1954
REMARKS 22569 - APPLIKASIE LEER.

DEPOT SAB
SOURCE LDE
TYPE LEER
VOLUME_NO 4848
SYSTEM 01
REFERENCE 22564/1
PART 1
DESCRIPTION PRIESKA GEDEELTE 4 VAN HEDLEY PLAINS A JZ MOOLMAN (BUS 23 MARYDALE).
STARTING 1946
ENDING 1959
REMARKS APPLIKASIE OMSLAG 22564.

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4847
SYSTEM 01
REFERENCE S22562/1
PART 1
DESCRIPTION PRIESKA (GRONDBRIEF 108/58) GEDEELTE 1 VAN DIE PLAAS HEDLEY PLAINS A CJ CONRADIE.
STARTING 1946
ENDING 1962
REMARKS 22562: APPLIKASIE LEER.

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4851
SYSTEM 01
REFERENCE S22571/1
PART 1
DESCRIPTION PRIESKA. GEDEELTE 3 VAN DIE PLAAS HEDLEY PLAINS A. JCK LE ROUX.
STARTING 1946
ENDING 1962
REMARKS 25571 APPLIKASIE LEER.

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER

VOLUME_NO 4848
SYSTEM 01
REFERENCE S22563/1
PART 1
DESCRIPTION PRIESKA. (GRONDBRIEF 27/1963) GEDEELTE 2 VAN DIE PLAAS HEDLEY
PLAINS A. JT VAN DER WESTHUIZEN.
STARTING 1946
ENDING 1963
REMARKS 22563 APPLIKASIE-LEER.

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4849
SYSTEM 01
REFERENCE S22565/1
PART 1
DESCRIPTION AFDELING PRIESKA (GRONDBRIEF 12/1965) GEDEELTE 5 VAN DIE PLAAS
HEDLEY PLAINS A. MC VAN NIEKERK.
STARTING 1946
ENDING 1965
REMARKS AANSOEK LEER 22565.

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4850
SYSTEM 01
REFERENCE S221568/1
PART 1
DESCRIPTION PRIESKA. GRONDBRIEF 107/58 GEDEELTE 8 VAN DIE PLAAS HEDLEY PLAINS
A. LJ VAN HEERDEN.
STARTING 1947
ENDING 1958
REMARKS APPLIKASIE LEER 22568.

DEPOT SAB
SOURCE LDE
TYPE LEER
VOLUME_NO 4851
SYSTEM 01
REFERENCE S22570/1
PART 2
DESCRIPTION PRIESKA. GEDEELTE 10 VAN DIE PLAAS HEDLEY PLAINS "A". MEVROU MM
SNYMAN.
STARTING 1950

ENDING 1962

REMARKS 22570 - AANSOEK LEER GFJ SNYMAN.

DEPOT SAB (Pretoria National Archives Repository)

SOURCE LDE

TYPE LEER

VOLUME_NO 4849

SYSTEM 01

REFERENCE 22567/1

PART 2

DESCRIPTION PRIESKA. GRONDBRIEF 191/57 GEDEELTE 7 VAN DIE PLAAS HEDLEY PLAINS
A. JJ JACOBS.

STARTING 1952

ENDING 1957

REMARKS AV HUGO 22567 - AANSOEK LEER.

DEPOT SAB (Pretoria National Archives Repository)

SOURCE LDE

TYPE LEER

VOLUME_NO 4850

SYSTEM 01

REFERENCE 22569/1

PART 2

DESCRIPTION PRIESKA. GRONDBRIEF 106/58 GEDEELTE 9 VAN DIE PLAAS HEDLEY PLAINS
A. AGJ VAN DER MERWE.

STARTING 1954

ENDING 1958

REMARKS 22569 - AANSOEK LEER.

DEPOT SAB (Pretoria National Archives Repository)

SOURCE LDE

TYPE LEER

VOLUME_NO 4848

SYSTEM 01

REFERENCE 22564/1

PART 2

DESCRIPTION PRIESKA GRONDBRIEF 116/59 GEDEELTE 4 VAN HEDLEY PLAINS A. JZ
MOOLMAN.

STARTING 1955

ENDING 1959

DEPOT SAB (Pretoria National Archives Repository)

SOURCE URU

TYPE LEER

VOLUME_NO 3694
SYSTEM 01
REFERENCE 1702
PART 1
DESCRIPTION UITREIKING VAN GRONDBRIEF TEN AANSIEN VAN GED 7 VAN HEDLEY PLAINS
A, AFD PRIESKA, KAAP.
STARTING 1957
ENDING 1957

DEPOT SAB (Pretoria National Archives Repository)
SOURCE URU
TYPE LEER
VOLUME_NO 3711
SYSTEM 01
REFERENCE 2172
PART 1
DESCRIPTION UITREIKING VAN GRONDBRIEF TEN AANSIEN VAN GED 8 VAN HEDLEY
PLAINS, A, AFD PRIESKA, KAAP.
STARTING 1957
ENDING 1957

DEPOT SAB (Pretoria National Archives Repository)
SOURCE URU
TYPE LEER
VOLUME_NO 3711
SYSTEM 01
REFERENCE 2173
PART 1
DESCRIPTION UITREIKING VAN GRONDBRIEF TEN AANSIEN VAN GED 9 VAN HEDLEY PLAINS
A, AFD PRIESKA, KAAP.
STARTING 1957
ENDING 1957

DEPOT SAB (Pretoria National Archives Repository)
SOURCE URU
TYPE LEER
VOLUME_NO 3748
SYSTEM 01
REFERENCE 2864
PART 1
DESCRIPTION UITREIKING VAN GRONDBRIEF TEN AANSIEN VAN GED 10 VAN HEDLEY
PLAINS A, AFD PRIESKA KAAP.
STARTING 1957
ENDING 1957

DEPOT SAB (Pretoria National Archives Repository)
SOURCE URU
TYPE LEER
VOLUME_NO 3758
SYSTEM 01
REFERENCE 200
PART 1
DESCRIPTION UITREIKING VAN GRONDBRIEF TEN AANSIEN VAN GED 1 VAN HEDLEY
PLAINS, A, AFD PRIESKA, KAAP.
STARTING 1958
ENDING 1958

DEPOT SAB (Pretoria National Archives Repository)
SOURCE URU
TYPE LEER
VOLUME_NO 3818
SYSTEM 01
REFERENCE 1644
PART 1
DESCRIPTION UITREIKING VAN GRONDBRIEF TEN AANSIEN VAN GED 4 VAN HEDLEY PLAINS
A, AFD PRIESKA, KAAPPROVINSIE.
STARTING 1958
ENDING 1958

DEPOT SAB (Pretoria National Archives Repository)
SOURCE LDE
TYPE LEER
VOLUME_NO 4852
SYSTEM 01
REFERENCE S22571/1
PART 2
DESCRIPTION PRIESKA. GEDEELTE 3 VAN DIE PLAAS HEDLEY PLAINS A. JCK LE ROUX.
STARTING 1963
ENDING 1965
REMARKS 22571 APPLIKASIE LEER.

Smous Pan 105:

No documents found

Doonies Pan 106:

DEPOT KAB (Cape Town Archives Repository)
SOURCE JUS
TYPE LEER
VOLUME_NO 148
SYSTEM 01
REFERENCE 26093/11
PART 1
DESCRIPTION PETITION FOR THE ESTABLISHMENT OF AN OUT-STATION AT DOONIESPAN
BY THE PRIESKA DISTRICT MOUNTED POLICE.
STARTING 1911
ENDING 1911

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.*

Archaeological 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 during the impact assessment phase 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 the area 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. Sites and artefacts dating to these periods are scattered over the landscape with MSA and LSA sites centred on pans and watercourses. Due to the importance of water sources on the landscape that attracted human activity in antiquity, this was used as the main criteria for generating a four tier sensitivity map of the study area (Figure 11).

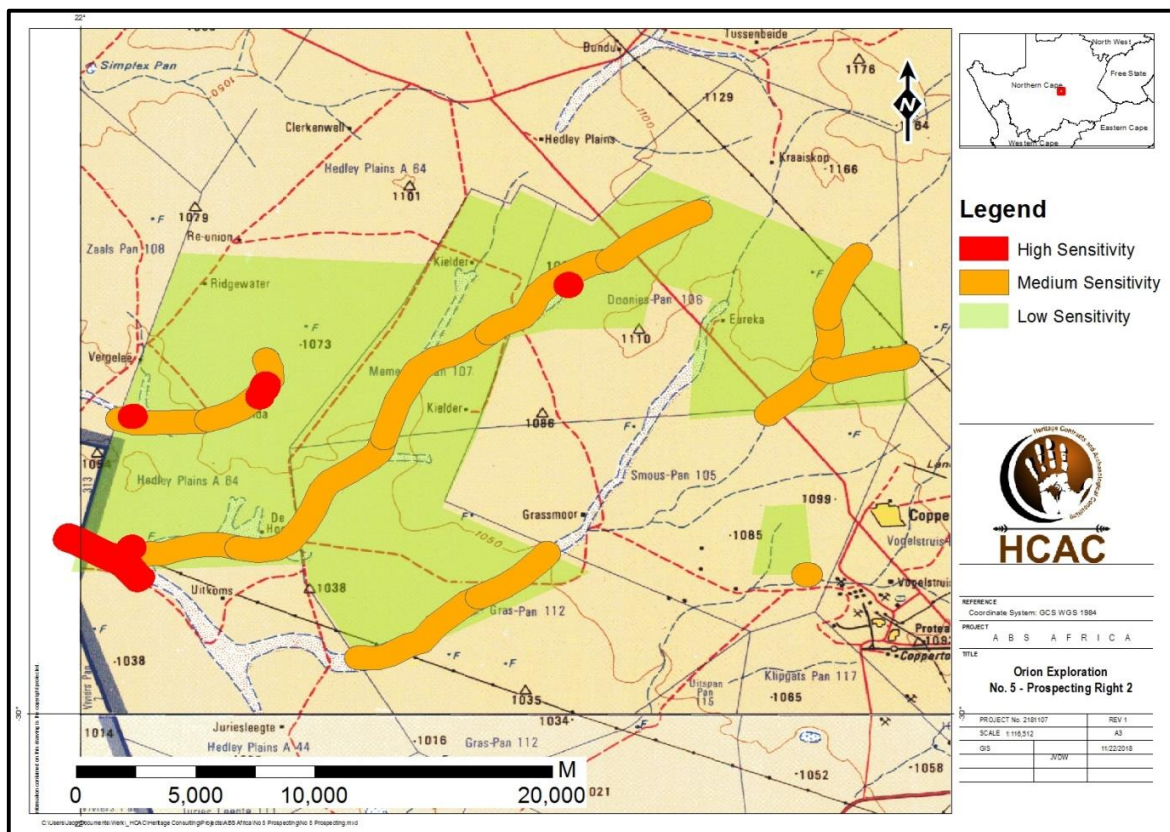


Figure 11. Heritage Sensitivity map.

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 EMP. 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 scoping report for a large prospecting right area comprising approximately 15973 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 larger study 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 highlighting the archaeological importance of watercourses and pans. Based on these studies the following heritage 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. Surface exposures are likely to be very weathered. Therefore, a Fossil Chance Find Protocol should be added to the EMP. 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).

» 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 however 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 EMP:

- 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 therefore 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 Merries Pan near Copperton, Northern Cape 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 Merries 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 Merries Pan, southwest of Copperton, Prieska area, adjacent to 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

Expertise of Specialist.....	1
Declaration of Independence.....	1
1. Background.....	4
2. Methods and Terms of Reference	6
i. Project location and geological context.....	7
ii. Palaeontological context	8
4. Impact assessment.....	10
5. Assumptions and uncertainties	11
6. Recommendation.....	11
7. References.....	12
8. Chance Find Protocol	13
Appendix A (examples of fossils	14
Appendix B (short CV of specialist)	16

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: Merries Pan cluster of farms for the EA

Farm Name	Farm No	Subdivision No
Merries Pan	107	1, 3, 4, 5, 6
Gras Pan	112	1, 2, 3, 4
Hedley Plains A	64	6, 7, 8
Smous Pan	105	2
Doonies Pan	106	4, 5, 6

A Palaeontological Impact Assessment was requested for the Merries 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

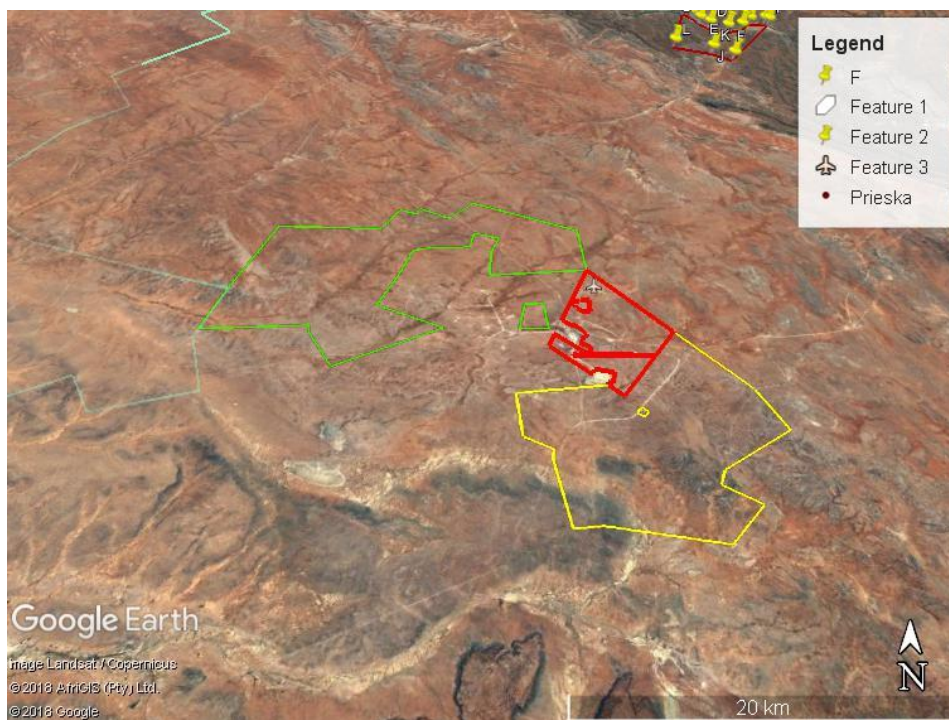


Figure 1: Google Earth map of the proposed area for the Merries Pan Prospecting Rights Application shown in the green outline. Map supplied by Heritage Consultants.

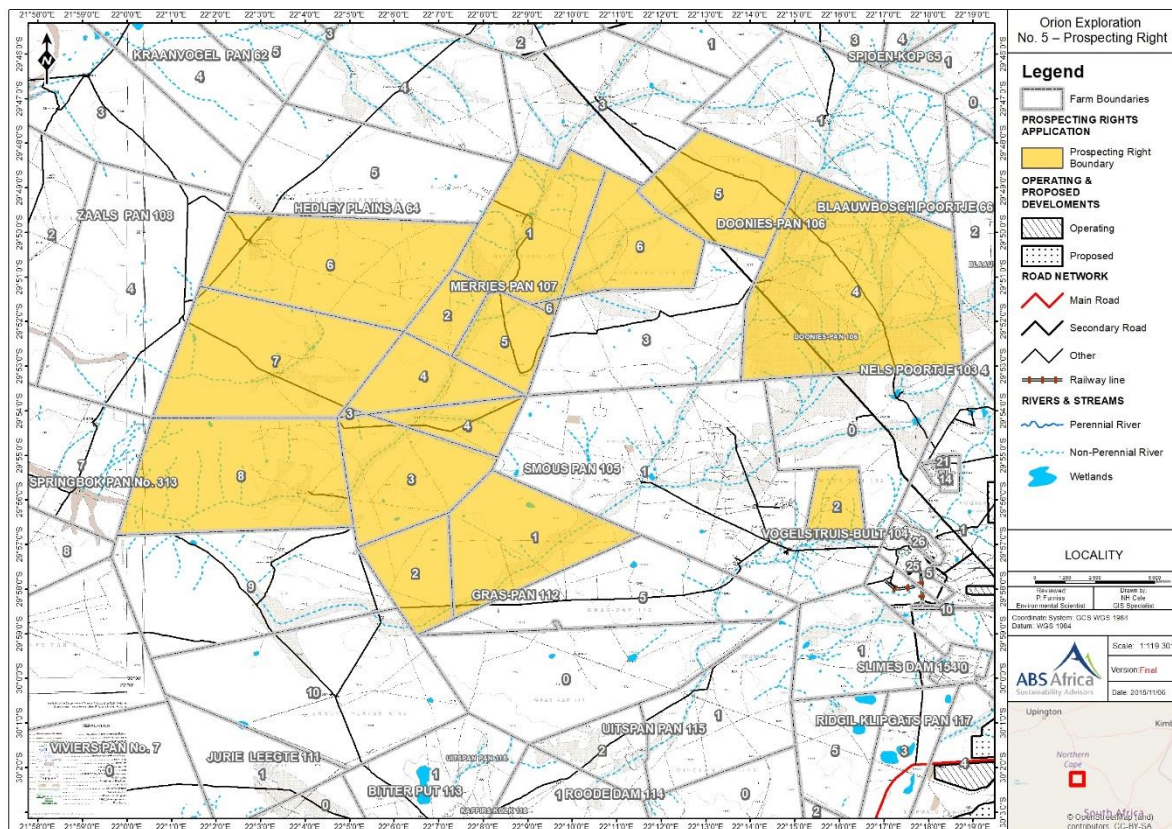


Figure 2: Site map for the Merries Pan prospecting rights area shown in yellow.

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.

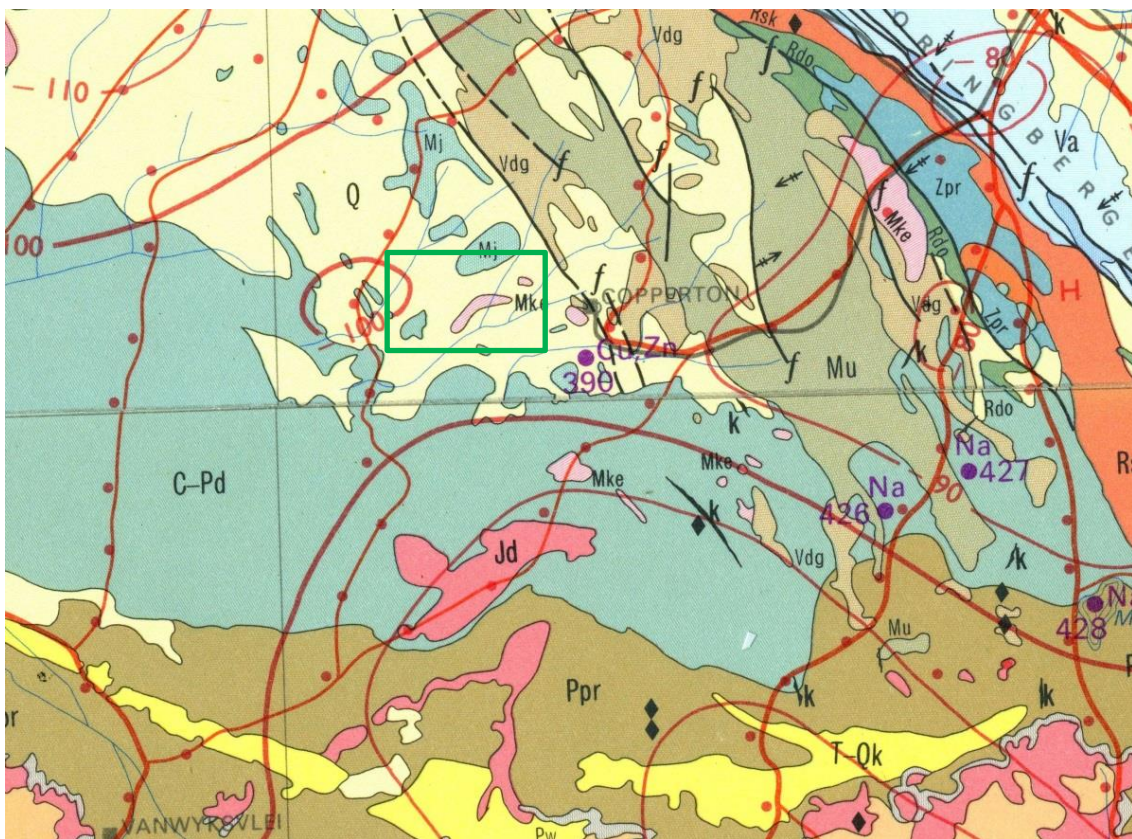


Figure 3: Geological map of the area around Copperton with the proposed site for the Klipgats Pan prospecting shown within the yellow rectangle. Abbreviations of the rock types are explained in Table 3. Map enlarged from the Geological Survey 1: 1 000 000 map 1984.

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.

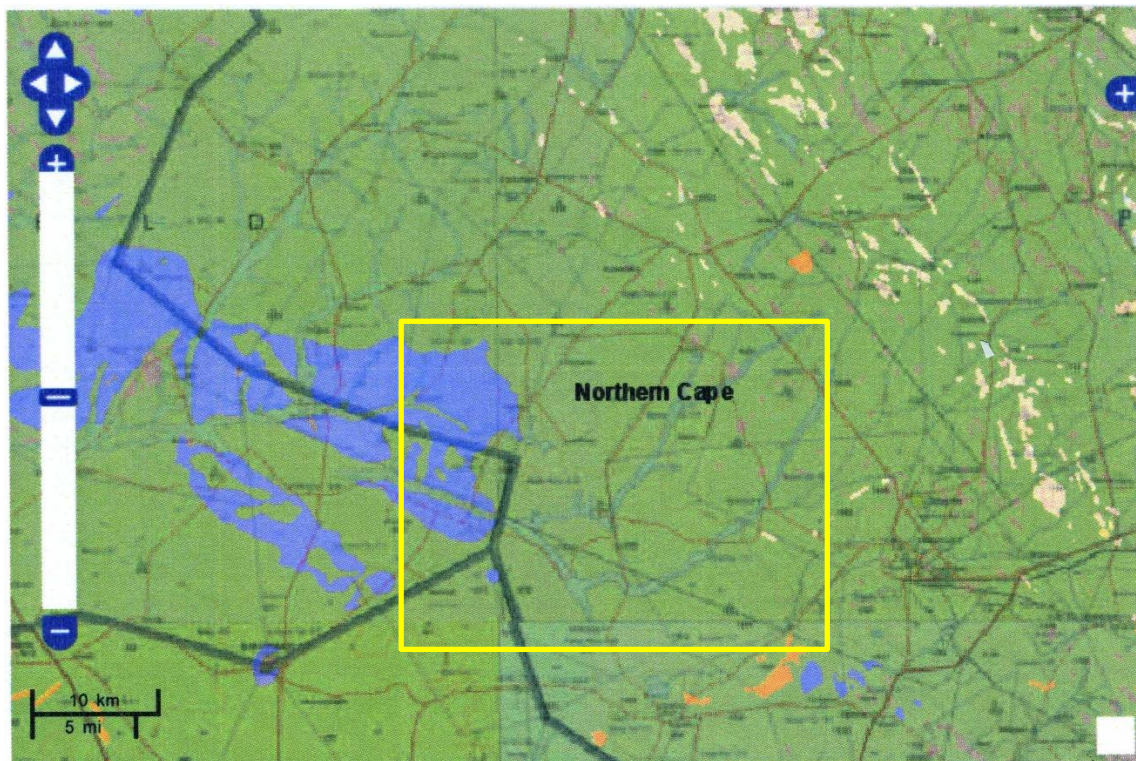


Figure 3: SAHRIS palaeosensitivity maps for the site for the proposed prospecting rights application, around the Farm Meries Pan shown within the yellow rectangle. Colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = 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 there 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	-
	H	Where manifest, the impact will be permanent.

PART B: ASSESSMENT		
SPATIAL SCALE	L	Since only the possible fossils within the area would be fossil plants from the <i>Glossopteris</i> 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: Prodrum of South African megaflores, 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 Bruijn, 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 in the glaciogenic Dwyka Formation in 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 ice sheet. *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

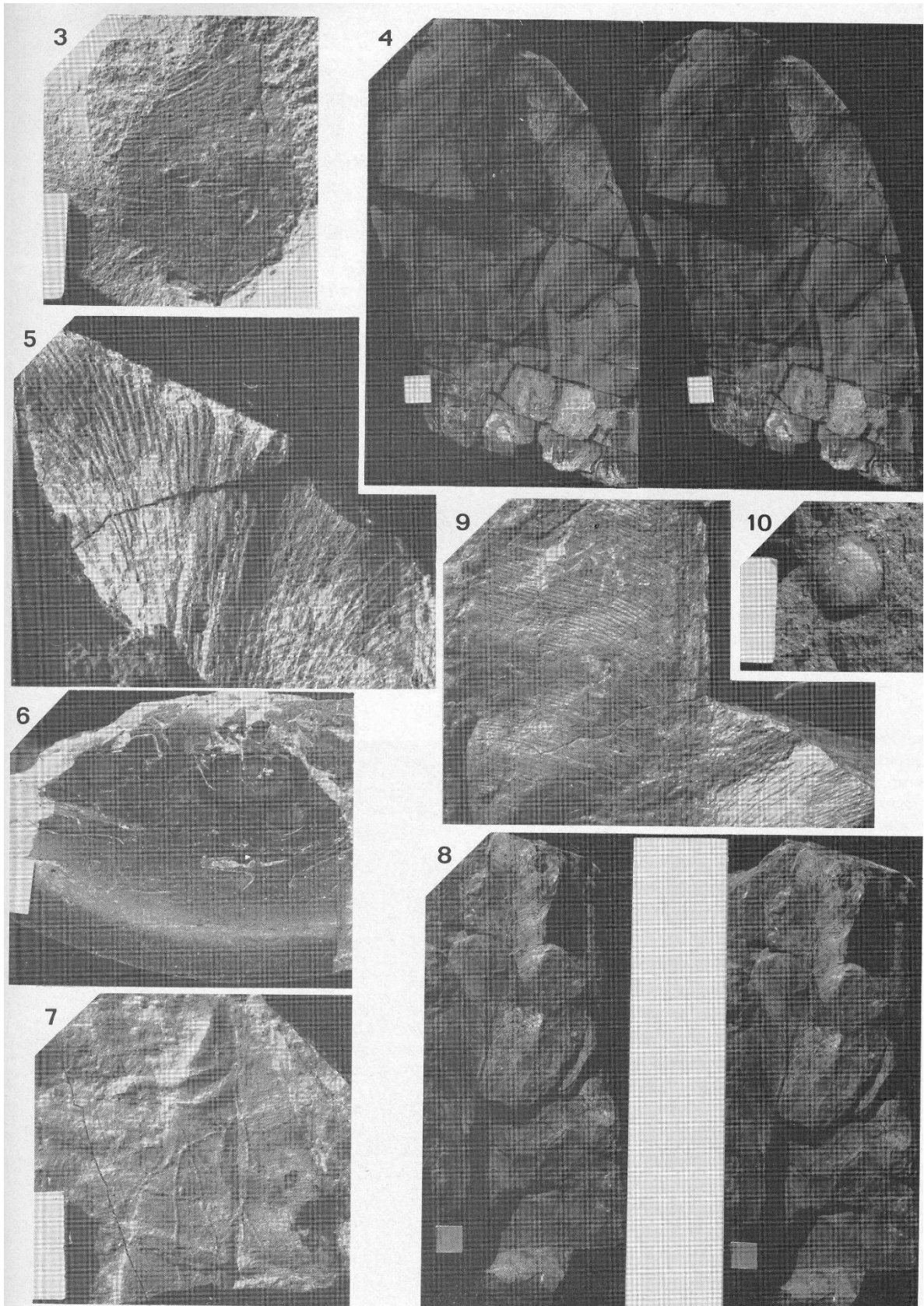


Figure 6: Fossil plants from the Dwyka Group near Douglas (From Anderson and McLachlan, 1976, (figures 3-10)).

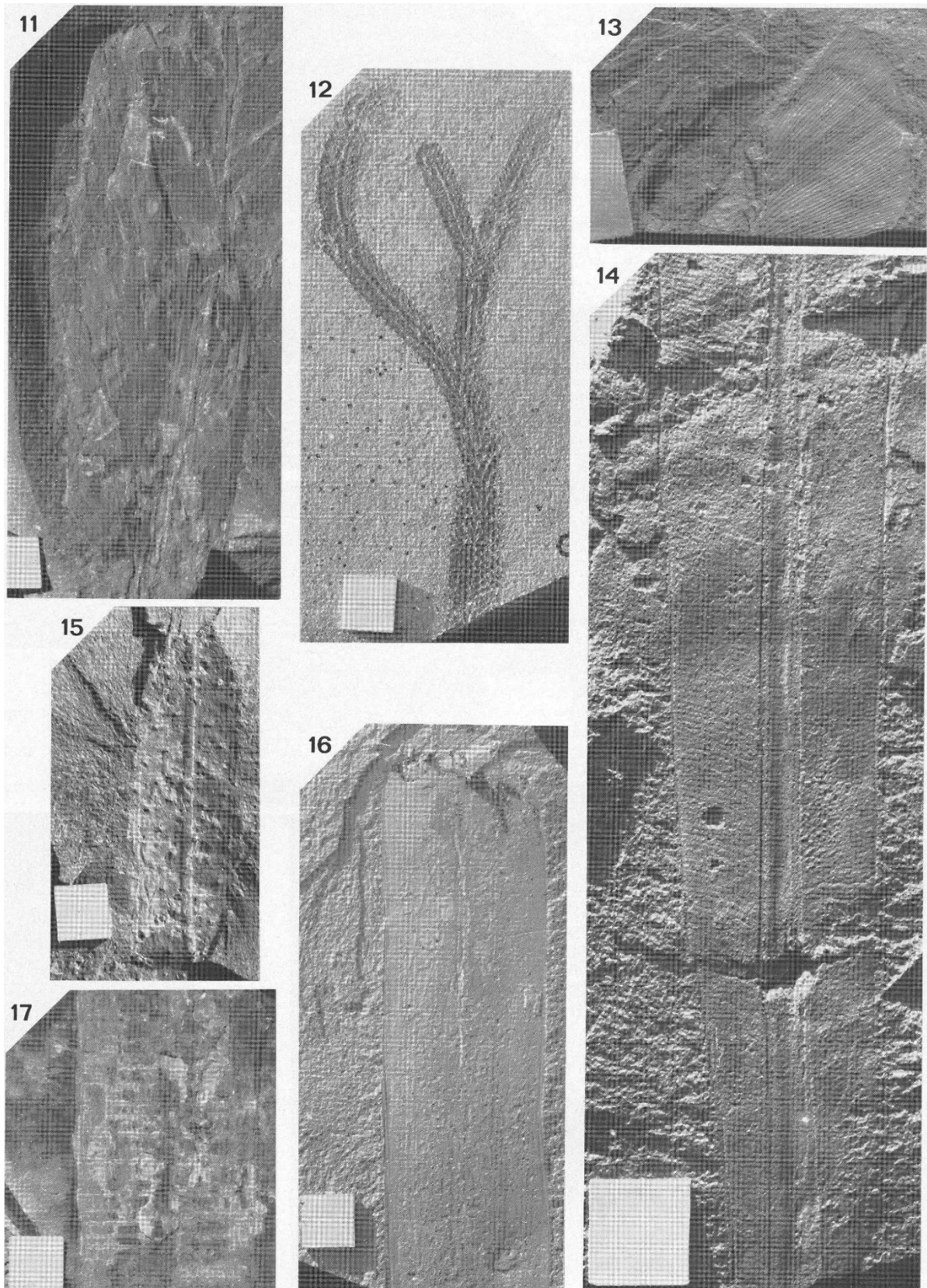


Figure 6: More examples of fossil plants from the Dwyka group near Douglas (from Anderson and McLachlan, 1976, figures 11-17).

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