Mokala Manganese (Pty) Ltd

Re-alignment of the R380 and a portion of the Ga-mogara River on a portion of the Farm Kipling 271, near Hotazel in the Northern Cape Province

Heritage Impact Assessment

Issue Date: 8 October 2015

Revision No.: 1

Project No.:

Declaration of Independence

The report has been compiled by PGS Heritage an appointed Heritage Specialist for SLR Consulting (Africa) (Pty) Ltd. The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes discussed in the Heritage Impact Assessment Process which includes this Heritage Impact Assessment Report..

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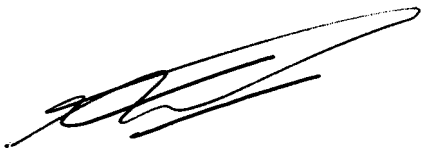

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ACKNOWLEDGEMENT OF RECEIPT

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Report Title	*Re-alignment of the R380 and a portion of the Ga-mogara River on a portion of the Farm Kipling 271, near Hotazel in the Northern Cape Province*		
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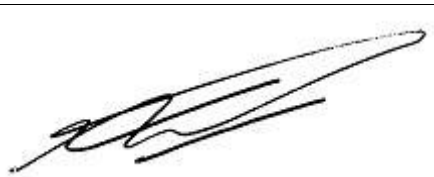
Author	**W Fourie**		**Heritage Specialist/ Principal Investigator**
Reviewed	**N Daly**		**SLR Consulting (Africa) (Pty) Ltd**

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by SLR Consulting (Africa) (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Management Plan (EMP) for the proposed re-alignment of the R380 and a portion of the Ga-mogara River on a portion of the Farm Kipling 271, near Hotazel in the Northern Cape Province.

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

Palaeontology

Although the palaeontological sensitivity of the study area is found to be low, the possibility of encountering "Stromatolites" during construction does exist.

Mitigation

The developer and the ECO must be made aware of the possible presence of stromatolites in the pre-Kalahari Formations and if recorded in future drilling operations, a palaeontologist must be informed and appropriate actions taken in the event of future mining of the stratigraphic units.

Archaeology

Previous studies conducted in the larger Hotazel and Black Rock areas has shown that the archaeological record is temporally confined to the Middle and Later Stone Age, while spatially distribution of such sites is concentrated around the riverine edges due to the harsh climate of the area.

Field work has confirmed this and of the three archaeological site associated with the MSA were identified in the study area.

Mitigation

Site HMK2 must be monitored by a qualified archaeologist during construction and where required further mitigation measures implemented through the guidelines provided in Section 5 of this report.

If at any stage the site (HMK2) is disturbed a qualified archaeologist must be contracted to evaluate the damage and make recommendations on the appropriate mitigation measures.

General

Further to these recommendations the general Heritage Management Guidelines in Section 5, need to be incorporated into the EMP for the project.

The overall impact of the development on heritage resources is seen as acceptably low and impacts can be mitigated to acceptable levels. It follows that if the management measures outlined in this report are implemented there is no reason why the development of the proposed Mokala Manganese Mine should not be approved.

The heritage impact assessment report has been compiled taking into account the NEMA appendix 6 requirements for specialist reports as indicated in the table below.

NEMA Regs (2014) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report	Page 2 of Report – Contact details and company
The expertise of that person to compile a specialist report including a curriculum vitae	Section 1.2 – refer to Appendix F
A declaration that the person is independent in a form as may be specified by the competent authority	Page 2 of the report
An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
The date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 4.1
A description of the methodology adopted in preparing the report or carrying out the specialised process	Section 4.1
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure	Section 3.2, 4.1- 4.2
An identification of any areas to be avoided, including buffers	Section 4.1 page 45
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;	Section 4.1 page 45
A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3 page 12
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 4.2 pages 44-57
Any mitigation measures for inclusion in the EMPr	Section 5 (p.58), Section 6 (p. 63)
Any conditions for inclusion in the environmental authorisation	Section 6 (p. 63)
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 6 (p. 63)
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Section 6 (p. 64)
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	
A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. A public consultation process was handled as part of the EIA and EMP process.
A summary and copies if any comments that were received during any consultation process	Not applicable. To date not comments regarding heritage resources that require input from a specialist have been raised.
Any other information requested by the competent authority.	Not applicable.

Contents

List of Figures

List of Appendices

1 INTRODUCTION

PGS Heritage (Pty) Ltd was appointed by SLR Consulting (Africa) (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Management Plan (EMP) for the proposed re-alignment of the R380 and a portion of the Ga-mogara River on a portion of the Farm Kipling 271, near Hotazel in the Northern Cape Province.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed re-alignment areas, and includes the findings of the 2013 Palaeontological Desktop Assessment done for the prospecting activities of the project, extrapolated for the use in this report. The HIA aims to inform the EMP 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 the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This Heritage Impact Assessment Report was compiled by PGS Heritage (PGS).

The staff at PGS has a combined experience of nearly 40 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Mr. Wouter Fourie, the Project Coordinator, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners (APHP).

Polke Birkholtz, field archaeologist for the project, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist.

Dr Gideon Groenewald, the appointed external Palaeontologist for this project, has a PhD in Geology from the Nelson Mandela Metropolitan University (1996) and the National Diploma in Nature Conservation from the University of South Africa (1990). He specialises in research

on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeontological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

Refer to **Appendix F** for CV's.

1.3 Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

The work conducted for this study, is an extension of the HIA completed in 2013 for the proposed prospecting activities that was a precursor to the current Mokala Manganese development on the farm Gloria 266. Only those sections not previously surveyed was included in this current study.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

i. National Environmental Management Act (NEMA), Act 107 of 1998
ii. National Heritage Resources Act (NHRA), Act 25 of 1999
iii. Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

i. National Environmental Management Act (NEMA) Act 107 of 1998
    a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
    b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
    c. Environmental Impact Assessment (EIA) – Section (32)(2)(d)
    d. Environmental Management Plan (EMP) – Section (34)(b)
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
    a. Protection of Heritage Resources – Sections 34 to 36; and
    b. Heritage Resources Management – Section 38
iii. Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
    a. Section 39(3)

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, "no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…" The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA, MPRDA and the DFA legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Section of these Acts relevant to heritage (Fourie, 2008).

The NEMA 23(2)(b) states that an integrated environmental management plan should, "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage".

A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken account of in the Regulations under NEMA is the Specialist Report requirements laid down in Section 33 of the regulations (Fourie, 2008).

1.5 Terminology and Abbreviations

Archaeological resources

This includes:

i. material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
iii. wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;
ii. carrying out any works on or over or under a place;
iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
iv. constructing or putting up for display signs or boards;
v. any change to the natural or existing condition or topography of land; and
vi. any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Holocene

The most recent geological time period which commenced 10 000 years ago.

Late Stone Age

The archaeology of the last 20 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 20 000-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

ABBREVIATIONS	DESCRIPTION
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

Refer to **Appendix C** for further discussions on heritage management and legislative frameworks

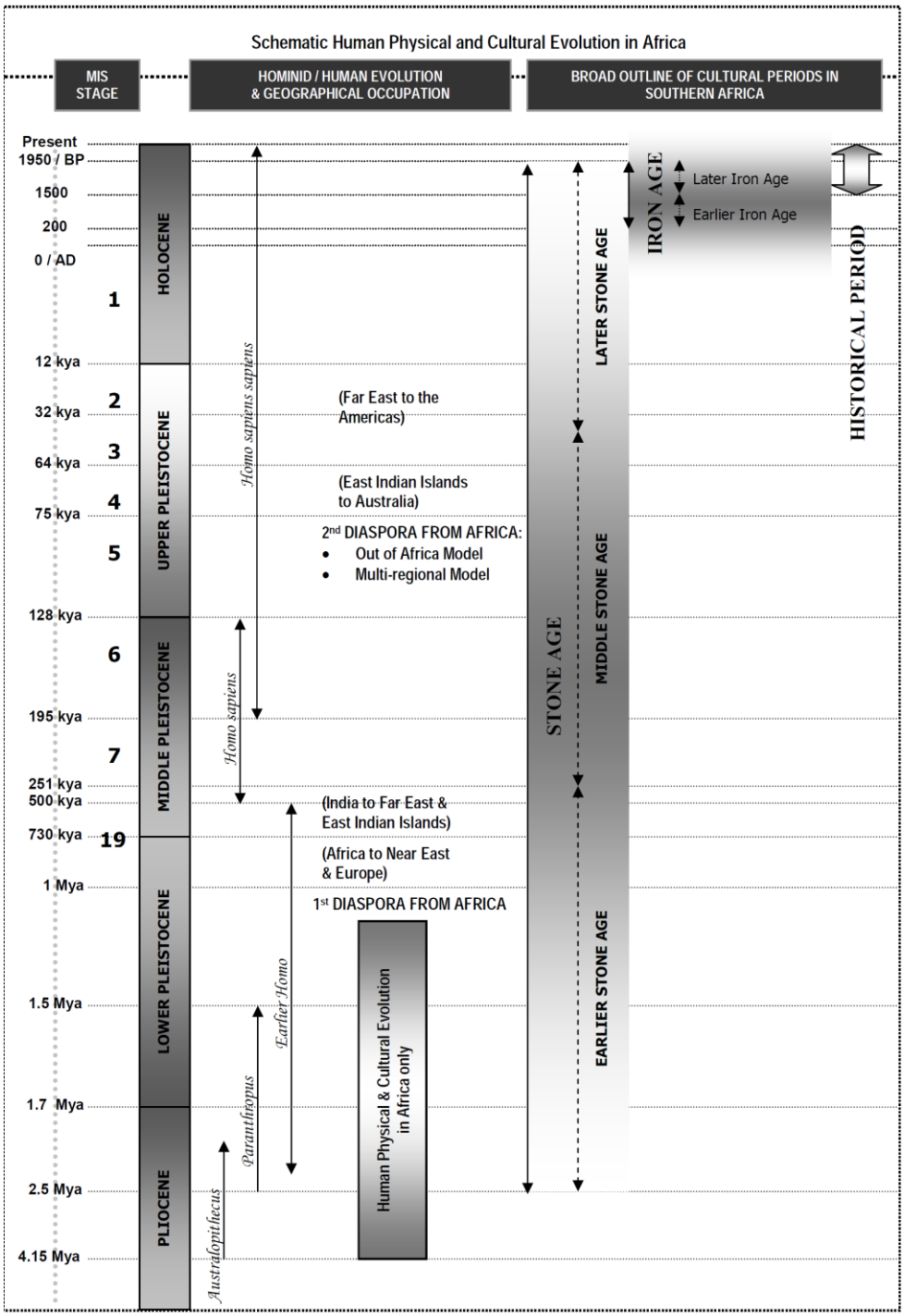


Figure 1 – Human and Cultural Time line in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Location	S27° 11' 11.3" E22° 55' 17.5" The proposed realignment of the R380 and Ga-mogara river is situated approximate 3 kilometres northwest of the town of Hotazel.
Land Description	The land is currently utilised for grazing (game) and prospecting related activities by Mokala, and consists of grass and bush cover in the Ga-Mogara River flood plain and characterised by red sand dunes on the banks of the river.

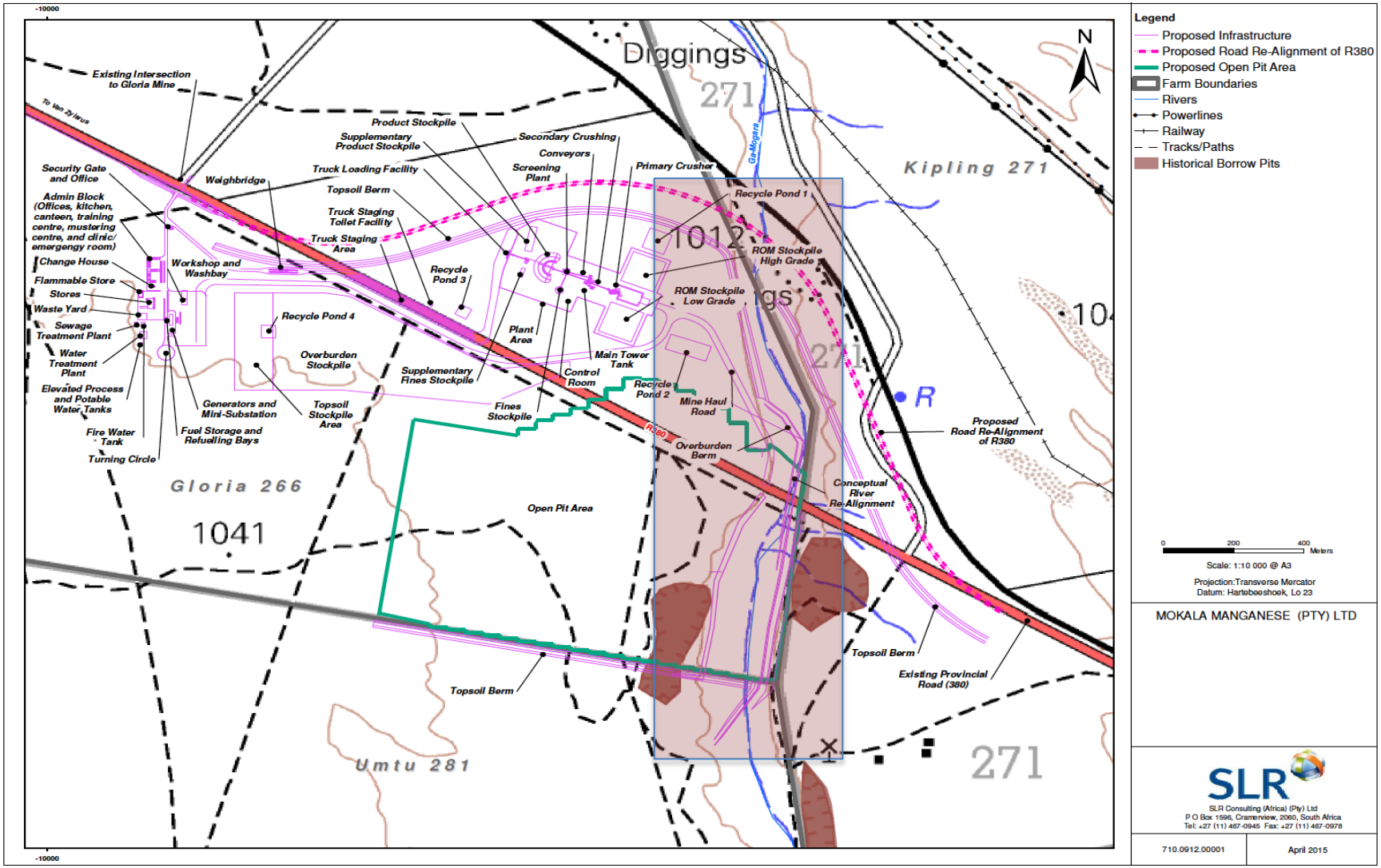


Figure 2 – Mining layout and proposed realignments in the red shaded block

2.2 Technical Project Description

The following brief project description for the project has been supplied by SLR Consulting.

The Mokala Manganese project on the farm Gloria 266, requires the realignment of the R380 road on the farm Kipling 271 and the realignment of a section of the Ga-mogara River that extends onto the farm Umtu 281 (Refer to Figure 2). This realignment is necessitated by the ore body as well as the open-pit configuration required for full economic utilisation of the ore body.

3 CURRENT STATUS QUO

3.1. Site Description

Large sections of the study area comprises reasonably level areas characterised by red Kalahari Sand with some grass and thornbush vegetation present. The Ga-Mogara River is located on the eastern side of the proposed project area. A railway line runs near the north and north-eastern ends of the study area with the main provincial tar road (R380) from Hotazel to Black Rock traverses the study area.

Sections of the site had been disturbed in the past, with the result of historic to recent quarrying activities still evident. Other disturbance include gravel roads and the tar road.

3.1 Archival findings

The archival research focused on available information sources that were used to compile a background history of the study area and surrounds. This data then informed the possible heritage resources to be expected during field surveying.

3.2 Palaeontology of the area

The following section is an extract from the Palaeontological Desktop Study conducted for the 2013 study, attached as **Appendix A**.

Literature reviews and reports associated with Heritage Conservation make no mention of any palaeontological finds in the Kalahari Formation in this region. Although it is known that certain facies in the Dwyka Formation contains trace fossils and vertebrate fossils, highly breciated nature of the formation in this area will exclude fossils. Algal growth structures,

known as “Stromatolites” are well-known fossil structures, described from the dolomites of the Transvaal Supergroup (**Figure 3**).

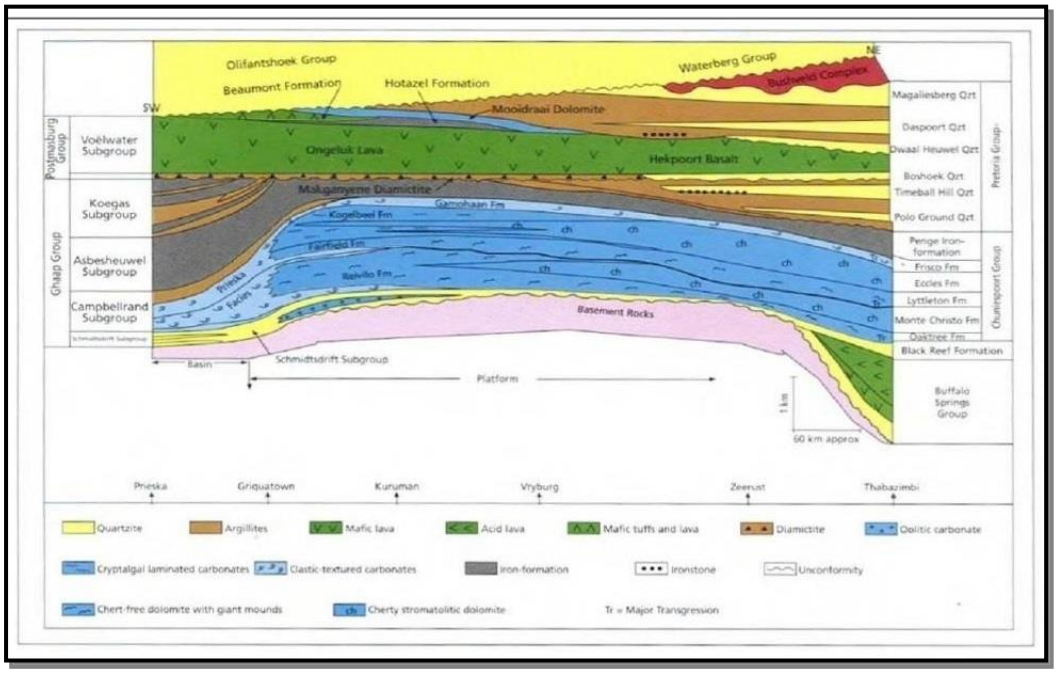


Figure 3 - Generalised plan of the geology of the Transvaal Supergroup is provided by Beukes (1983) and Van der Merwe (1997).

3.2.1 **Kalahari Formation**

No fossils have been recorded from the Kalahari Formation. It is, however, likely that fossils might be present in the calcareous deposits of this formation.

Relicts of possible bone structure were observed by the author, but the structures are completely replaced by calcium and silica, making it virtually impossible to determine with any certainty what the original material was.

3.2.2 **Pre-Kalahari Formations**

The palaeontological importance of the Proterozoic Transvaal Supergroup is mainly associated with well-defined stromatolite structures in the dolomite deposits.

Figure 4.1, of the palaeontological desktop assessment (**Appendix A**) shows typical stromatolite structures usually associated with dolomite deposits such as the dolomite of the Mooidraai Formation that overlies the Hotazel Formation. It is highly likely that structures such as in this photograph, might be exposed during exposure of the dolomite

and Banded Iron Units in the Hotazel Formation (Photograph from Wikipedia 201) en.wikipedia.org/wiki/Stromatolite.

There are no outcrops of Pre-Kalahari Dwyka or older Transvaal Supergroup rocks in the study area and outcrops of the banded shale and thin dolomite zones that crop out on the main road between Hotazel and Kuruman shows very poorly defined algal structures that probably represent micro-stromatolites.

Small scale algal structures were observed by the author in boreholes from the area. The structures in the borehole logs are mostly of small (cm) scale and associated with banded iron formation of the Hotazel Formation or the overlying dolomite of the Mooidraai Formation.

Refer to **Appendix A** for the detailed Palaeontological Desktop Study

The following section leans heavily on previous archival studies conducted by PGS Heritage in the Hotazel/Black Rock Areas (PGS Heritage, 2009; PGS Heritage, 2010; PGS Heritage, 2010).

3.3 Archaeological background

Most archaeological material in the Northern Cape is found near water sources such as rivers, pans and springs, as well as on hills and in rock shelters. Sites usually comprise of open sites where the majority of evidence of human occupation is scatters of stone tools (Parsons 2003).

3.3.1 Early Stone Age (400 000 – 2 million years Before Present/BP)

An important archaeological site in the region is the Wonderwerk Cave, located approximately x km away. The Early Stone Age (ESA) levels at Wonderwerk Cave date to approximately 780 000 years old and are characterised by Acheulean stone tools such as prepared cores, bifacial cleavers and refined hand axes. A few pieces of haematite were also found in the uppermost MSA layers. Bedding material recovered indicates that the site was used as a home base by the end of the ESA. A few small irregular flakes and cores may belong to the older Oldowan era, but the dating of this material is uncertain (Beaumont & Vogel 2006).

3.3.2 **Middle Stone Age (30 000 – 300 000 BP)**

Middle Stone Age (MSA) artefacts belonging to the Fauresmith industry are also found in the region. The Fauresmith is characterised by prepared cores, long, narrow flake blades, convergent points and small, broad hand axes (Mitchell 2002). Also at Wonderwerk, layers with Fauresmith tools were dated to 276 00 – 510 000 BP. Associated with the MSA materials were several incised stone slabs, most with curved parallel lines. Pieces of haematite were also found. The cave was abandoned between 70 000 and 12 500 BP due to significantly drier conditions. During this time, much of the region was abandoned and settlement only occurred at a few sites near permanent water sources (Beaumont & Vogel 2006).

3.3.3 **Later Stone Age (30 000 BP – recent times)**

The earlier LSA industry of the region forms part of the Oakhurst industry (some have labelled this local variant the Kuruman), characterised by rare retouched artefacts, most of which are large scrapers that are oblong with retouch on the side. The predominant raw materials are banded ironstone and dolomite. Very few adzes and blades are found, while backed artefacts and bone tools are absent. Ostrich eggshell beads and fragments are found (Humphreys & Thackeray 1983). At Wonderwerk, Oakhurst assemblages were dated to 8000 – 10 500 BP (Beaumont & Vogel 2006).

This was followed by the Wilton industry, characterised by the use of various raw materials including banded ironstone, chert, chalcedony, jasper and quartz. The main retouched tools are elongated scrapers with retouch on the end and backed artefacts such as segments and blades. Other retouched tools include adzes, unifacial points, borers and notched artefacts. At other sites, bifacial points and bifacial tanged and barbed arrowheads are found. At Wonderwerk, a few bone points have been found. Ostrich eggshell beads, pendants and decorated fragments, as well as stone rings were found (Humphreys & Thackeray 1983). Wilton layers at Wonderwerk have been dated to 2000 – 8000 BP. Associated with the LSA materials were 20 fine-line incised engraved stone slabs, most with schematic motifs. One example of a mammal depiction has been found. Pieces of haematite and specularite were also found in these layers (Beaumont & Vogel 2006).

Pottery made its appearance in the region by approximately 1400 BP and at Wonderwerk, Ceramic Later Stone Age layers have been dated to 900 – 2000 BP (Humphreys & Thackeray 1983; Beaumont & Vogel 2006). Two discrete, contemporary stone tool industries are

associated with pottery remains in the Northern Cape: Swartkop and Doornfontein (Beaumont *et al.*1995). Swartkop is a Wilton industry characterised by circular blades, a high proportion of backed blades, coarse undecorated pottery sherds that commonly contain grass temper, and a few iron items. It seems scrapers were favoured over blades on the Ghaap plateau (Humphreys & Thackeray 1983). These sites are usually found near water sources, such as pans and springs, or on the sides of low hills. Stone circles and ovals are sometimes also found and may represent the bases of dwellings. A late phase of this industry can be linked with the */Xam* San who lived in the Karoo. Doornfontein is characterised by the predominance of coarse irregular flakes, frequent use of quartz as a raw material, and very little retouch. Many ceramics are found, which are amphora-like in shape with grit temper and decoration on the necks and rims. Later sites contain some large ostrich eggshell beads, iron objects, and coarser sherds with grass temper. These sites are found along the Orange River and nearby permanent water sources. This tradition is probably associated with Khoekhoen groups (Beaumont *et al*. 1995).

Two prehistoric specularite mines have been excavated near Postmasburg–Doornfontein (Beaumont & Boshier 1974) and Blinklipkop (Thackeray *et al.* 1983). These sites show that specularite mining started before 1200 BP. This substance was prized as a cosmetic by hunter-gatherers, Khoekhoen pastoralists and Iron Age peoples, making it an important trade item. At Blinkklipkop, there is evidence of either trade with or occupation by Iron Age peoples by the seventeenth century. Historical sources indicate that Tlhaping Sotho-Tswana peoples occupied the mine in 1801 (Thackeray *et al.* 1983).

3.3.4 **Rock Art**

Rock engravings are principally found in the interior of South Africa and are plentiful in the Northern Cape. Engravings are found on rocky outcrops, river beds and boulders. They are made by pecking away the surface of the rock with another rock, incising it with a sharp stone or scraping it off with another stone. Unfortunately, there are no scientific methods for securely dating engravings and research into this is still at an experimental stage.

Most engravings were made by the San and were associated with their religious beliefs and rituals. San shamans went into trance to perform certain tasks such as controlling game, protecting the group and rainmaking. Certain animals were believed to hold supernatural power and thus many of the engraved animals can be seen as both sources and symbols of supernatural power. The places where engravings were made were also sources of supernatural power, especially in rainmaking rituals. Certain geometrics such as zigzags and

dots are likely to have been associated with forms called entoptics seen whilst in trance (Dowson 1992).

Some engravings–particularly those featuring nonentoptic geometrics and aprons–were probably made by Khoekhoen people. Similar motifs are found in finger painted Khoekhoen rock art sites in certain regions of the Northern Cape, especially in the Vaal-Harts region to the east. Khoekhoen rock art is typified by finger paintings and roughly pecked engravings of geometrics that are located near water sources (Smith & Ouzman 2004). The rock paintings found in the Kuruman hills (Morris 1988) are probably of Khoekhoen authorship. Korana rock art–mostly painted–has also been identified in the Vaal-Harts region but may stretch into the Daniëlskuil region (Ouzman 2005). These depictions are characterised by finger painted and rough brush painted horses, human figures, geometrics, aprons, guns and finger dots. They are painted in shelters that are either hidden or not easily accessible. The complex issues of ethnicity and authorship of rock art–especially engravings–are still being researched.

3.4 Archival/historical maps

A number of maps depicting the study area were located. Enlarged sections of these maps are presented below. A short discussion on each of these maps is also made.

3.4.1 Merensky Map, 1887

(National Archives, Maps, 3/302)

The map depicted in **Figure 4** below is titled "*Original Map of South Africa"*. It was compiled by Reverend A. Merensky and dates from 1887. The map does not appear to be all that accurate, but provides some idea as to the characteristics of the study area at the time (refer **Figure 4**).

It is evident from the enlarged map component below that many of the settlements in the general vicinity of the study area were located on the existing rivers. See for example '*Ga Maperi*', '*Batlaros*', '*Old Lattaku*' and so forth.

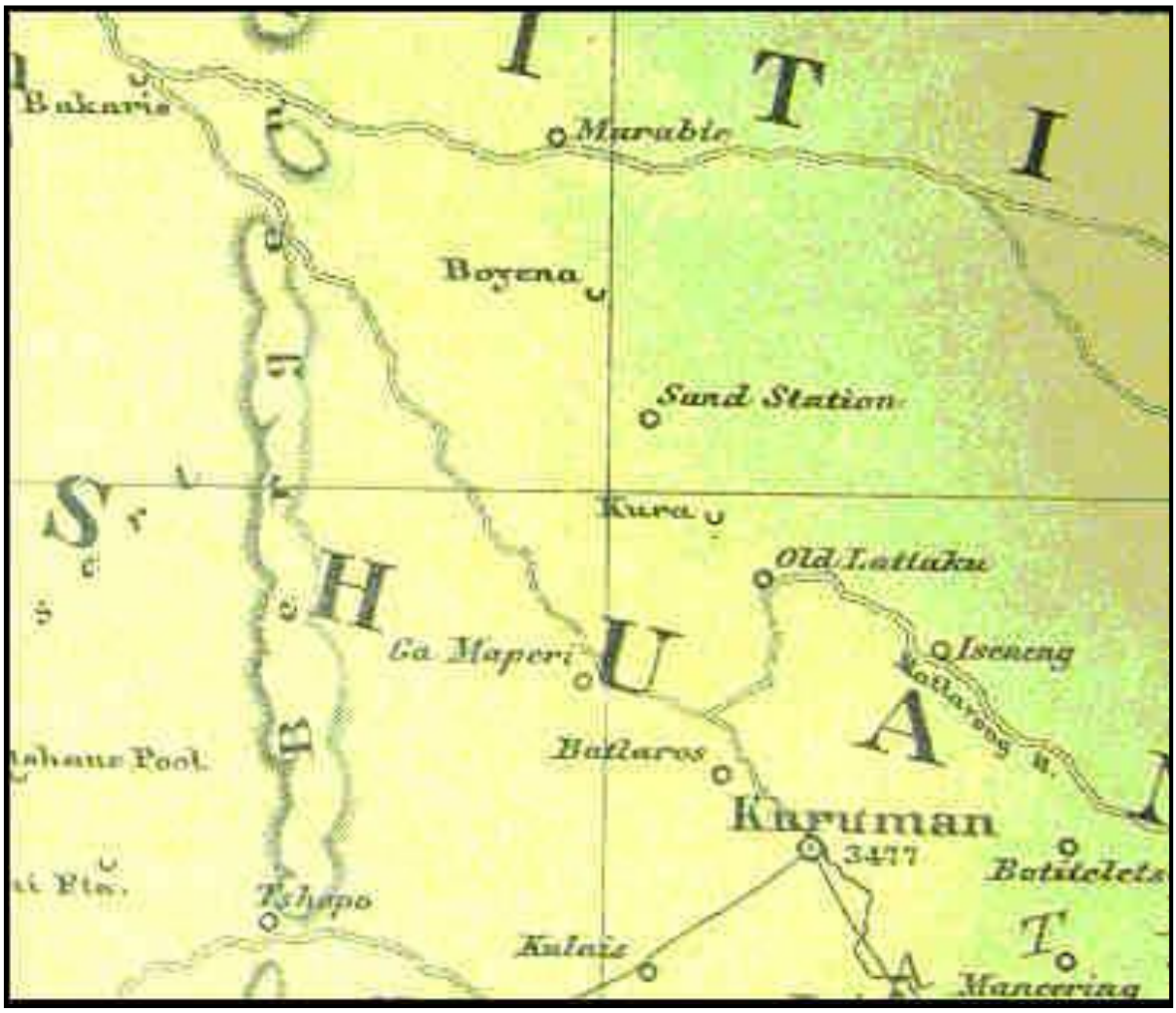


Figure 4 - Map depicting the study area and surrounding region. Note that almost all the towns are situated on or near the main rivers (National Archives, Maps, 3/302).

3.4.2 **"Kuruman", Undated**

(National Archives, Maps, 3/533)

This map is simply titled "*Kuruman"*, and contains no other information.

An important observation made from this map and which is supported by the other data, is that the proclaimed farms at the time extended only to the vicinity of the Kuruman River, with no proclaimed farms to the west of it. Although settlements are shown to the west of the said river, these are all located on the banks of rivers.

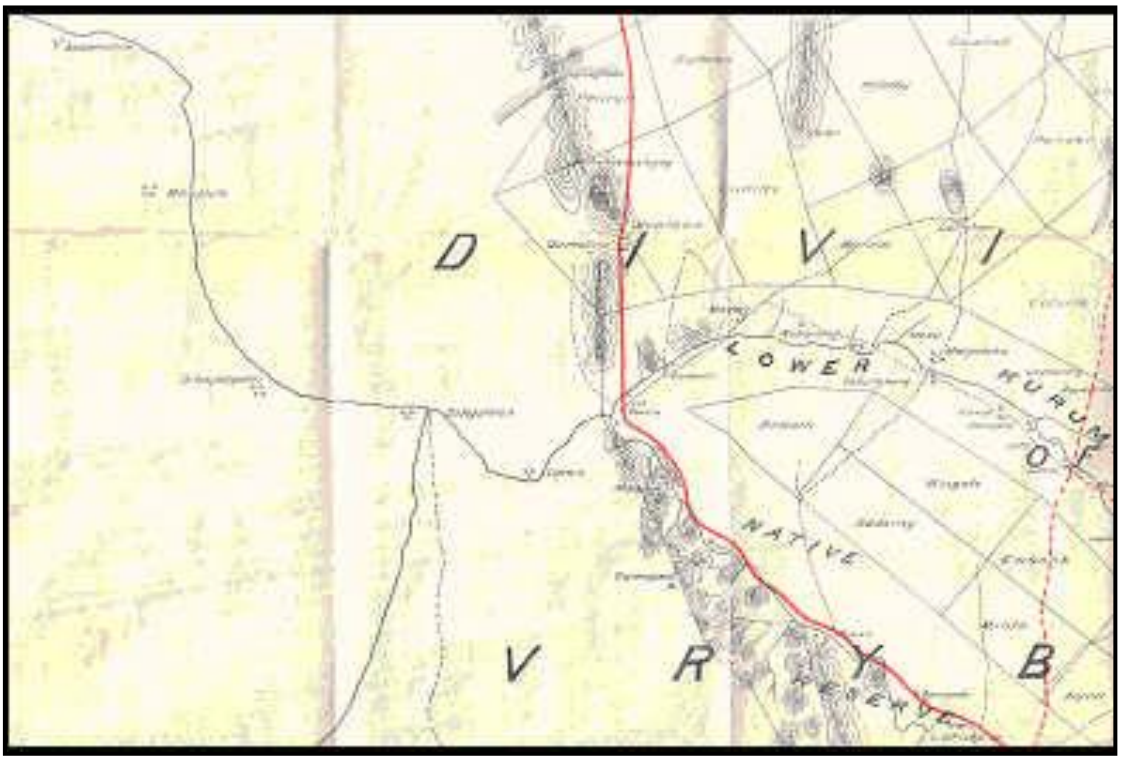


Figure 5 - Depiction of the wider landscape surrounding the study area (National Archives, Maps, 3/533). The so-called Lower Kuruman Native Reserve is shown on the right.

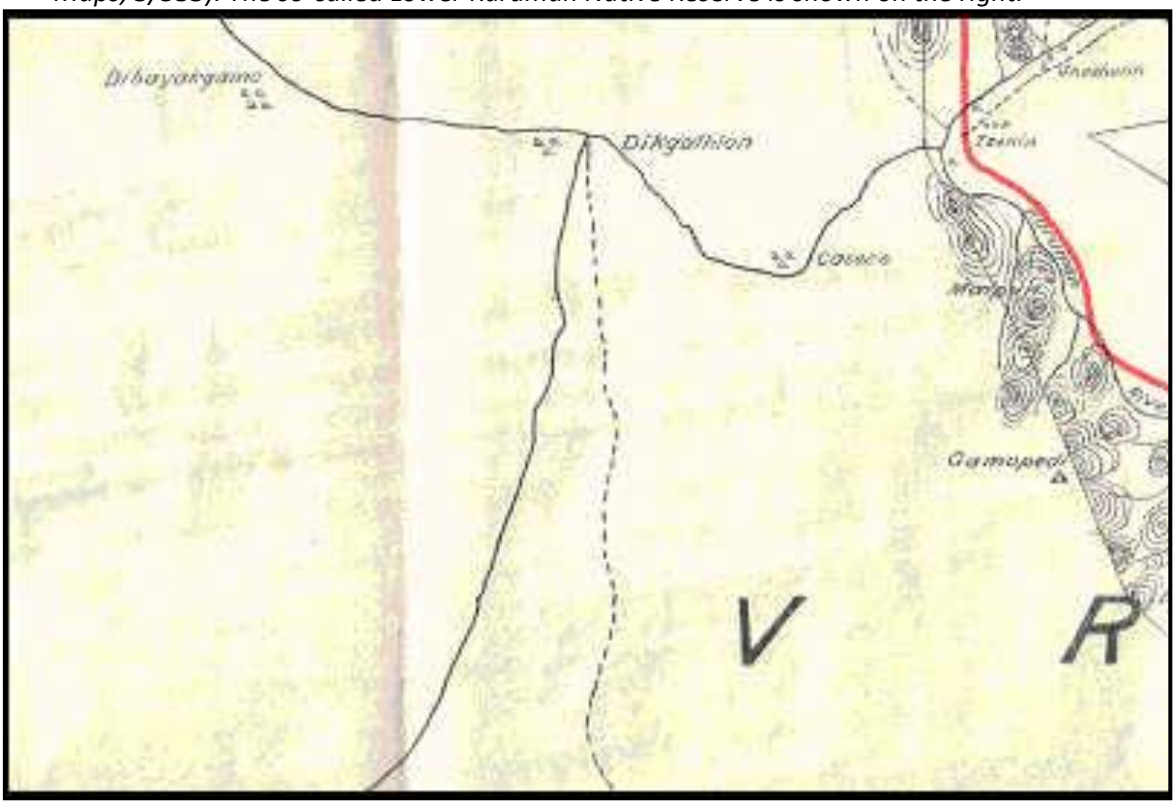


Figure 6 - Close-up view of the study area and surroundings. Note the location of the towns close to river courses (demarcated in black line). A road (stippled line) can also be seen crossing over the vicinity of the study area from Dikgathlon southwards. (National Archives, Maps, 3/533).

3.4.3 **British Bechuanaland Map, 1894**

(National Archives, Maps, 1/441)

"*Map of the Surveyed Portion of British Bechuanaland"* was compiled by the Surveyor-General's Office in Vryburg. It is a relatively accurate map and, importantly, indicates the extent to which farms in the area have been proclaimed and demarcated. Note that the entire section in which the study area is located was still unsurveyed at the time with no farm boundaries shown.

No settlement features or human activity centres are shown for the areas in which the farms under discussion are located. Almost all the settlements shown on this map are located on or near the rivers.

3.4.4 **Geological Map, 1925**

(National Archives, Maps, 2/304)

This map was made in 1925, and is titled the "*Geological Map of the Union of South Africa"*. It was produced by the Geological Survey of the Department of Mines and Industries.

No settlement features or human activity centres are shown for the areas in which the farms under discussion are located. Note that all the indicated settlements in the wider region are located adjacent to rivers. These include settlements such as Dikgatlon, Batlaros and Gamopedi. Also note the demarcation of the Lower Kuruman Native Reserve on this map.

3.4.5 **Orange River Sheet 3, 1945**

(National Archives, Maps, 2/1085)

This map is titled is titled "*Orange River Sheet 3"*, and dates from 1945. It was produced by the Union Defence Force (U.D.F.), and although this edition is dated 1945, it appears to have been drawn during 1942. The map provides a general view on the study area and the surrounding region.

No settlement features or human activity centres are shown for the areas in which the farms under discussion are located. Note the way in which the secondary road (thin brown line) follows the rivers. Only the smaller roads (brown stippled line) cross over the waterless areas. Furthermore, three Post Offices are shown, all located on the rivers. Although three mines are indicated, these are all situated closer to Kuruman. No mines are shown for the areas under discussion.

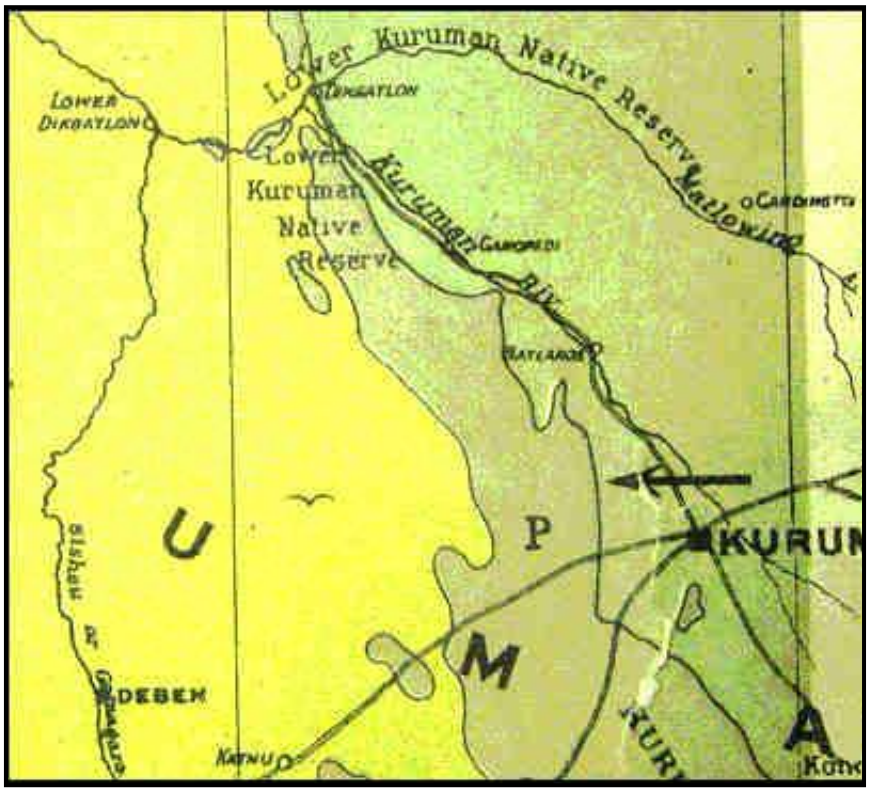


Figure 7 - Geological map of the study area and surrounding region (National Archives, Maps, 2/304).

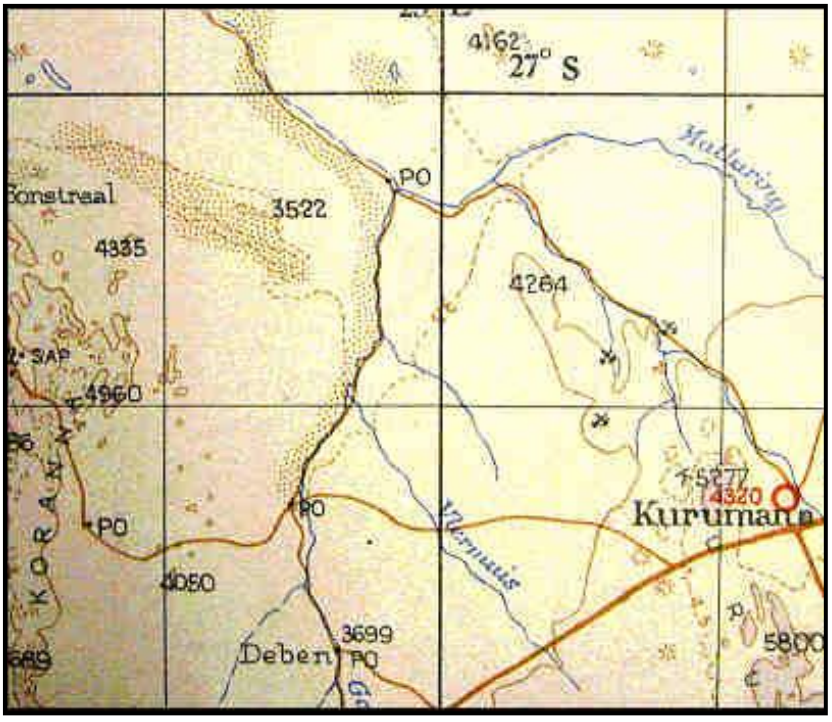


Figure 8 - Map depicting the study area and surrounding region (National Archives, Maps, 2/1085).

3.5 Aspects of the area's history as revealed by the archival/desktop study

3.5.1 Settlement during the Later Stone Age

A number of Stone Age sites are known for the area surrounding Kuruman as well as along the Kuruman River (Humphreys & Thackeray, 1983; Beaumont & Morris, 1990; Parsons, 2003). Some of these sites contain rock engravings as well, such as Nchwaneng and Tsineng (Beaumont & Morris, 1990; Morris, 1988, 2002, 2003).

As the wider landscape became increasingly inhabited, the San were forced to move further west and northwest to remain in the vicinity of wild game (Snyman, 1992).

3.5.2 Early Black Settlement during the Late Iron Age and Historic Period

The Tlharo seems to have been the first Tswana group to enter the Kuruman area. They originated from the Hurutshe group further to the north-east, and after splitting from this group during the end of the 17th century, moved in a southern direction down the Molopo River. Their early settlements included Khuis, Madibeng, Heuningvlei, Langeberg and Tsineng (Snyman, 1992). As mentioned earlier, the town of Tsineng (Tsenin) is located in the general vicinity of the present study area.

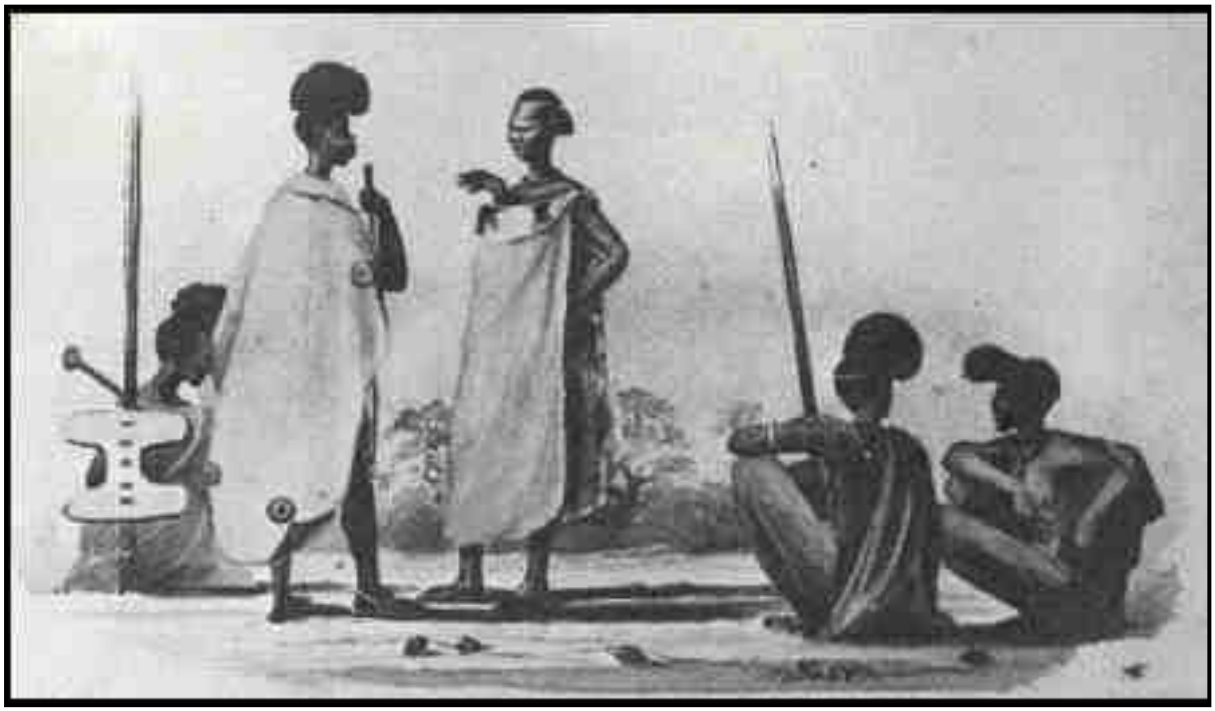


Figure 9 - "Tlharo of the Kalahari Desert" A sketch that appeared in Dr. Andrew Smith's travel journal (Lye, 1975:171).

The second important Tswana group from the wider area is the Tlhaping. They originated from the Rolong group and during the mid-1700s moved southward along the Harts and Vaal Rivers to the vicinity of Campbell, from where they travelled westwards into the area falling between Tsantsabane and Majeng on the edge of the Kalahari Desert. The Tlhaping established a capital on a perennial river known as Nokaneng. Their ruler during this time was King Maswe. Although the exact locality of Nokaneng is not known, one possibility is that the present non-perennial river Ga-Mogara used to be the Nokaneng River. This possibility was supported by the missionary John Campbell, who in 1820 referred to the Ga-Mogara River as the Nokaneng (Campbell, 1922: Vol II:125; Snyman, 1992). Interestingly, Robert Moffat indicated Nokaneng to have been situated to the east of the Langeberg, but see also map accompanying Campbell (1922:Vol. II). This said, it is important to note that Breutz (1992) stresses the point that the actual capital Nokaneng was in fact located in the direct vicinity of Postmasburg.

During the reign of Molehabangwe, who had succeeded his father Maswe in 1775, a confederation was formed which consisted of a stratified society comprised of the Tlhaping, Rolong, Tlharo, Kgalagadi and San groups. While the Tlhaping was seen as the ruler class, the Kgalagadi and San were viewed as vassals (Snyman, 1992).

The Tlhaping conducted extensive trading activities with the Korana to the south and the Tswana to the north. During 1770 some of the Korana groups crossed the Orange River and came to the land of the Tlhaping. Although the initial contact was peaceful, conflict soon erupted. The better-armed Korana managed to force the Tlhaping out of the area in approximately 1790. This move was further augmented by the fact that the Nokaneng River had dried up. Campbell (1922: Vol. II:125) on his visit in 1820 also remarked that both the Nokaneng and Kuruman Rivers then had dried up, but that deep wells dug into the river beds supplied water. The Tlhaping first moved to Kathu and then to Ga-Mopedi on the Kuruman River. The Tlhaping eventually established themselves at Dithakong on the Moshaweng River (Snyman, 1992).

3.5.3 **European Explorers and Visitors**

Two of the more well-known early European explorers to these areas were Dr. Hinrich Lichtenstein in 1805 and Dr. Andrew Smith during 1835.

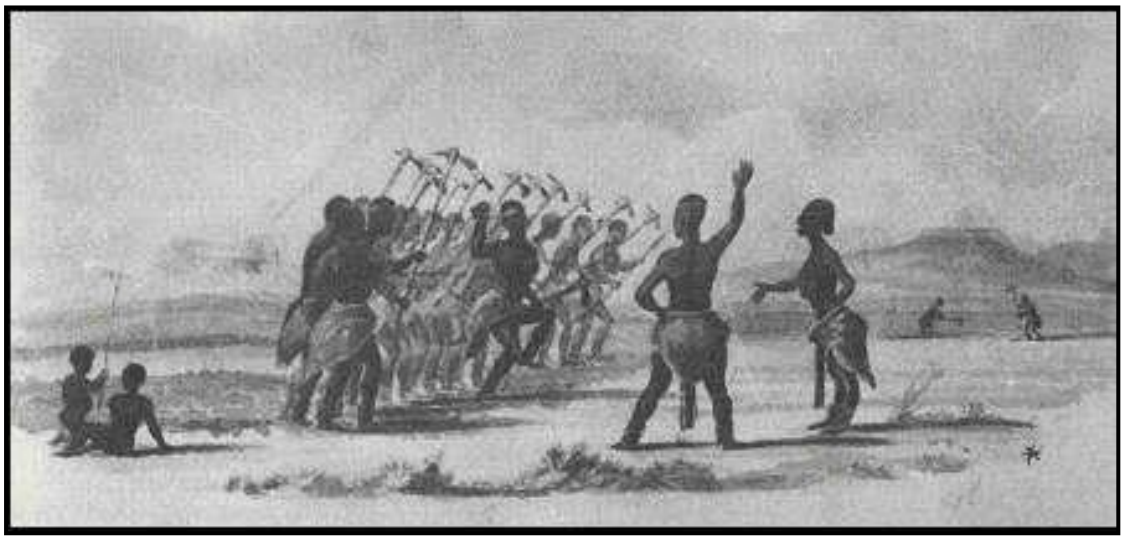


Figure 10 - "Tlhaping women cultivating gardens and singing" One of the sketches appearing in Dr. Andrew Smith's journal (Lye, 1975:171).

3.5.4 **The journey of Lichtenstein (1805)**

After crossing the Orange River in the vicinity of present-day Prieska, Lichtenstein's party visited present-day Danielskuil, and by June 1805 they were at Blinkklip (Postmasburg), a well-known source for obtaining specular haematite. Archaeological investigations at Blinkklipkop (also known as Nauga) established a date of AD 800 for the utilization of this particular rich source (Thackeray, et al 1983; Beaumont & Morris, 1990). From here they travelled further north and reached the Kuruman River where they met Tswana-speaking people. They followed the river downstream for three days, after which they followed a tributary to reach Lattakoe. From here they turned south and reached the Orange River on 11 July 1805.

While on their way to the Kuruman River (and to the south thereof), Lichtenstein and his fellow travellers visited a small settlement consisting of "*…about thirty flat spherical huts.*" Although the people who stayed here were herdsmen who looked after the cattle of richer people living on the Kuruman River, they indicated that San (Bushmen) were also present in the area.

Lichtenstein's party subsequently travelled further north to visit the capital of King Mulihawang located on a plain in the vicinity of the Kuruman River. He described the town as consisting of six hundred houses with 5 000 inhabitants. The individual dwellings were described as follows: "*The houses were all of a circular form, with the roof running up to a point; the roof rests on a circle of poles, which are united together below by thin walls of*

loam; above, for a little way below the roof, they are left open to admit light and air." (Lichtenstein, 1930:373). Lichtenstein also indicated that hedges were used as cattle enclosures.

3.5.5 **Andrew Smith's journey (1835)**

Dr. Andrew Smith's expedition into the interior of Southern Africa can be seen as one of the highlights of the era of exploration and travel into these regions of Africa. After some travelling, which included a visit to Mosjesj, Smith's party crossed over the Vaal River and after reaching this river's confluence with the Harts, followed it to Boetsap and subsequently reached Kuruman (Bergh, 1999).

Smith met Robert Moffat at Kuruman, and during this time made a journey all along the Kuruman River to Tsineng from where he travelled south to the Langeberg. Returning to Tsineng, Smith travelled north to Heuningvlei before returning back to Kuruman (Bergh, 1999).

For the aims of the present study, it is especially Smith's journey from Tsineng to the Langeberg and back which is most interesting. The route followed by Smith seems to have been the Ga-Mogara River, and as such his route crossed over portions of the present study area.

In the vicinity of Tsineng Smith found a number of springs which the local people called Malichana. He observed a small group of Tswanas (*Bituanas*) as well as a Griqua family staying near the springs, and indicated that the Tswana group conducted agricultural activities in gardens laid out near the springs.

From Tsineng Smith's party travelled all along the bank of the Kuruman River, presumably to the confluence of the Ga-Mogara River. On this stretch of the journey Smith observed "…*a number of almost naked natives in the distance carrying ostrich shells and something resembling leather sacks upon their shoulders…*" (Lye, 1975:181). These people were on their way to a water hole, which had been excavated some seven meters deep. Anyone wishing to obtain water had to climb down the hole making use of footholds along the sides.

3.5.6 **British Protectorate**

On 23 March 1885 Britain declared a Protectorate over Bechuanaland and the Kalahari. On 30 September 1885 the Protectorate was divided into two parts. The area north of the Molopo River remained the Bechuanaland Protectorate and up to 1895 was administered from Vryburg, after which the capital was moved to Mafeking. The area south of the Molopo became the Crown Colony of British Bechuanaland with its capital at Vryburg (Tlou & Campbell, 1997). This area included the present study area as well as Kuruman.

In accordance to Act 31 of 1895 the area south of the Molopo River, namely British Bechuanaland, was included in the Cape Colony. This took place during November 1895 (Smit, 1966).

3.6 Historic Black Settlement

3.6.1 Situation at the beginning of the 19th century

When Reverend Robert Moffat first arrived in the Kuruman area in 1819 he found the Tlhaping settled at Maropin in the Kuruman Valley under their ruler Mothibi. They subsequently moved upstream to the vicinity of present-day Kuruman.

During the same time Moffat found the BaTlharo established at Tsening.

In a document written by the Superintendent of Natives on 3 November 1921, it is indicated that before the farms to the west of the Lower Kuruman Native Reserve were surveyed and ceded to different white farmers, the black people of the area *"…had the run of the whole country to the Moshewing River on the one side and the Gamagara River on the other…*" and grazed their livestock and conducted agricultural activities over these vast tracts of land. In an associated petition document drawn up by the Thlaro people of Bathlaros, they indicated that their agricultural lands and cattle posts used to stretch in a westward direction all the way to the "*Dibeng*" River, which appears to be the present-day Ga-Mogara River (NTS, 7752, 22/335).

3.6.2 Lower Kuruman Native Reserve

On 4 May 1895 the Lower Kuruman Native Reserves well as a number of other so-called native reserves were established by virtue of Bechuanaland Proclamation No. 220 of 1895. These reserves were demarcated as part of a commission which investigated land claims and land settlement in British Bechuanaland. A subsequent report titled "*Report of the*

Commissioners appointed to determine land claims and to the effect of a land settlement in British Bechuanaland" and published in 1896, contained all the findings of the commission (Breutz, 1963).

At the time of its establishment, the Lower Kuruman Native Reserve had a population of 5425, and being 225 square miles in extent, had a population density of 26.5 acres per individual. With time, the population density increased. Livestock numbers also increased drastically. As a result of these pressures the size of the reserve was subsequently extended.

During negotiations and discussions on such an expansion of the reserve, it was indicated that a number of black people were residing outside the boundaries of the reserve. In a police report dated 22 January 1908 a list is provided of all the people, white and black, residing "*…on the banks of the Kuruman River north of the surveyed farms in the Sishen Valley.*" This document provides an indication of human habitation in the direct vicinity of the study area during the early 1900s. One interesting observation to be made from the document is that some of the persons who acted as borehole watchmen were black. For example, Hans Gaboerkwe had been living at Dibiachomo since 1899 and was tasked with keeping the well open (NTS, 7752, 22/335).

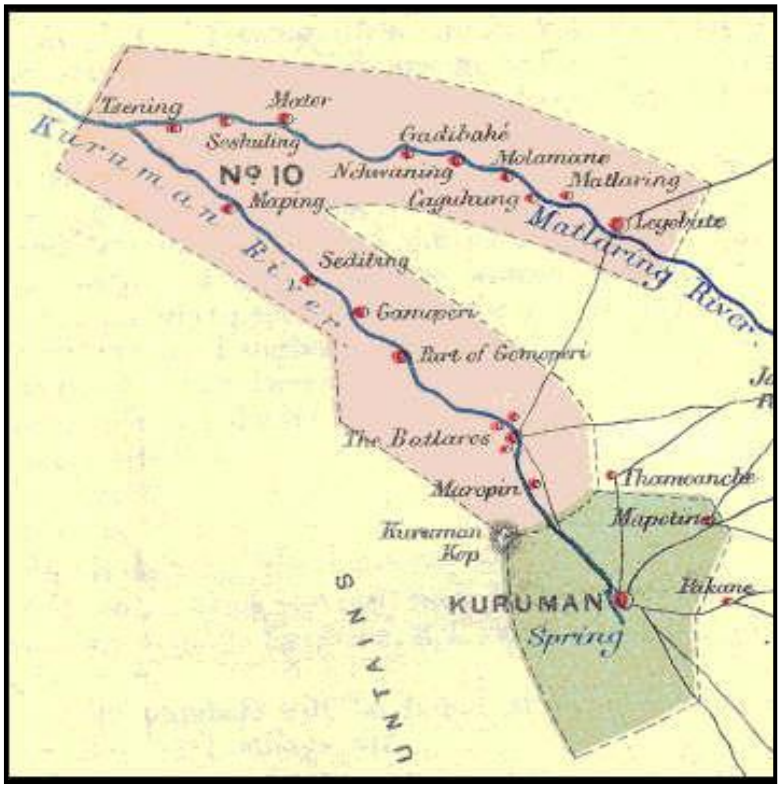


Figure 11 - Map showing the original demarcation of the Lower Kuruman Native Reserve.

3.6.3 **The Langeberg Rebellion**

During 1897 conflict broke out between the authorities and a Thlaping leader from Taung, Galeshewe. The conflict arose after some of Galeshewe's cattle that were infected by Rinderpest had to be destroyed. After killing an officer, Galishewe fled to the Thlaro leader, Toto, of the Langeberg. Subsequently, a full-scale rebellion broke out that was eventually suppressed (Breutz, 1963).

Figure 12 – Photograph of Galeshewe (National Archives, TAB, 36277).

Although most of the activities associated with the rebellion took place away from the study area and surrounding region, it is evident from the historical records documenting the rebellion that some activities did take place in the vicinity. On 13 June 1897, for example, a battle took place between Inspector Berrangé's Cape Police and a large force under Galishewe at Tsineng (Dalgerty, 1898).

Another incident which took place in the area was the killing of J.P. and Edward Drotskie in the vicinity of Boeredraai (Snyman, 1992). It can be expected that the movement of military units must have taken place a number of times in the area as well. From the British records, for example, it is known that military patrols traversed the area between Kuruman and Tsineng, as well as along the Ga-Mogara river. Furthermore, on 20 June 1897 a large force of "rebel reinforcements" were observed between Upper and Lower Dikgathlong on their way to the Langeberg.

3.7 Settlement of White Farmers

Background information on the settlement of white farmers in the area

According to Smit (1966) the farm Boerdraai 228, which is adjacent and to the west of the farm Wessels 227, was always seen as situated on the edge of the real desert.

Although some white farmers did travel down the Kuruman River to settle in the vicinity of Boeredraai during the latter part of the 19th century, by 1897 most of them had moved away again.

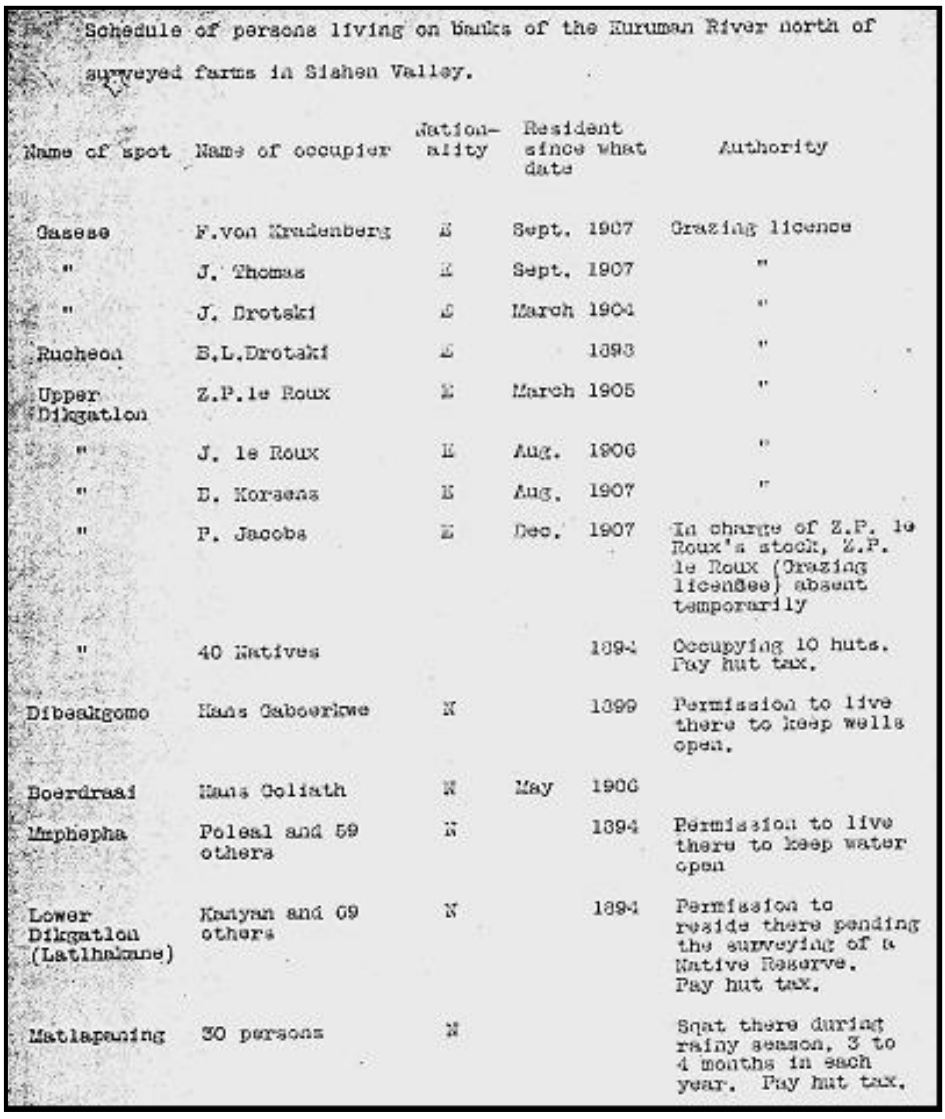
The first white people to settle on a permanent basis in the area were the Le Roux family who established themselves at Dikgathlon. More families followed and subsequently also settled in the area. During a period of great drought between 1907 and 1908 many farmers of the then Cape Colony moved into these areas along the edge of the Kalahari Desert in search of better grazing for their cattle (Smit, 1966).

When the First World War (1914-1918) broke out, and the South African Union Government decided to attack German South West Africa, the Union troops needed water to sustain them along the way. As a result a number of boreholes were dug all along the banks of the Kuruman River. These boreholes were drilled at places such as Eensaam, Kameelrus, Murray, Springputs and Van Zylsrus (Smit, 1966; Van der Merwe, 1949).

After the war, farmers established themselves at these localities as borehole watchmen, and in exchange for these duties were allowed free grazing rights on the surrounding land. Subsequently, even more boreholes were sunk by the Department of Lands (Smit, 1966; Van der Merwe, 1949).

Since the formulation of the Land Settlement Act No. 12 of 1912 as amended by Act No. 23 of 1917, numerous farms in the vicinity of the study area had been allocated to white farmers. By 1921 almost all of the land surrounding the *Lower Kuruman Native Reserve* had become occupied.

At the end of the First World War the Department of Lands started distributing the farms on application under very lenient conditions. Many of the people who was already established as borehole watchmen and tenants were given first choice to apply for the farms on which they were residing (Smit, 1966).



Schedule of persons living on banks of the Kuruman River north of surveyed farms in Siahen Valley.

Name of spot	Name of occupier	Nationality	Resident since what date		Authority
Gasese	F.von Krudenberg	E	Sept.	1907	Grazing licence
"	J. Thomas	E	Sept.	1907	"
"	J. Drotski	E	March	1904	"
Rucheon	B.L.Drotski	E		1893	"
Upper Dikgatlon	Z.P.le Roux	E	March	1905	"
"	J. le Roux	E	Aug.	1906	"
"	D. Korsens	E	Aug.	1907	"
"	P. Jacobs	E	Dec.	1907	In charge of Z.P. le Roux's stock, Z.P. le Roux (Grazing licendee) absent temporarily
"	40 Natives			1894	Occupying 10 huts. Pay hut tax.
Dibeakgomo	Hans Gaboerkwe	N		1899	Permission to live there to keep wells open.
Boerdraai	Hans Goliath	N	May	1906	
Lmphepha	Poleal and 59 others	N		1894	Permission to live there to keep water open
Lower Dikgatlon (Latlhakane)	Kanyan and 69 others	N		1894	Permission to reside there pending the surveying of a Native Reserve. Pay hut tax.
Matlapaning	30 persons	N			Squat there during rainy season, 3 to 4 months in each year. Pay hut tax.

Figure 13 - Police document listing all the people who resided on the banks of the Kuruman River at the time of an inspection in 1908. The names of a number of the early white pioneers in the area are also listed here.

Many farms were distributed during this time, so much so that by 1929 all the farms up to Vanzylsrust were already handed out (Smit, 1966).

3.7.1 **Farm Surveys**

During the 1910s a full scale survey of large portions of the region was undertaken by Dirk Roos and Hendrik Wessels. While Wessels was concerned with surveying the farms from Dingle and Sishen up to Cobham and Shirley, Dirk Roos was responsible for the surveying of the farms from Mamatwan in the south to areas further north of the Kuruman River (Samangan, 1977).

Many stories are told about these two pioneering characters. As they were allowed to name the farms they surveyed, most of the farms names appearing on maps of the area were created by them. The farm Wessels, for example, was named by Dirk Roos in honour of his colleague Hendrik Wessels. Mamatwan, another farm forming part of this study, was derived from the Tswana name for a bat.

One of the more well-known stories relates to the naming of the farm Hotazel. Dirk Roos was assisted at the time by Veldcornet J.U. Waldeck. One evening, after a long day's work in the hot Kalahari sun Roos sat down at the camp and remarked: "*What about a name for the farm? Phew! What a day! What a place! Hot as hell.*" Waldeck replied with the words "*That's it. The perfect name for it – hot as hell*" (Samangan, 1977:19 & 20). The wording was slightly changed to "*Hotazel*" and this version was used as the farm name on the survey diagram.

FARM NAME	DATE
Dibiaghomo 266	**1914**
Dikgathlong 268	**1924**
Goold 329	**1928**
Hotazel 280	**1914**
Mamatwan 331	**1914**
Middelplaats 730	**1929**
Wessels 227	**1914**
York 279	**1914**

3.8 Mining

The study area and surrounding region is today well known for its manganese mines. The importance of manganese lies in the fact that it is used in the manufacture of carbon steel.

The history of modern manganese mining in the area can be traced back to Dr. A.W. Rogers, who published a record of the geology of present-day Botswana and Griqualand West as part of the annual report of the Geological Commission of the Cape Colony in 1906. What is significant about his publication is that Rogers found that the well-known hill from the area known as Black Rock consisted largely of manganese, a mineral ore previously undiscovered in the Cape Colony.

The next important person to appear on the scene was Dr. L.G. Boardman. While employed by the Government Geological Survey as a geologist, Dr. Boardman investigated the manganese deposits at Black Rock during or directly after 1940. He was very excited by the extent of the manganese, and published his findings in a paper he wrote for the Geological Society of South Africa.

Even before the visit by Dr. Boardman, a prospector by the name of A.T. Fincham had felt that the area surrounding the Black Rock outcrop may also contain manganese. As a result he obtained options on a number of farms surrounding Black Rock. He approached the mining company S.A. Manganese with these farm options, but they felt that the Black Rock area was too isolated at the time. Fincham approached Ammosal as well, who took over his options on three farms and after a further assessment by geophysicist Oscar Weiss, decided to mine the Black Rock area during mid-1940.

During 1950 S.A. Manganese was again approached by Fincham regarding new options on farms surrounding Black Rock. Although the mining company was not interested Dr. Boardman, who had joined their ranks earlier, convinced the board to at least investigate the Black Rock area. Boardman subsequently surveyed a large tract of land, including the farms Wessels, Mamatwan, Dikgathlong and Dibiaghomo. He found very promising results over large sections of land, and a drilling rig soon arrived. The first borehole was drilled on Wessels, and after disappointing results it was moved to Dibiaghomo. Here, at a depth of 280 meters, ore containing a very high manganese percentage was reached. Other boreholes in the area yielded similar results and the freehold to a number of farms was obtained. When information about these discoveries leaked out and reached Ammosal, a

tussle broke out between the two companies to obtain freeholds to as many farms in the mineral-rich area as possible.

Although mining operations started in earnest on Smartt, S.A. Manganese's attention was soon drawn to the farm Hotazel where very promising results were also found. A whole village was constructed on the farm, and the Hotazel mine was officially opened on 19 November 1959.

During the early 1960s S.A. Manganese Limited (Samangan) at the time had options on 18 farms, including the farms Mamatwan and Goold on the southern edge of the ore body. Although Mamatawan had been prospected, only low grade manganese ore could be found. However, the ratio between iron and manganese from Mamatwan was believed to be excellent. During this time Ammosal had started mining on the adjacent farms of Devon and Adams, and it was not long before the decision was made to commence mining operations on Mamatwan as well.

After a crushing and screening plant was erected at Mamatwan the mine began producing in November 1963. During the 1970s the mine reached a production output of more than one million tons a year (Samangan, 1977).

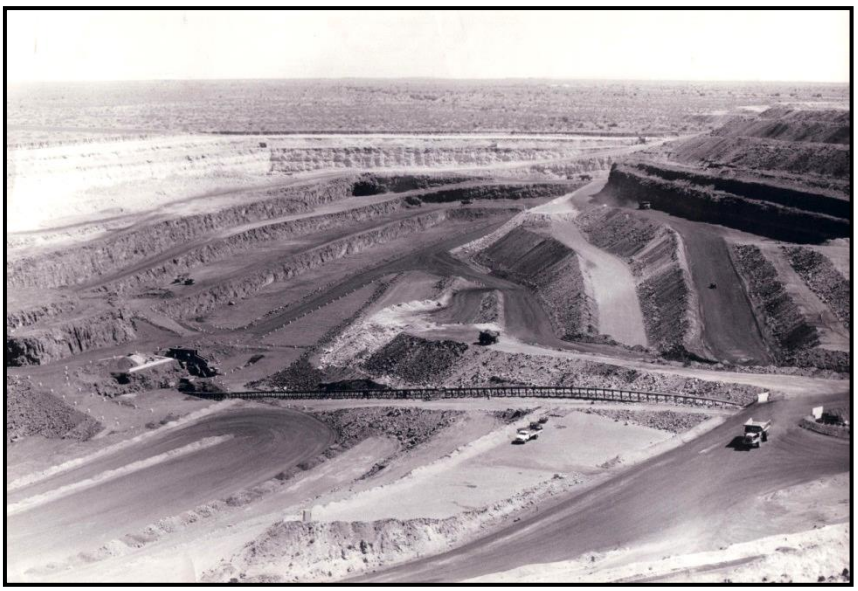


Figure 14 "A view of the huge open-cast manganese ore mine of Samancor at Mamatwan…" The photograph was taken during August 1982 (National Archives, TAB, 16396).

Although the mining rights of the farm Wessels had been acquired by S.A. Manganese in 1952, and even though some prospecting work had taken place, it was not until 1965 that the farm was again investigated.

By January 1969 20 boreholes had been sunk on the farm Wessels, Dibiaghomo and Dikgathlong, which revealed three bands of manganese ore, of which the top and bottom bands were considered mineable.

The official opening of Wessels mine took place on 2 May 1973. By 1976 the mine was producing 750 000 tons of ore a year (Samangan, 1977).

3.9 Possible heritage sites

As mentioned elsewhere, a number of old houses are shown on the old survey diagrams for the farms Wessels and Middelplaats. These houses represent some of the earliest white settlement in the area and as such are of historic significance. Any remaining houses should therefore be documented and mitigated.

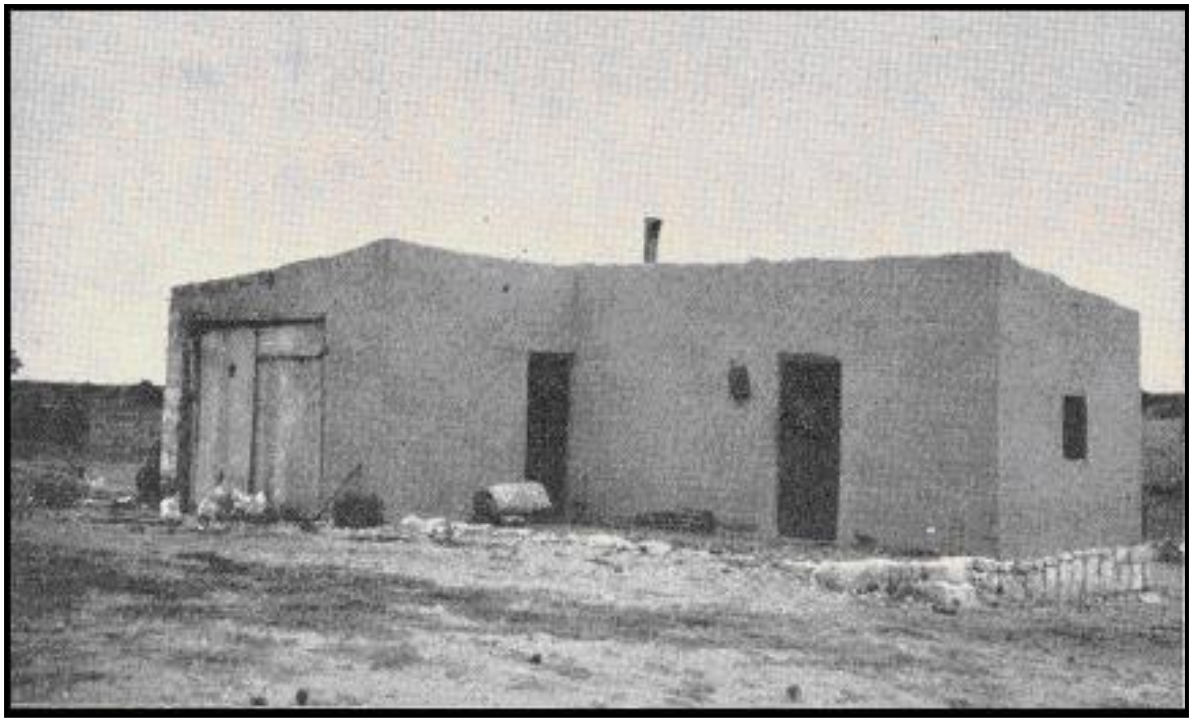


Figure 15 - Historic photograph of an early farmer's dwelling along the Kuruman River (Van der Merwe, 1949).

It should also be noted that many of the archival maps show an old road following the Ga-Mogara River. This road seems to at least have existed during the 1890s. It is possible that the old road transects some of the properties included in this study.

3.10 Conclusions

This archival study has revealed important aspects about the history of the area. Certainly some of the key aspects emanating from this study are firstly, the relative low human presence for the dry regions surrounding the study area and, secondly, a tendency for human settlements in these areas to be located on or near the water courses.

4 IMPACT ASSESSMENT

The impact assessment rating is based on the rating scale as contained in **Appendix D and E**.

4.1 Field work Methodology

On Tuesday, 18 August 2015 a walkthrough was carried out by an experienced fieldwork team comprising one archaeologist (Polke Birkholtz) and one field assistant (John Anderson). The focus of the fieldwork was placed on the footprint area of the proposed road extension, associated soil berm and river diversion on the farm Kipling.

On the day of the fieldwork an on-site meeting took place with Mr. Kelly Byrne.

Tracklogs of the fieldwork was logged and is depicted in **Figure 16.** All structure identified were logged with handheld GPS and documented with digital camera.

During the field work, two archaeological sites were identified. The position of these sites is illustrated in Figure 16. Further information regarding the identified archaeological sites are provided below.

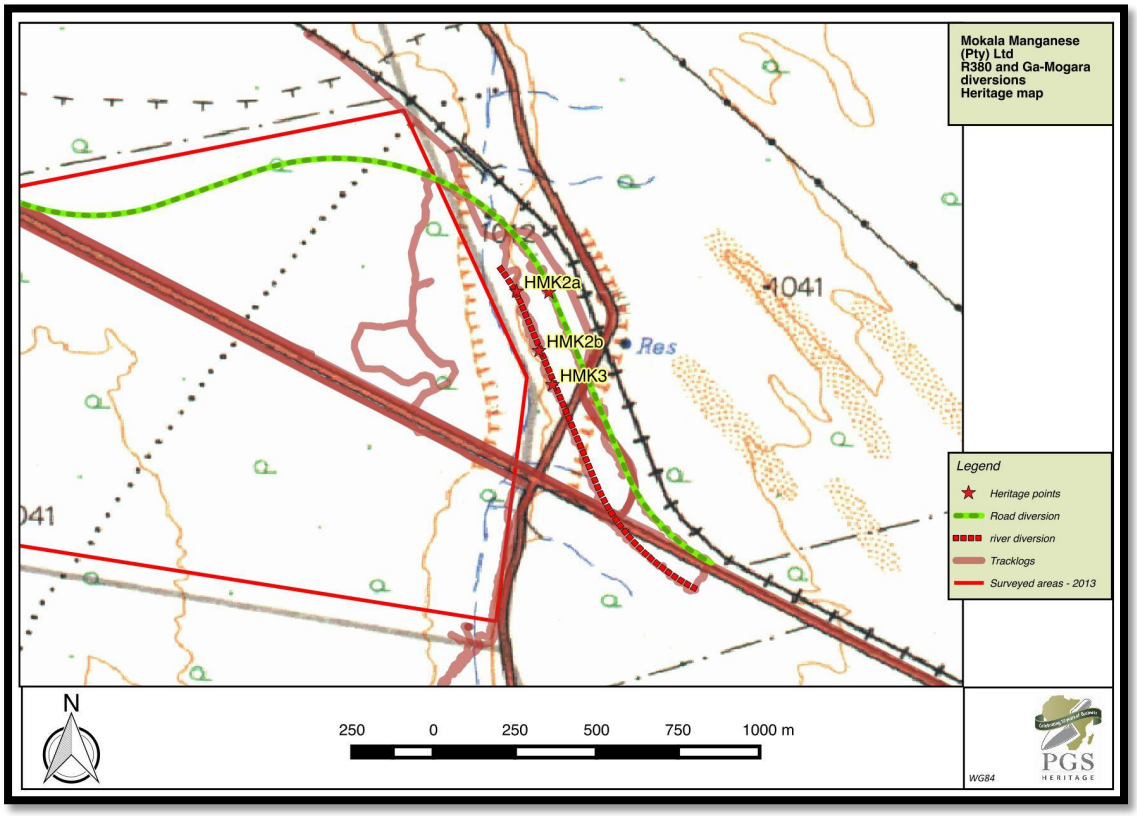


Figure 16 – Map with track logged survey including the identified heritage sites

4.2 General Description

Significant disturbance of a section of the eastern bank of the Ga-Mogara River was observed. This disturbance may have been the result of calcrete quarrying activities through the calcrete bank of the river (Figure 17). As a result, significant disturbance occurred to Stone Age sites and material which would have been located along the higher slopes and tops of these calcrete banks. Later Stone Age, Middle Stone Age as well as some Early Stone Age material could be identified along the spoil heaps (Figure 18) resulting from the disturbance.

Figure 17 – Disturbance of river bank

Figure 18 – Berms pushed in the red sands of river bank

Figure 19 – Lithics present in disturbed soil

Figure 20 – Large lithic core identified in spoil heaps

Figure 21 – Disturbance calcrete outcrop in river bed

Figure 22 – View of the calcrete deposits in the general vicinity of the proposed river alignment

Figure 23 shows the typical red Kalahari Sand characterising large sections of the study area. The photograph was taken outside of the footprint area, but on the same farm.

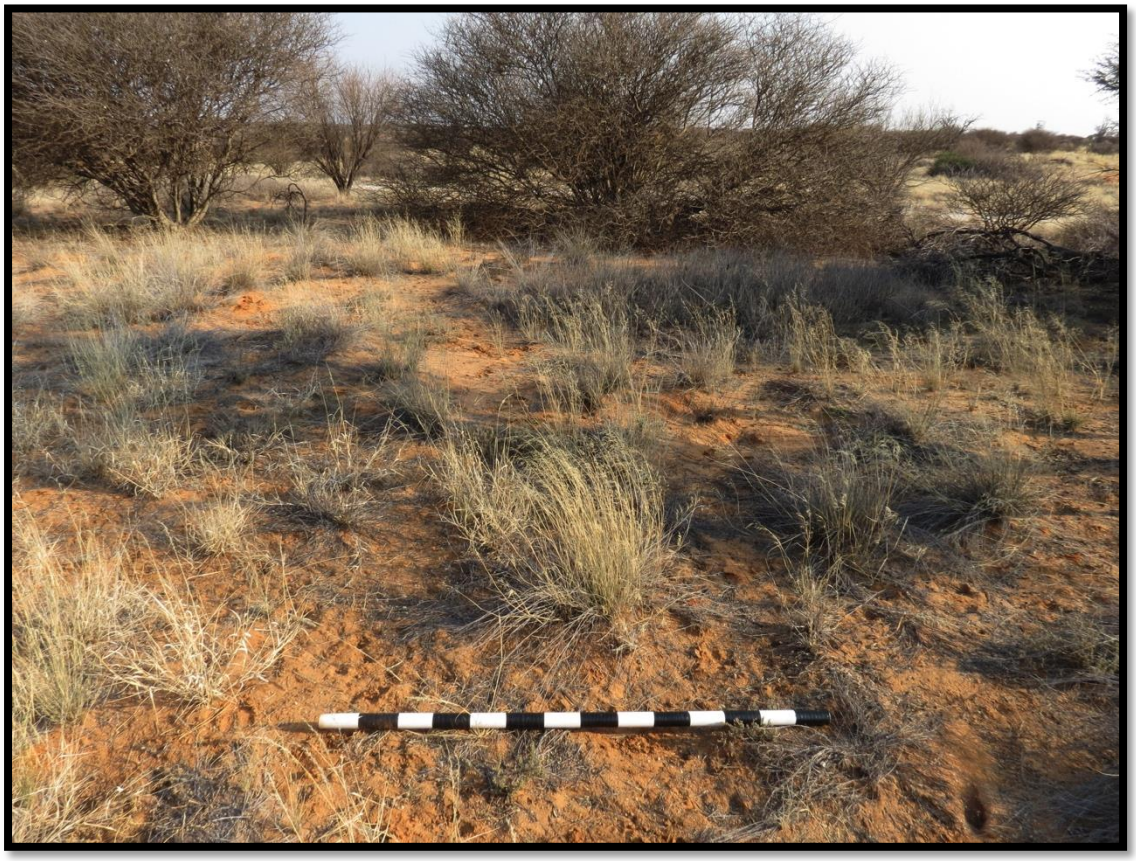


Figure 23 – General view of undisturbed red sands

4.2.1 **Archaeological Site – HMK1**

GPS Coordinates: S 27° 11' 11.3" E 22° 55' 17.5"

A low density surface scatter of Middle Stone Age and Later Stone Age material was identified here. While the general surroundings of the site is characterised by red Kalahari Sand, the site is located in an area where a pebble layer had been exposed to the surface by erosion.

Approximately 15 individual lithics were identified in an area roughly 25m square, with the highest concentration found to be two lithics within a 1m square block. The lithics were manufactured from hornfels and jasper material and is generally rough flakes with minimal retouch.

The Ga-Mogara River is located roughly 180m west of the site.

In accordance to the classification standards as prescribed by SAHRA (**Appendix D**), the evaluation of the density of the lithics scatter and its extent gives the site low heritage significance and it is graded as **Generally Protected GP.C.**

Figure 24 – View of site (HKM1)

Figure 25 – MSA Lithics found on site (HKM1)

Impact Evaluation:

The impact rating provided below is based on the methodology described in A**ppendix E**. The impact rating below assumes that no mitigation measures have been implemented.

IMPACT	SEVERITY	SPATIAL SCALE	DURATION	CONSEQUENCE	PROBABILITY	SIGNIFICANCE
Destruction of archaeological site	Low	Low	High	**Medium**	**Medium**	**Low**

The impact significance is rated as low, as it may be possible that the site can be impacted by the construction activities of the realignments. Heritage Resources are none renewable, and an impact on such a site can lead to permanent destruction of the site. However the site has a low heritage significance and no further mitigation will be required. The documentation of this site in this report is deemed sufficient and no further permitting for destruction will be required.

4.2.2 **Archaeological Site – HMK2**

GPS Coordinates:

S 27° 11' 11.2" E 22° 55' 13.9"

S 27° 11' 17.8" E 22° 55' 16.4"

Middle Stone Age and Later Stone Age material was identified over an area roughly 220m in extent along the higher slope and top of the calcrete banks on the eastern end of the GaMogara River. The locality was chosen due to the closeness of the water source as well as the availability of a large amount of raw material present on the calcrete banks. Pockets of Red Kalahari Sand are also present on the site.

While the entire number of lithics from the site could not be counted, 11 lithics were identified in a 10m square area where the concentration of material appeared the highest. The highest concentration of lithics per 1m square block that could be counted was six. This indicates that the Stone Age material is only present in low densities, although it extends over a very wide area.

Raw materials used include red and brown jasper as well as quartzite and quarts.

The Ga-Mogara River is located directly west of the site.

In accordance to the classification standards as prescribed by SAHRA (**Appendix D**), the evaluation of the density of the lithics distribution and the extent of the site gives it low to medium heritage significance and it is graded as **Generally Protected GP.A.**

Figure 26 – View of red sands on eastern bank of the river at HMK2

Figure 27 – Exposed pebble layer at HMK2

Figure 28 – MSA lithics (HMK2)

Impact Evaluation:

The impact rating provided below is based on the methodology described in **Appendix E**. The impact rating below assumes that no mitigation measures have been implemented.

IMPACT	SEVERITY	SPATIAL SCALE	DURATION	CONSEQUENCE	PROBABILITY	SIGNIFICANCE
Destruction of archaeological site	Moderate	Low	High	**Medium**	**Medium**	**Medium**

The impact significance is rated as medium, as it may be possible that the site can be impacted by construction activity if not demarcated. Heritage Resources are none renewable, and an impact on such a site can lead to permanent destruction of the site.

Mitigation:

- A qualified archaeologist must monitor the construction activity in the vicinity of HMK2 during the construction of the realignment and associated earth works.

4.2.3 **Archaeological Site – HMK3**

GPS Coordinates: S 27° 11' 21.6" E 22° 55' 17.9"

A low density surface scatter of Middle Stone Age material was identified on the eastern bank of the GaMogara River. Partially exposed sections of a calcrete bank with a dense pebble layer as well as red Kalahari Sand defines the site. The site would have been well chosen due to the closeness of water in the nearby river and the availability of good quality raw material .

Approximately eight individual lithics were identified in an area roughly 10m square, with the highest concentration found to be four lithics within a 1m square block.

The Ga-Mogara River is located directly west of the site.

In accordance to the classification standards as prescribed by SAHRA (**Appendix D**), the evaluation of the density of the lithics distribution and the extent of the site gives it low heritage significance and it is graded as **Generally Protected GP.C.**

Figure 29 – View of red sands on eastern bank of the river at HMK3

Figure 30 – MSA lithics (HMK3)

Impact Evaluation:

The impact rating provided below is based on the methodology described in A**ppendix E**. The impact rating below assumes that no mitigation measures have been implemented.

IMPACT	SEVERITY	SPATIAL SCALE	DURATION	CONSEQUENCE	PROBABILITY	SIGNIFICANCE
Destruction of archaeological site	Low	Low	High	**Medium**	**Medium**	**Low**

The impact significance is rated as low, as it may be possible that the site can be impacted by the construction activities of the realignments. Heritage Resources are none renewable, and an impact on such a site can lead to permanent destruction of the site. However the site has a low heritage significance and no further mitigation will be required. The documentation of this site in this report is deemed sufficient and no further permitting for destruction will be required.

Refer to **Appendix B** for distribution maps of heritage sites.

4.2.4 **Palaeontology**

An independent palaeontological specialist was appointed by PGS to undertake the necessary work to determine whether or not any significant palaeontological resources where located on the farm Gloria 266. The findings indicate that the geology on the farm Gloria is the same as on the farm Kipling 271, thus the same impact assessment and mitigation measures will apply. A summary of the result of the palaeontological report are provided below. Refer to **Appendix A** for the complete palaeontological study.

The palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself.

The palaeontological sensitivity of the Kalahari Formation can be described as low and it is not foreseen that the proposed project will have any significant palaeontological impact.

The palaeontological sensitivity of pre-Kalahari formations can also be regarded as low, with no exposures in the study area.

The proposed boreholes have the potential to cut into algal structures, called "Stromatolites", and if these are present, it will be of a high significance for palaeontology.

Impact Evaluation

Based on the findings of the palaeontological study, no palaeontological resources are expected to occur on the farm Kipling 271 so no impacts are considered.

Mitigation:

The developer and the ECO must be made aware of the possible presence of stromatolites in the pre-Kalahari Formations and if recorded in future drilling operations, a palaeontologist must be informed and appropriate actions taken in the event of future mining of the stratigraphic units.

5 HERITAGE MANAGEMENT GUIDELINES

5.1 General Management Guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-

(a) the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site-

  (i) exceeding 5 000 m^2 in extent; or

  (ii) involving three or more existing erven or subdivisions thereof; or

  (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

  (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA.

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the SAHRA needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. If a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA) and or the Association of Professional Heritage Practitioners (APHP).

This survey and evaluation must include:

(a) The identification and mapping of all heritage resources in the area affected;

(b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Heritage Resources Act;

(c) An assessment of the impact of the development on such heritage resources;

(d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the **SHEQ training** given to contractors involved in surface earthmoving activities. These sections must include basic information on:

    a) Heritage;
    b) Graves;
    c) Palaeontology;
    d) Archaeological finds; and
    e) Historical Structures.

    This module must be tailor made to include all possible finds that could be expected in that area of construction.

4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.

5. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.

6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.

7. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.

8. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.

9. In the event that human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation of the finds made.

10. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process.

Table 1: Roles and responsibilities of archaeological and heritage management

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should attend all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology support team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology support team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into the employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites.	The client	Environmental Consultancy and the Archaeologist
After the specialist/archaeologist has been appointed, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

5.2 All phases of the project

5.2.1 Archaeology

Based on the findings of the HIA, all stakeholders and key personnel should undergo an archaeological induction course during this phase. Induction courses generally form part of the employees' overall training and the archaeological component can easily be integrated into these training sessions. Two courses should be organised – one aimed more at managers and supervisors, highlighting the value of this exercise and the appropriate communication channels that should be followed after chance finds, and the second targeting the actual workers and getting them to recognize artefacts, features and significant sites. This course should be reinforced by posters reminding operators of the possibility of finding archaeological/palaeontological sites. **This needs to be supervised by a qualified archaeologist.**

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area and small scale infrastructure development associated with the project/operations.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to during the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction/operational phase, it is important to recognise any significant material being unearthed, and to make the correct judgment on which actions should be taken. A responsible archaeologist must be appointed for this commission. This person does not have to be a permanent employee, but needs to attend relevant meetings, for example when changes in design are discussed, and notify SAHRA of these changes. The archaeologist would inspect the site and any development on a recurrent basis, with more frequent visits to the actual workface and operational areas.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Plan (EMP) of the project. Should an archaeological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery.

SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist available to do such work.

5.2.2 **Procedure**

In the case where archaeological finds are identified during construction the following measures must be taken:

- Upon the accidental discovery of archaeological finds, a buffer of at least 20 meters should be implemented.
- If archaeological finds are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find.
- If the evaluation of the finds require further documentation and mitigation such as excavations, surface collections and/or in situ documentation, a permit must be applied from SAHRA.
- This documentation and mitigation must conform to the guidelines and requirements of SAHRA and international accepted standards.

5.2.3 **Procedure for discovery of human remains / graves**

In the case where a grave is identified during construction the following measures must be taken:

- Upon the accidental discovery of graves, a buffer of at least 20 meters should be implemented.
- If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the

remains a permit must be applied for from SAHRA and other relevant authorities. The local South African Police Services must immediately be notified of the find.

- Where it is recommended that the graves be relocated, a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

i. A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
ii. Site notices indicating the intent of the relocation;
iii. Newspaper notices indicating the intent of the relocation;
iv. A permit from the local authority;
v. A permit from the Provincial Department of Health;
vi. A permit from the South African Heritage Resources Agency, if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
vii. An exhumation process that keeps the dignity of the remains intact;
viii. The whole process must be done by a reputable company that is well versed in relocations;
ix. The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the developing company.

6 CONCLUSIONS AND RECOMMENDATIONS

In general, heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant, where applicable.

Palaeontology

Although the palaeontological sensitivity of the study area is found to be low, the possibility of encountering “Stromatolites” during construction does exist.

Mitigation

The developer and the ECO must be made aware of the possible presence of stromatolites in the pre-Kalahari Formations and if recorded in future drilling operations, a palaeontologist must be informed and appropriate actions taken in the event of future mining of the stratigraphic units.

Archaeology

Previous studies conducted in the larger Hotazel and Black Rock areas has shown that the archaeological record is temporally confined to the Middle and Later Stone Age, while spatially distribution of such sites is concentrated around the riverine edges due to the harsh climate of the area.

Field work has confirmed this and of the three archaeological site associated with the MSA were identified in the study area.

Mitigation

Site HMK2 must be monitored by a qualified archaeologist during construction and where required further mitigation measures implemented through the guidelines provided in Section 5 of this report.

If at any stage the site is disturbed a qualified archaeologist must be contracted to evaluate the damage and make recommendations on the appropriate mitigation measures.

General

Further to these recommendations the general Heritage Management Guidelines in Section 5, need to be incorporated into the EMP for the project.

The overall impact of the development on heritage resources is seen as acceptably low and impacts can be mitigated to acceptable levels. It follows that if the management measures outlined in this report are implemented there is no reason why the development of the proposed Mokala Manganese Mine should not be approved.

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Appendix A

PALAEONTOLOGICAL DESKTOP STUDY

PALAEONTOLOGICAL DESKTOP ASSESSMENT OF THE FARM GLORIA 266, NEAR HOTAZEL TOWN IN THE JOHN TOALO GAETSEWE DISTRICT MUNICIPALITY IN THE NORTHERN CAPE PROVINCE

Developer: Ntsimbintle Mining (Pty) Ltd

For:

HIA CONSULTANTS

DATE: 08 April 2013

By

GIDEON GROENEWALD

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontological impact of the proposed drilling of 30 additional boreholes for related prospecting and future mining activities on the farm Gloria 266, situated near Hotazel town in the John Toalo Gaetsewe District Municipality in the Northern Cape Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

Ntsimbintle Mining (Pty) Ltd (Ntsimbintle) currently undertakes prospecting related activities in accordance to its approved environmental management plan (EMPlan) (NC30/5/1/1/3/2/1/1250 EM) on the farm Gloria 266. The approved EMP was amended in September 2012 to cater for approximately 120 boreholes. To date Ntsimbintle has drilled a total of 31 boreholes on the farm Gloria 266. Ntsimbintle is proposing to drill an additional 30 boreholes on the farm Gloria 266 within the next three years

The proposed development site is underlain by claystone, calcrete and dune sand of the Cretaceous to Tertiary Kalahari Formation, which is in turn underlain by remnants of the Dwyka tillite of the Karoo Supergroup and Proterozoic aged Hotazel Iron Formation and underlying Ongeluk lava Formation.

Literature reviews and reports associated with Heritage Conservation make no mention of any palaeontological finds in the Kalahari Formation in this region. Although it is known that certain facies in the Dwyka Formation contains trace fossils and vertebrate fossils, highly breciated nature of the formation in this area will exclude fossils. Algal growth structures, known as “Stromatolites” are well-known fossil structures, described from the dolomites of the Transvaal Supergroup

Recommendation:
The developer and the ECO must be made aware of the possible presence of “Stromatolites” in the pre-Kalahari Formations and if recorded in future drilling operations, a palaeontologist must be informed and appropriate actions taken in the event of future mining of the stratigraphic units.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Background

Gideon Groenewald was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontological impact of the proposed drilling of 30 additional boreholes for related prospecting and future mining activities on the farm Gloria 266, situated near Hotazel town in the John Toalo Gaetsewe District Municipality in the Northern Cape Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

1.2 Aims and Methodology

Following the *"SAHRA APM Guidelines: Minimum Standards for the Archaeological & Palaeontological Components of Impact Assessment Reports"* the aims of the palaeontological impact assessment are:

- to identifying exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources.

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 below.

Table 1.1 Palaeontological Sensitivity Analysis Outcome Classification

Sensitivity	Description
Low Sensitivity	Areas where a negligible impact on the fossil heritage is likely. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

1.3 Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc).

2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

Ntsimbintle Mining (Pty) Ltd (Ntsimbintle) currently undertakes prospecting related activities in accordance to its approved environmental management plan (EMPlan) (NC30/5/1/1/3/2/1/1250 EM) on the farm Gloria 266. The approved EMP was amended in September 2012 to cater for approximately 120 boreholes. To date Ntsimbintle has drilled a total of 31 boreholes on the farm Gloria 266. Ntsimbintle is proposing to drill an additional 30 boreholes on the farm Gloria 266 within the next three years.

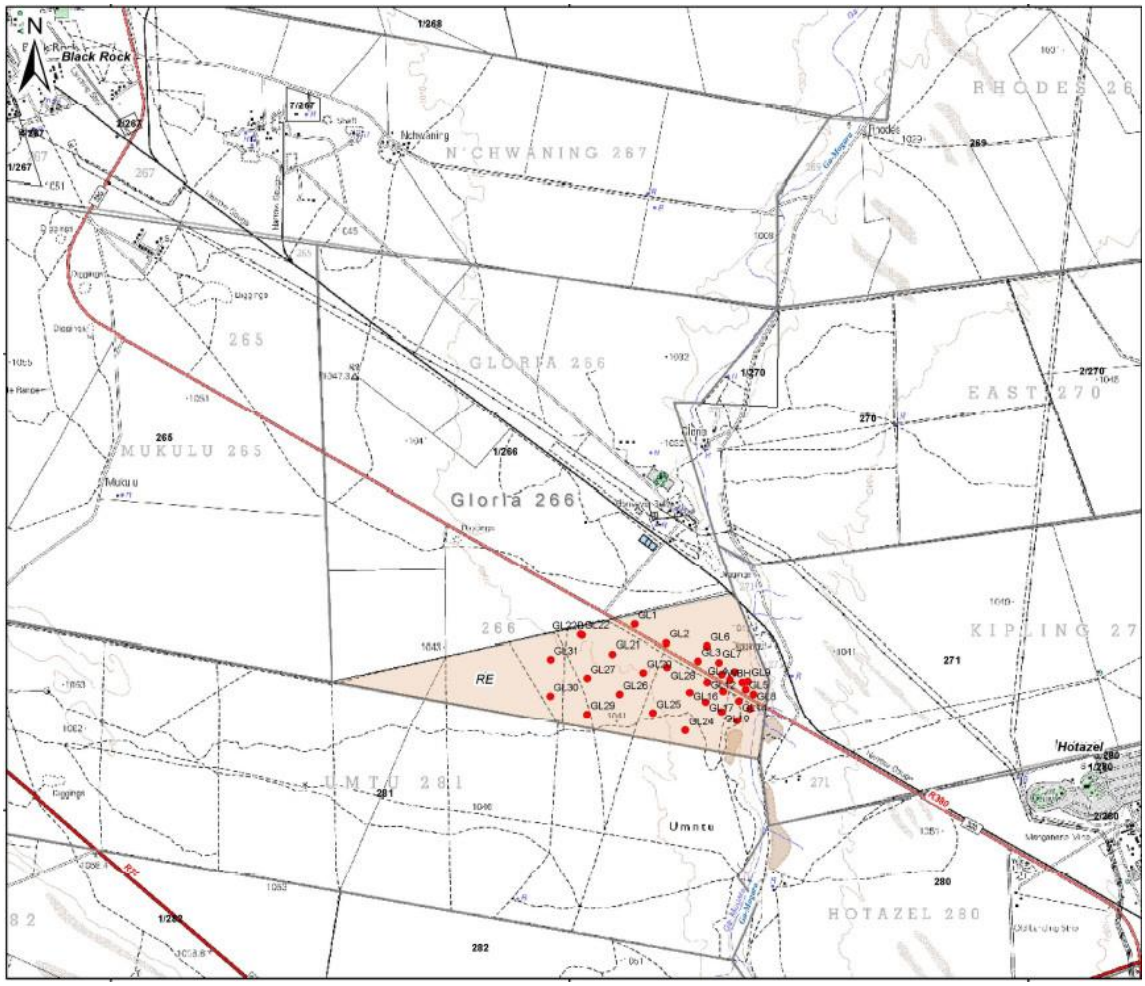


Figure 2.1 Location of the study area showing the localities of completed boreholes

Figure ***Error! No text of specified style in document.****..31* ***Google image of the study area***

3 GEOLOGY

The proposed development site is underlain by claystone, calcrete and dune sand of the Cretaceous to Tertiary Kalahari Formation, which is in turn underlain by remnants of the Dwyka tillite of the Karoo Supergroup and Proterozoic aged Hotazel Iron Formation and underlying Ongeluk lava Formation (Table 3.1) (Beukes, 1983 in Van der Merwe, 1997).

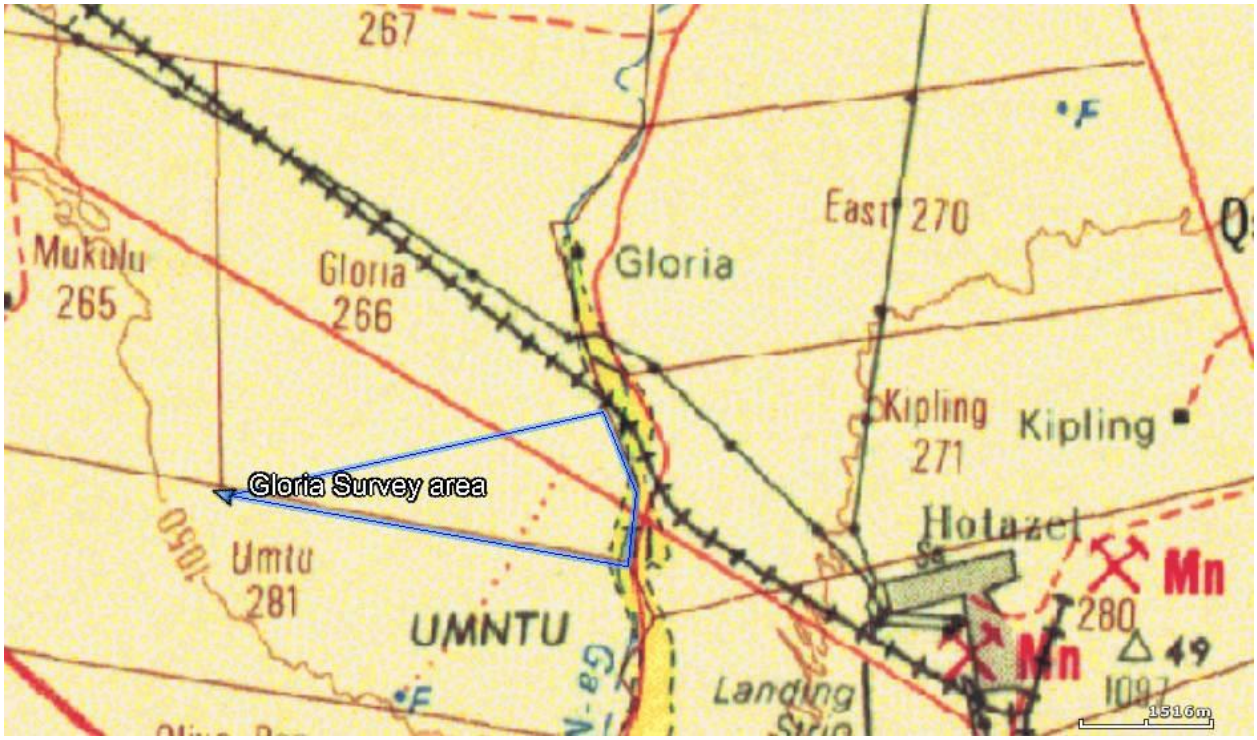


Figure ***Error! No text of specified style in document.****..32* ***Geology of the study area. The entire area is underlain by the Kalahari Formation with a small area in the East underlain by alluvium.***

Stratigraphy				Lithology
Kalahari Formation				Sand, Clay, Limestone
Karoo Supergroup				Dwyka Tillite
Olifantshoek Supergroup			Lucknow Formation	Quartzite
			Mapedi Formation	Red and grey shale
Transvaal Supergroup	Postmansburg Group	Voelwater Subgroup	Mooidraai Formation	Dolomite
			Hotazel Formation	Iron formation
				Upper Mn ore body
				Middle Mn ore body
				Iron formation
				Lower Mn ore body
				Mn-rich iron formation
				Iron formation
		Ongeluk Formation		Basaltic lava

3.1 Kalahari Formation

The Kalahari Formation is characterised by extensive sand dune deposits, with extensive outcrops of limestone along the banks of the GaMogara River. The limestone is interbedded with prominent calcareous conglomerate beds with predominantly clasts of Ongeluk lava and scattered clasts of banded iron stone and Jaspelite (Personal observation of the author)

3.2 Pre-Kalahari Geology

The underlying geology of the Karoo and Transvaal Supergroups is not exposed, and borehole evidence from the region confirms that the area is underlain by rocks of the Ongeluk lava and banded iron formations.

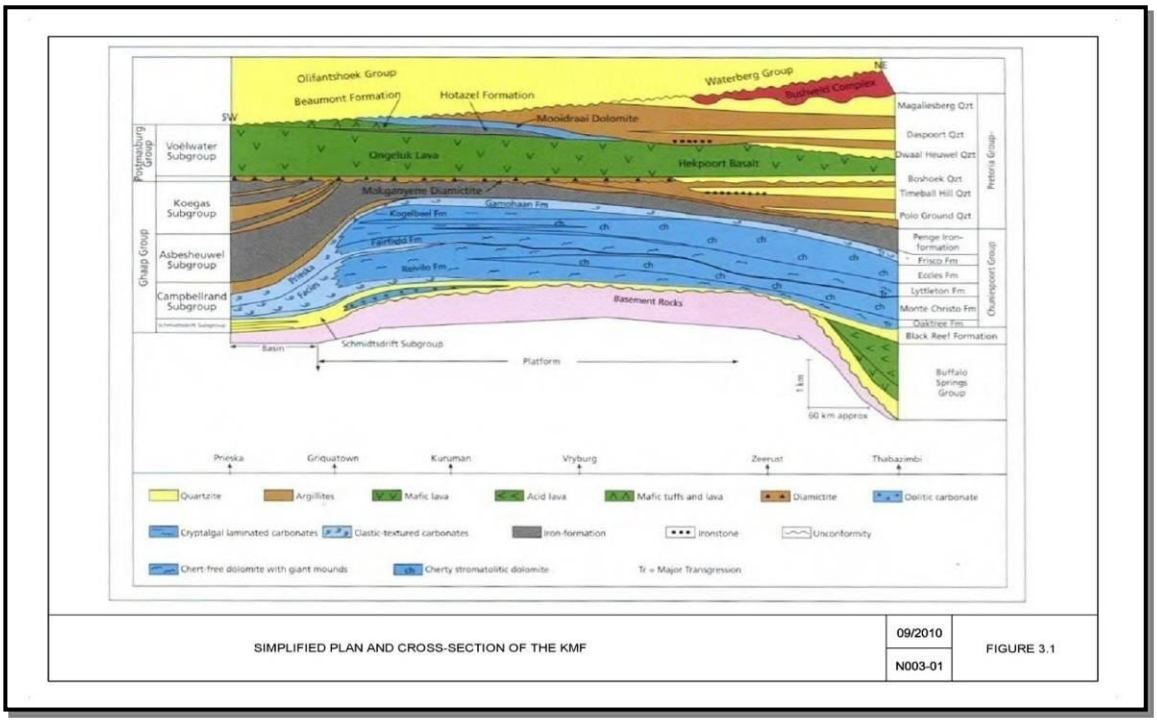


Figure ***Error! No text of specified style in document.****..33* ***Generalised plan of the geology of the Transvaal Supergroup is provided by Beukes (1983) and Van der Merwe (1997).***

4 PALAEONTOLOGY OF THE AREA

Literature reviews and reports associated with Heritage Conservation make no mention of any palaeontological finds in the Kalahari Formation in this region. Although it is known that certain facies in the Dwyka Formation contains trace fossils and vertebrate fossils, highly breciated nature of the formation in this area will exclude fossils. Algal growth structures, known as "Stromatolites" are well-known fossil structures, described from the dolomites of the Transvaal Supergroup.

4.1 Kalahari Formation

No fossils have been recorded from the Kalahari Formation. It is, however, likely that fossils might be present in the calcareous deposits of this formation.

Relicts of possible bone structure were observed by the author, but the structures are completely replaced by calcium and silica, making it virtually impossible to determine with any certainty what the original material was.

4.2 Pre-Kalahari Formations

The palaeontological importance of the Proterozoic Transvaal Supergroup is mainly associated with well-defined stromatolite structures in the dolomite deposits (Figure 4.1).

Figure 4.1 Typical stromatolite structures usually associated with dolomite deposits such as the dolomite of the Mooidraai Formation that overlies the Hotazel Formation. It is highly likely that structures such as in this photograph, might be exposed during exposure of the dolomite and Banded Iron Units in the Hotazel Formation (Photograph from Wikipedia 201) en.wikipedia.org/wiki/Stromatolite.

There are no outcrops of Pre-Kalahari Dwyka or older Transvaal Supergroup rocks in the study area and outcrops of the banded shale and thin dolomite zones that crop out on the main road between Hotazel

and Kuruman shows very poorly defined algal structures that probably represent micro-stromatolites (Figure 4.2).

Small scale algal structures were observed by the author in boreholes from the area. The structures in the borehole logs are mostly of small (cm) scale and associated with banded iron formation of the Hotazel Formation or the overlying dolomite of the Mooidraai Formation.

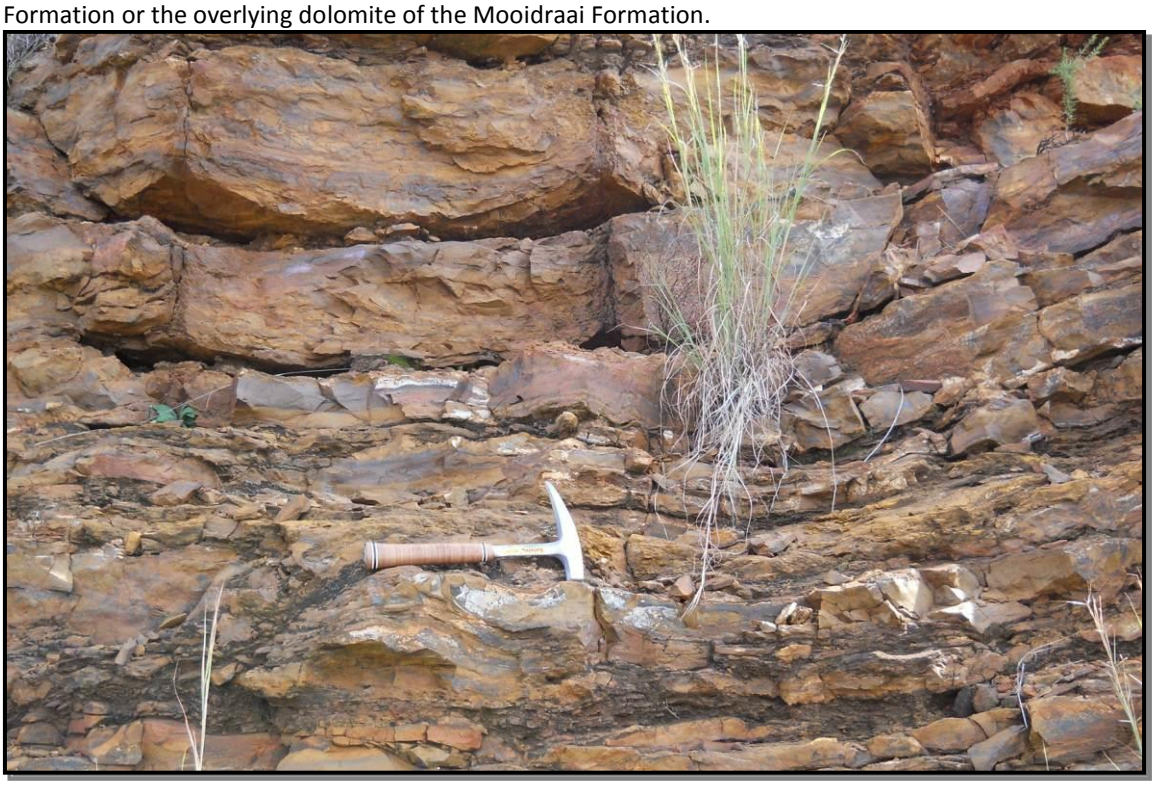


Figure 4.2 Poorly defined algal structures in outcrops of the Transvaal Supergroup between Hotazel and Kuruman

5 PALAEONTOLOGICAL SENSITIVITY

The palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units; ascertaining the fossil heritage from the literature and evaluating the nature and scale of the development itself.

The palaeontological sensitivity of the Kalahari Formation can be described as low and it is not foreseen that the proposed drilling of more boreholes will have any significant palaeontological impact.

The palaeontological sensitivity of pre-Kalahari formations can also be regarded as low, with no exposures in the study area.

The proposed boreholes have the potential to cut into algal structures, called “Stromatolites”, and if these are present, it will be of a high significance for palaeontology.

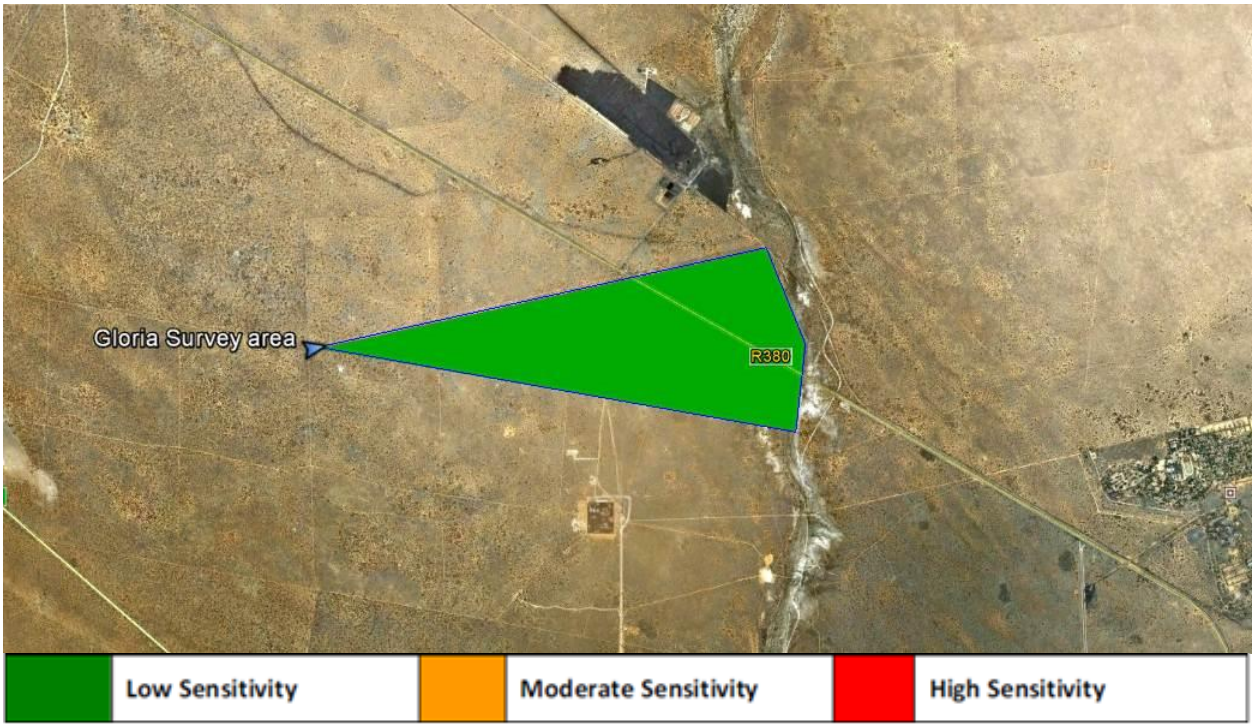


Figure ***Error! No text of specified style in document.****..34* ***Palaeontological sensitivity of the study area***

6 CONCLUSION AND RECOMMENDATIONS

The Cretaceous to Tertiary Kalahari Formation overlies the entire study area and outcrops of the more resistant limestone are restricted to the banks of the GaMogara River.

No conclusive evidence of fossils have been recorded in either of the red claystone, conglomeratic limestone, calcareous sandstone or sand dunes of the Kalahari Formation.

The Proterozoic aged Hotazel Formation within the Kalahari Manganese Basin is host to the world's largest land based manganese deposit. Three manganese-rich units are present within a banded iron formation (BIF) (Van der Merwe, 1997).

The mineralogical associations within the different iron formation facies reflect the chemistry of the environment during precipitation, leading to the formation of stromatolite structures when associated with algal growth.

Stromatolites might be present in the banded iron units of the Mooidraai Formation. From borehole log information it appears that the structures are poorly developed and are representative of micro-stromatolites if compared to the well-developed stromatolites in the dolomites of the Transvaal Supergroup.

Recommendation:
The developer and the ECO must be made aware of the possible presence of stromatolites in the pre-Kalahari Formations and if recorded in future drilling operations, a palaeontologist must be informed and appropriate actions taken in the event of future mining of the stratigraphic units.

7 REFERENCES

Johnson MR , Anhaeusser CR and Thomas RJ (Eds) (2006). The Geology of South Africa. GSSA, Council for Geoscience, Pretoria.

Van der Merwe SJ. (1997). Basin Analysis of the Kalahari Manganese Basin. Unpublished MSc Thesis, UOFS.

8 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

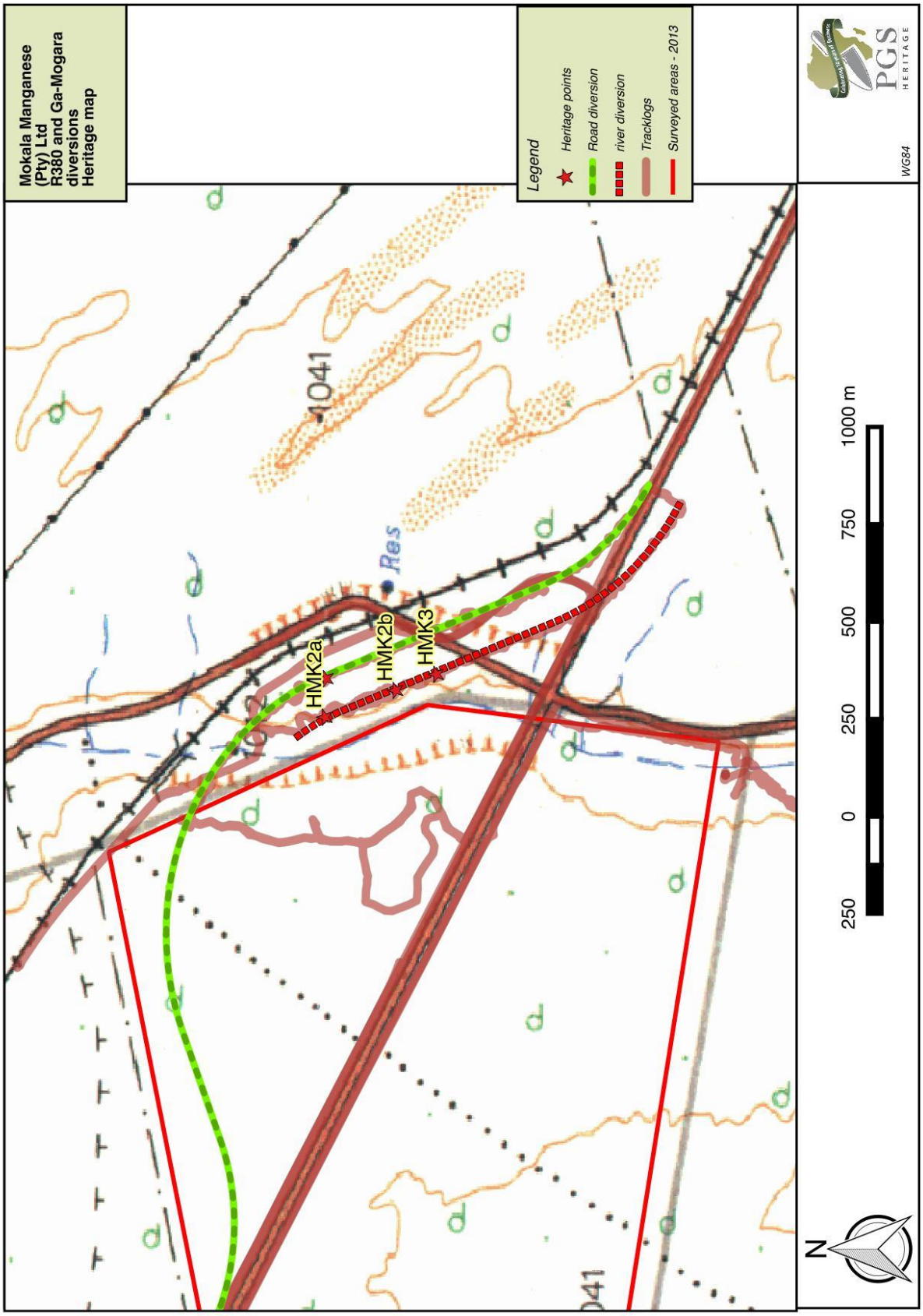
9 DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald
Geologist

Appendix B

HERITAGE MAP



Appendix C

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

3.1 General principles

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In the heritage legislation, permits are required to damage, destroy, alter, or disturb them. People who already possess such material are required to register it. The management of heritage resources isintegrated with environmental resources and this means that, before development takes place heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have an interest in the graves: they must be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle shouldbe identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the construction company's cost. Thus, the construction company will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:

An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection to, all historic and pre-historic cultural remains, including graves and human remains.

3.2 Graves and cemeteries

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 0f 2003) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or

regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years, fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 0f 2003) and are the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.

Appendix D

HERITAGE ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

The Heritage Impact Assessment (HIA) report compiled by PGS Heritage (PGS) for the ***the proposed Mokala project*** have assessed the significance of the heritage resources found on site by utilising the classification standards as prescribed by SAHRA .

The significance of heritage sites was based on four main criteria:

- **site integrity** (i.e. primary vs. secondary context),
- **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
    - Density of scatter (dispersed scatter)
        - Low - <10/50m^2
        - Medium - 10-50/50m^2
        - High - >50/50m^2
- **uniqueness** and
- **potential** to answer present research questions.

Table 3: Site significance classification standards as prescribed by SAHRA

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.A)	-	Low Significance	Destruction

Appendix E

THE SIGNIFICANCE RATING SCALES FOR THE PROPOSED PROSPECTING ACTIVITIES ON HERITAGE RESOURCES

IMPACT ASSESSMENT METHODOLOGY

In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY 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

PART B: DETERMINING CONSEQUENCE					
SEVERITY = L					
DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**
SEVERITY = M					
DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**
SEVERITY = H					
DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			Localised - Within site boundary - Site	Fairly widespread - Beyond site boundary - Local	Widespread - Far beyond site boundary - Regional/ national
			SPATIAL SCALE		

PART C: DETERMINING SIGNIFICANCE					
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**	**Medium**	**Medium**	**High**
	Possible/ frequent	**M**	**Medium**	**Medium**	**High**
	Unlikely/ seldom	**L**	**Low**	**Low**	**Medium**
			L	**M**	**H**
			CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

***H = high, M= medium and L= low and + denotes a positive impact.**

Appendix F

Curriculum vitae

WOUTER FOURIE

Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage

Summary of Experience

Specialised expertise in Archaeological Mitigation and excavations, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including *inter alia*:

Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave "rescue" excavations in the various provinces of South Africa

Involvement with various Heritage Impact Assessments, within South Africa, including:

- Archaeological Walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
- Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring
- Involvement with various Heritage Impact Assessments, outside South Africa, including:
    - Archaeological Studies in Democratic Republic of Congo
    - Heritage Impact Assessments in Mozambique, Botswana and DRC
    - Grave Relocation project in DRC

Key Qualifications

BA [Hons] (Cum laude): Archaeology and Geography - 1997

BA: Archaeology, Geography and Anthropology - 1996

Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member

Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)

CRM Accreditation (ASAPA):

- Principal Investigator - Grave Relocations
- Field Director – Iron Age
- Field Supervisor – Colonial Period and Stone Age
- Accredited with Amafa KZN

Key Work Experience

2003- current: Director – Professional Grave Solutions (Pty) Ltd

2007 – 2008: Project Manager – Matakoma-ARM, Heritage Contracts Unit, University of the Witwatersrand

2005-2007: Director – Matakoma Heritage Consultants (Pty) Ltd

2000-2004: CEO– Matakoma Consultants

1998-2000: Environmental Coordinator – Randfontein Estates Limited. Randfontein, Gauteng

1997-1998: Environmental Officer – Department of Minerals and Energy. Johannesburg, Gauteng

Worked on various heritage projects in the SADC region including, Botswana, Mozambique and the Democratic Republic of the Congo

POLKE DOUSSY BIRKHOLTZ
Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage

Name: Polke Doussy Birkholtz

Date & Place of Birth: 9 February 1975 – Klerksdorp, North West Province, South Africa

Place of Tertiary Education & Dates Associated:

Institution: University of Pretoria
Qualification: BA (Cum Laude) - Bachelor of Arts Degree Specializing in Archaeology, History and Anthropology
Date: 1996

Institution: University of Pretoria
Qualification: BA Hons (Cum Laude) - Bachelor of Arts with Honours Degree Specializing in Archaeology
Date: 1997

Qualifications:

BA	-	Degree specialising in Archaeology, History and Anthropology
BA Hons	-	Professional Archaeologist

Memberships:

Association of Southern African Professional Archaeologists (ASAPA)
Professional Member of the CRM Section of ASAPA

Overview of Post Graduate Experience:

1997 – 2000 – Member/Archaeologist – Archaeo-Info
2001 – 2003 – Archaeologist/Heritage Specialist – Helio Alliance
2000 – 2008 – Member/Archaeologist/Heritage Specialist – Archaeology Africa
2003 - Present – Director / Archaeologist / Heritage Specialist – PGS Heritage

Languages: English: Speak, Read & Write & Afrikaans: Speak, Read & Write

Total Years' Experience: 17 Years

Experience Related to the Scope of Work:

Polke has worked as a **HERITAGE SPECIALIST / ARCHAEOLOGIST / HISTORIAN** on more than 270 projects, and acted as **PROJECT MANAGER** on almost all of these projects.

DR GIDEON GROENEWALD
Professional Palaeontologist

Sections	Guide
Name:	Dr Gideon Groenewald
Profession:	Geologist
Date of Birth:	1955 09 30
Parent Firm:	Associate at PGS Heritage
Position in Firm:	Associate
Years with Firm:	11 Tears
Nationality:	South African
Academic Qualifications:	PhD Geology Nat Dip Nature Conservation
Professional Qualifications:	Professional Scientist (Reg. No. 401946/83). Professional membership with the Geological Society of South Africa, the Borehole Water Association of South Africa, the Palaeontological Association of South Africa and the Grassland Society of South Africa.
Languages: 1st language, if its English please indicate proficiency.	Afrikaans English fully proficient in speaking, reading and writing
General Environmental Management Experience:	1) Jan Naude - Environmental Impact Assessment for the development of a Resort -Sep10 - Apr11 2) LHL Engineers - Environmental Impact Assessment for Nketoane & Setoto Local Municipalities Waste Disposal Sites Dec 2011 - Ongoing 3) Javelin Trucking - Environmental Impact Assessment for Bitumen Plant – Prospection DurbanMarch - June 2011
Project Experience:	1) Nature Conservation Corporation - Palaeontological Assessments and Recovery of fossils at Ingula Pumped Storage Scheme 2009 – 2011 2) Umlando Agrological, Tourism and Resource Management 2.1) Palaeontological Assessment and Recovery of fossils for New Multi Purpose Pipeline for TRANSNET Jun-Nov 2010 2.2) Palaeontological Screening of Ethekwini Pipeline May 2011. 2.3) Palaeontological Screening of Slangspruit Sewerage and Ozwathini Water Pipeline – Jun 2011 3) Metago Environmental Engineer 3.1) Palaeontological Assessment for proposed Kudumane Manganese Mine at Hotazel as part of EIA Feb 2011 3.2) Palaeontological Assessment for proposed Leeuw Coal Mine at Utrecht as part of EIA – Feb 2011 4) eThebeni Cultural and Heritage - Palaeontological Screening of the new N3 Alternatives and De Beers Routes Jun 2011 5) Coastal Environmental Services - Palaeontological Assessment for various proposed Wind Energy Generating Facilities in the Eastern Cape as part of EIA May – Oct 2011

Client and Technical reports:	1) Palaeontology of The Ingula Pumped Storage Scheme. Final Report for Eskom 20 April 2011 2) Palaeontological Assessment and Field Survey Report for New Multi Product Pipeline. - Transnet Limited. - 07 April 2011 3) Palaeontological Impact Assessment Report for the Northern Aqueduct Augmentation (NAA) for Umlando - 28 April 2011 3) Palaeontological Assessment of Ozwathini Pipeline Development for Umlando - 10 June 2011 4) Palaeontological Impact Assessment Report. Proposed Underground Coal Mine. - Metago Environmental Engineers (Pty) Ltd - 10 July 2011 5) Palaeontological Impact Assessment for the De Beers Pass Route And Alternatives. - Ethembeni Cultural Heritage. 20 May 2011 5) Palaeontological Impact Assessment Report Proposed Lushington Park Wind Energy Facility. - Coastal & Environmental Services. - 13 June 2011
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