PGS
HERITAGE

PHASE 1 HERITAGE IMPACT ASSESSMENT

PROPOSED DEVELOPMENT OF A NEW POLLUTION CONTROL DAM AT ALDAG, ON THE REMAINDER OF THE FARM SISHEN 543, AND THE EXPANSION OF A CURRENTLY PLANNED POLLUTION CONTROL DAM ON THE REMAINDER OF THE FARM LYLYVELD 545, NORTHERN CAPE.

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Client: EXM Advisory Services (Pty) Ltd

Project Number: 287HIA

DECLARATION OF INDEPENDENCE

The report has been compiled by PGS Heritage, an appointed Heritage Specialist for EXM Advisory Services (Pty) Ltd. The views stipulated in this report are purely objective and no other interests are displayed in the findings and recommendations of this Heritage Impact Assessment.

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Report Title	Phase 1 Heritage Impact Assessment for the Proposed Development of a new Pollution Control Dam at Aldag, on the Remainder of the Farm Sishen 543, and the Expansion of a Currently Planned Pollution Control Dam on the Remainder of the Farm Lylyveld 545, Northern Cape.		
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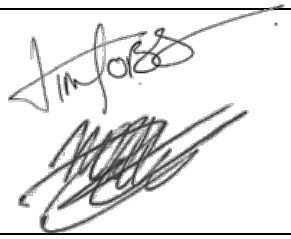
Co-authors	**Dr Tim Forssman** **Dr Matt Lotter**		**Stone Age Specialists / PGS Heritage Associates**
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The heritage impact assessment report has been compiled taking into account the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

NEMA Regulations (2014) - Appendix 6	Relevant section in report
Details of the specialist who prepared the report.	Cover Page and 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
A declaration that the person is independent in a form as may be specified by the competent authority.	Page 2 of 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 3.1
A description of the methodology adopted in preparing the report or carrying out the specialised process.	Section 3.1
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.	Section 6
An identification of any areas to be avoided, including buffers.	Section 6
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 6 & Appendix B
A description of any assumptions made and any uncertainties or gaps in knowledge.	Section 1.3
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 7
Any mitigation measures for inclusion in the EMPr.	Section 8
Any conditions for inclusion in the environmental authorisation.	Section 8
Any monitoring requirements for inclusion in the EMPr or environmental authorisation.	Section 8
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised; and	Executive Summary & Section 9
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 basic assessment and EMP process.
A summary and copies if any comments that were received during any consultation process.	Not applicable. A public consultation process was handled as part of the basic assessment and EMP process.
Any other information requested by the competent authority.	Not applicable.

EXPLANATION OF ABBREVIATIONS USED IN THIS DOCUMENT

Abbreviations	Description
AIA	Archaeological Impact Assessment
ASAPA	Association of Southern African Professional Archaeologists
CMP	Conservation Management Plan
CRM	Cultural Resource Management
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPR	Environmental Management Programme Report
ESA	Earlier Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
LIA	Late Iron Age
LSA	Later Stone Age
MSA	Middle Stone Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PGS	PGS Heritage
PHRA	Provincial Heritage Resources Authority
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by EXM Advisory Services (Pty) Ltd to undertake a Heritage Impact Assessment (HIA), which forms part of the Basic Assessment (BA) for the development of a new pollution control dam at Aldag, on the remainder of farm Sishen 543, and the expansion of a currently planned pollution control dam on the remainder of farm Lylyveld 545, near the southern side of the town of Kathu, Northern Cape.

Due to the significance of the Stone Age sites from the surrounding landscape, Drs. Matt Lotter and Tim Forssman were appointed to conduct the field survey and prepare the report and Dr. Matt Caruana was appointed to perform the palaeontological desktop study.

An archival and historical desktop study was undertaken and was used to compile a historical layering of the study area within its regional context. This component indicated that the landscape within which the project area is located has a rich and diverse history.

The proposed National Heritage Site Nomination of the Kathu Archaeological Complex demonstrates the importance of the archaeological heritage of the region (Walker et al, 2013; SAHRIS accessed August 2014). The scientific and heritage significance as well as the occurrence of archaeological material was taken into account in the HIA under review (Beaumont, 1990, 2004, 2013; Porrat et al, 2010; Herries, 2012; Chazan et al, 2012; Wilkins & Chazan, 2012; Walker et al, 2013; Walker et al 2014).

The heritage desktop study component of the project was followed by fieldwork. The methodology comprised a detailed walkthrough of the study area by an experienced archaeologist. No heritage sites were identified within the study area boundaries during the fieldwork.

Despite the fact that subterranean Stone Age material is known from the surroundings of the study area, no mitigation is needed. However, the following general recommendations are required:

- If a deposit is identified, a controlled sampling of the material found should be done;
- This work must be done in such a way as to augment the current research questions and field work such as the excavations at the Kathu Townlands Site and Kathu Pan;
- These test excavations and sampling must be done after a permit has been granted under Section 35 of the NHRA (Act 25 of 1999) to a qualified and experienced Stone Age archaeologist;

- In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location;
- An archaeologist suitably qualified in Stone Age fieldwork and research must be appointed to undertake an Archaeological Watching Brief during the Construction[1] Phase of the project. The appointed archaeologist will be responsible for the following:

    - Provide training to the project Environmental Control Office (ECO) in Stone Age archaeology and the identification of Stone Age artefacts and sites. The ECO will be responsible for daily on-site monitoring during the Construction Phase with the appointed archaeologist visiting the site every two weeks.
    - Conduct an archaeological monitoring program whereby the construction site is visited once every two weeks for at least the first three months of the project.
    - On-site assessment of any Stone Age material exposed during construction and the provision of recommendations for the way in which the exposed material must be mitigated.
    - Compile and submit an archaeological monitoring report at the end of the monitoring process.

- During the monitoring undertaken everyday on-site by the ECO and once every two weeks by the appointed archaeologist, all construction work must be closely monitored. Should any Stone Age material or any archaeological material be identified, all construction work in that area must immediately stop and the ECO or archaeologist (if already present on site) must demarcate a construction free area around the discovery. If the ECO made the discovery, the archaeologist must be contacted immediately to visit the construction site to assess the exposed material. After assessing the exposed material, the archaeologist would provide recommendations for the exposed material, which may range from destruction without mitigation (if the exposed material is found to be of little significance) to archaeological mitigation (if the exposed material is found to be significant).

As per the palaeontological desktop assessment (**Annexure C**), the proposed development is unlikely to pose a substantial threat to local fossil heritage. However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*)

[1] *the initial site establishment when the area is cleared and support infrastructure is established.*

and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

The proposed developments at Aldag and Lylyveld can continue if the recommendations as outlined in this report are adhered to.

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1 INTRODUCTION

PGS Heritage (Pty) Ltd was appointed by EXM Advisory Services (Pty) Ltd to undertake a Heritage Impact Assessment (HIA), which forms part of the Basic Assessment (BA) for the development of a new pollution control dam at Aldag, on the remainder of farm Sishen 543, and the expansion of a currently planned pollution control dam on the remainder of farm Lylyveld 545, near the southern side of the town of Kathu, Northern Cape.

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 development area. The Heritage Impact Assessment (HIA) aims to inform the BA in the development of a comprehensive Environmental Management Plan (EMP) to assist the developer in managing the identified 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 HIA was compiled by PGS, the staff of which has a combined experience of nearly 70 years in the heritage consulting industry and have extensive experience in managing HIA processes.

Polke Birkholtz, the project manager and principal heritage specialist, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is also accredited with the CRM Section of the same association. He has 18 years of experience in the heritage assessment and management field and holds a B.A. (cum laude) from the University of Pretoria specialising in Archaeology, Anthropology and History and a B.A. (Hons.) in Archaeology (cum laude) from the same institution.

Dr Matt Lotter acted as specialist for the Stone Age. Since 2007 he has participated in research programmes from a range of sites across South Africa, Botswana, and most recently at sites in China; these include Historic, Iron Age, Rock Art, and Stone Age sites. Matt has published in international peer-reviewed scientific journals and continues to do so. Currently, Matt is the co-permit holder for three ESA sites in the Eastern Cape Province. Matt is a member of the Association of Southern African Professional Archaeologists (ASAPA).

Dr Tim Forssman acted as specialist for the Stone Age. He has undertaken extensive and in-depth research at several Stone Age, Iron Age and rock art localities around southern Africa. He has also published several scientific articles with a focus on the Later Stone Age, Iron Age, rock art and archaeological method. He is registered with the Association of Southern African Professional Archaeologists (ASAPA).

Dr Matt Caruana acted as palaeontological specialist in this report. He has been involved in a variety of archaeological and palaeontological projects ranging from Pliocene to Holocene in age. His specialty is in the analysis of Earlier Stone Age (ESA) archaeological materials and excavation methods. Matt currently works at Swartkrans Cave (Gauteng Province), Amanzi Springs (Eastern Cape Province) and the Taung World Heritage Site (Northwest Province). While specializing in the ESA time period, he is also involved in the analysis of fossil remains, as well as Middle and Later Stone Age materials from numerous sites in South Africa.

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 sites located during the fieldwork do not necessarily represent all the heritage sites present within the area. Should any heritage features or objects not included in the 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.

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. Minerals 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 Impacts Assessment (EIA) – Section (32)(2)(d)
    d. Environmental Management Programme (EMP) – Section (34)(b)

II. National Heritage Resources Act (NHRA) Act 25 of 1999
    a. Protected Areas – Section 28;
    b. Protection of Heritage Resources – Sections 34 to 36; and
    c. Heritage Resources Management – Section 38

III. Minerals 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 NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "*…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*." In accordance with legislative requirements and EIA rating criteria, the regulations of SAHRA and ASAPA have also been incorporated to ensure that a comprehensive and legally compatible HIA report is compiled.

1.5 Terminology and Abbreviations

Archaeological resources

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 a 10m buffer area;

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. structures, features 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 according to the heritage agency 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

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.

Find Spot

Can be classified as an area where only a single artefact or low density of artefacts occurs. The absence of associated material or artefacts that indicate a temporal shallow or ephemeral occupation. The association of numerous artefacts or structures and /or cultural deposits that all combine to indicate a temporal depth and information to a site.

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 place or object of cultural significance. The association of numerous artefacts or structures and /or cultural deposits that all combine to indicate a temporal depth and information to a site.

Later Stone Age (LSA)

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

Late Iron Age (Early Farming Communities)

The archaeology of the last 2000 years up to the 1800s associated with ironworking and farming activities such as herding and agriculture.

Middle Stone Age (MSA)

The archaeology of the Stone Age from 20 000/40 000-300 000/300 000 years ago – a period associated with early modern humans.

Earlier Stone Age (ESA)

The archaeology of the Stone Age from 300 000 years ago to >3.2 million years ago, associated with the Lomekwian, Oldowan and Acheulean industries.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past and any site which contains such fossilised remains or trace.

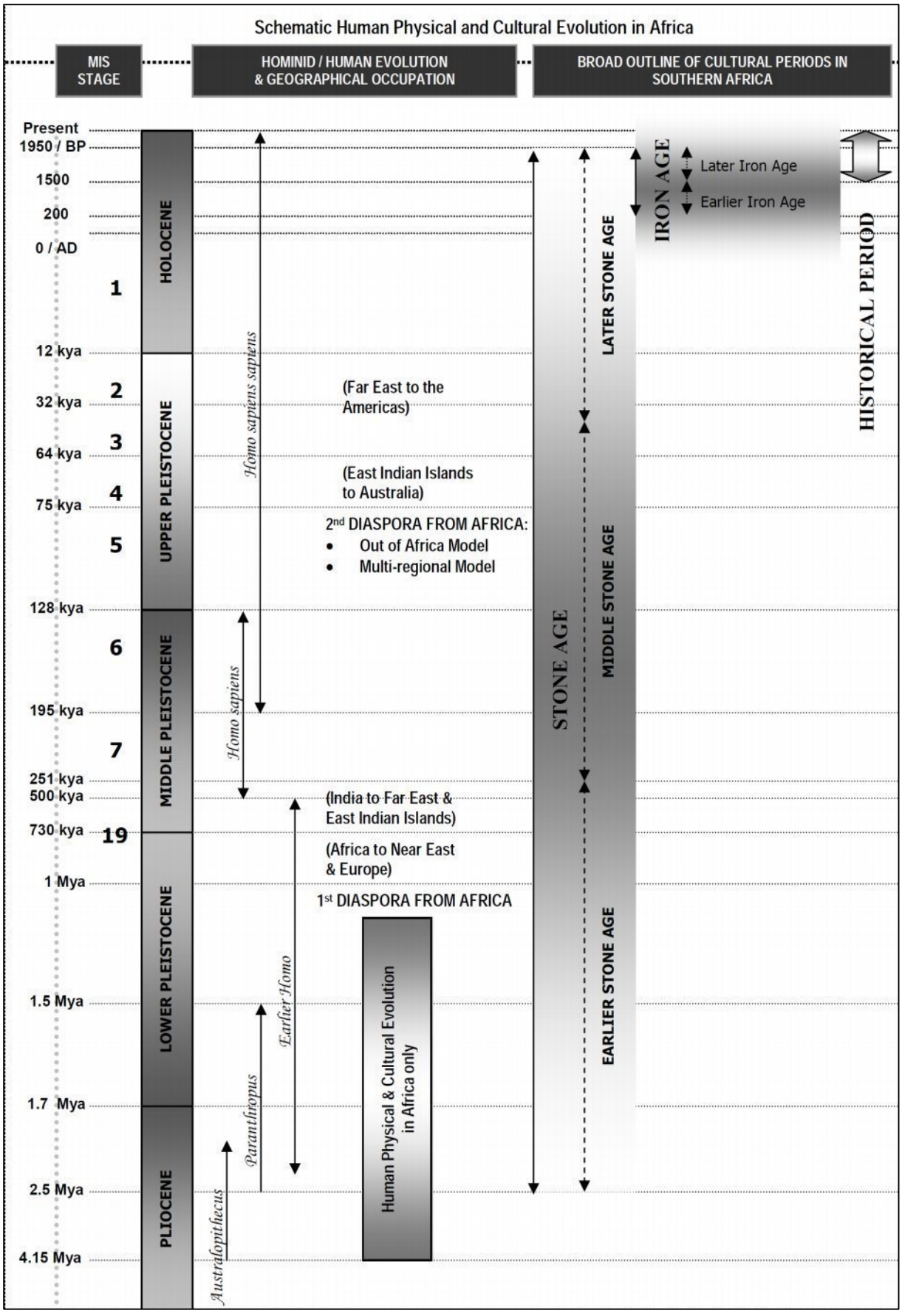


Figure 1 – Human and Cultural Time line in Africa (Morris, 2008; Lomekwian not included).

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Coordinates	Lylyveld: 27° 49’ 56.02” S; 23° 02’ 18.40” E Aldag: 27° 44’ 55.91” S; 23° 00’ 50.22” E
Property	Remainder of the farm Sishen 543 (Aldag) and the Remainder of the farm Lylyveld 545.
Location	The proposed developments are situated in the general surroundings of the town of Kathu, with Lylyveld located approximately 13.9km south of the town and Aldag situated roughly 6.8km south-west of Kathu.
Extent	The combined extent of the two proposed study areas is approximately 20 hectares.
Land Description	The study area is located within the heavily disturbed mine complex situated in the southern and western areas of the town Kathu. The nature of this disturbance has affected the local environment but it is characterised by flat plains with mixed wooded and shrub savannah and a Kalahari Sand substrate.

2.2 Technical Project Description

The Sishen Iron Ore Company (Pty) Ltd (SIOC) has applied for the construction of a new pollution control dam (PCD) at the Aldag Filling Station and the expansion of the existing PCD at the Lylyveld South Mining Areas. Sishen Mine manages dirty and clean water systems according to GN 704 of 1999 (Regulations on use of water for Mining and Related Activities aimed at the Protection of Water Resources) in terms of the National Water Act, 1998 (NWA). The additional PCD at Aldag and expansion of the PCD at Lylyveld are needed to increase the volumes for a 1:50 year storm event.

Sishen Mine will start construction of the PCD at Aldag Filling Station (**Figure 2**), although it has been identified that the current approved dam of 4 000 m3 requires expansion. A second overflow dam has been proposed, which will be directly connected to the currently planned dam. It was determined that the size of the planned dam should increase to 10 000 m3 to retain a 1:50 year 24-hour storm event for the Aldag catchment area. It is therefore proposed that an additional PCD at Aldag be constructed with a volume 6000 m3 to ensure compliance with GN 704 (**Figure 3**).

The currently approved Lylyveld 25 800 m3 PCD has also been found to be too small in volume. A larger

PCD is required to ensure that all dirty water is contained as required by GN. 704. The purpose of this dam is to control and prevent siltation from the mining area onto the Gamagara River. The approved dam has not been constructed and a new larger dam of 38 800 m3 is now proposed to retain a 1:50 year 24-hour storm event for the Lylyveld south catchment area. This is an additional 13 000 m3 to the approved PCD volume (**Figure 3**).

Figure 2 – General characteristics of Aldag (above) and Lylyveld (below).

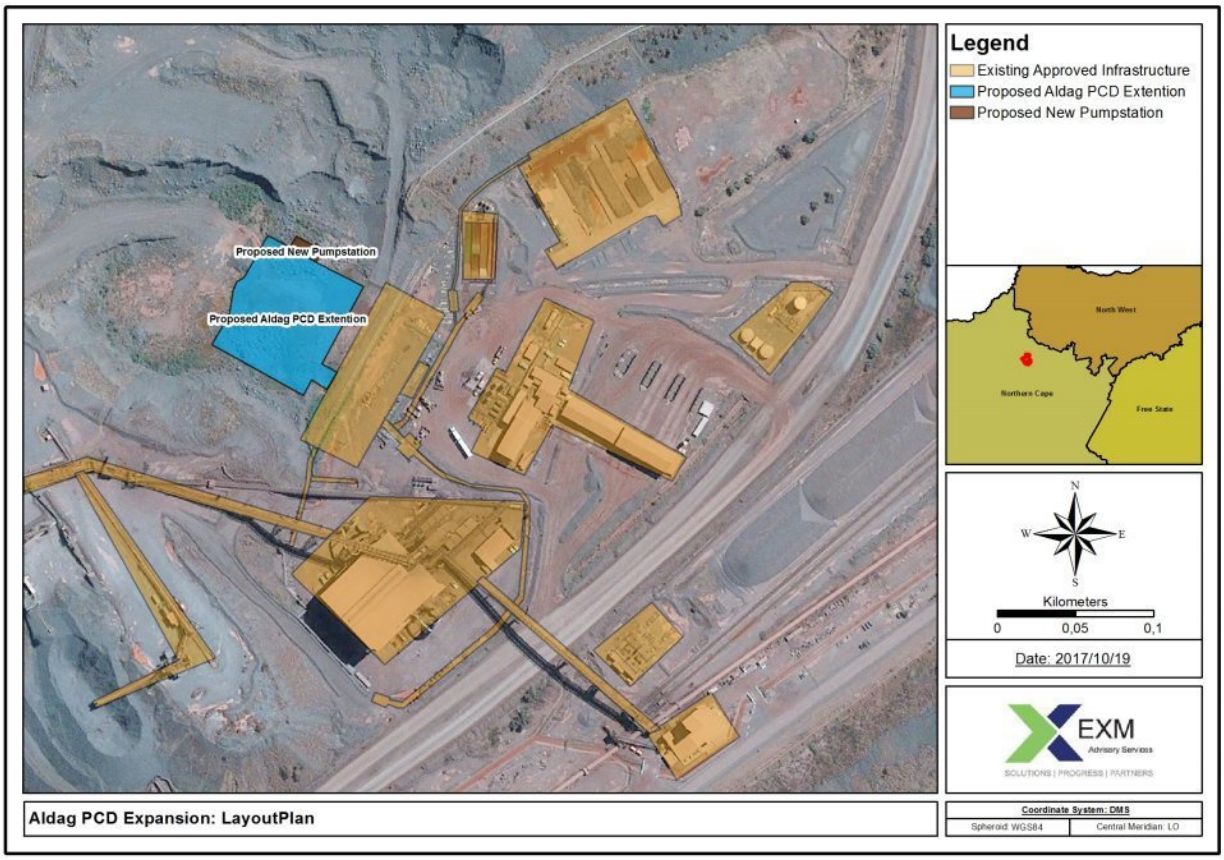


Figure 3 – Development layout plan of the proposed Aldag development. Map supplied by client.

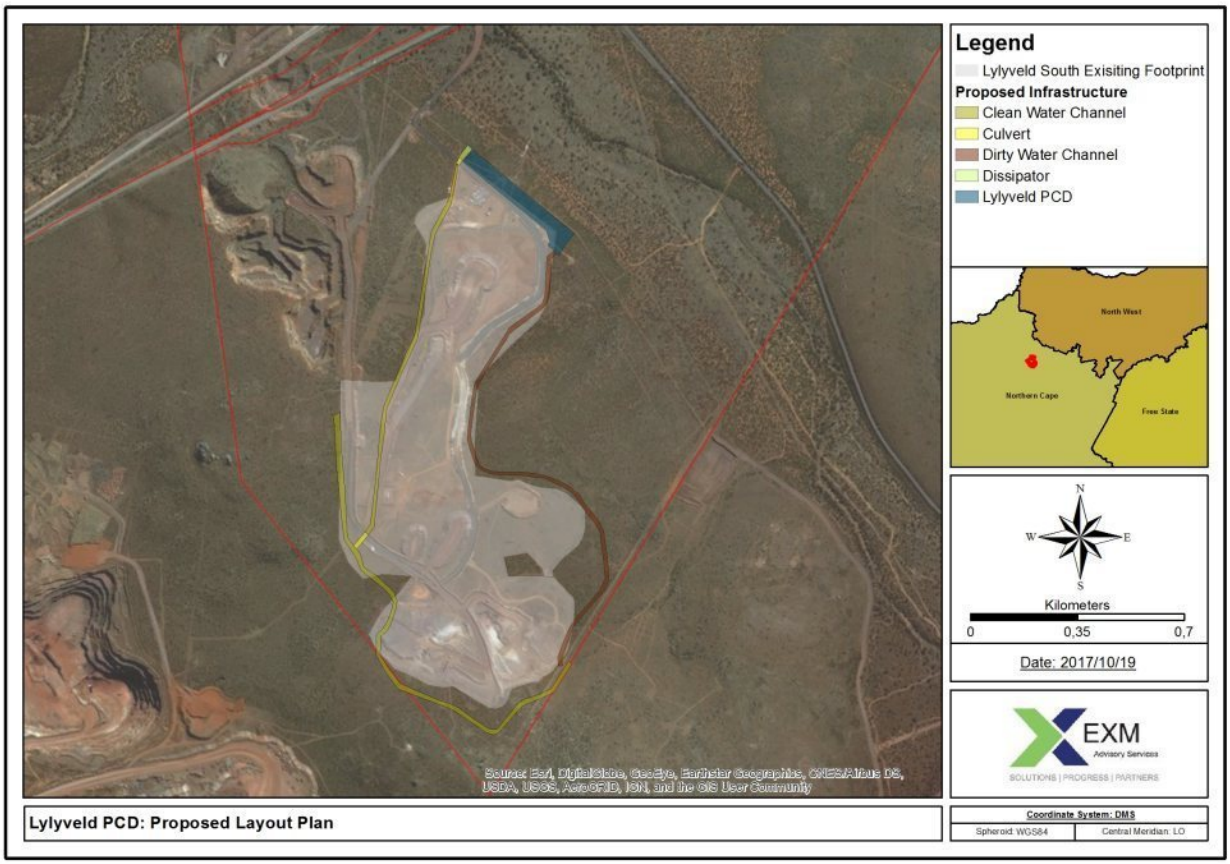


Figure 4 – Development layout plan of the proposed Lylyveld development. Map supplied by client.

3 ASSESSMENT METHODOLOGY

3.1 Methodology for Assessing Heritage Site Significance

This report was compiled by PGS for the proposed developments on the Remainder of the farm Sishen 543 and the Remainder of the farm Lylyveld 545. The applicable maps, tables and figures are included as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (no 107 of 1998). The HIA process consisted of three steps:

Step I – Literature Review: An archaeological and historical background study was undertaken using available sources. This was augmented by an assessment of historic topographical maps, which allowed for the historic layering of the study area. Previous archaeological and heritage studies from the study area and surroundings were also accessed using inter alia the South African Heritage Resources Information System (SAHRIS) of the South African Heritage Resources Agency (SAHRA).

Step II – Physical Survey: The physical survey was conducted on foot over the entire area proposed for the development. Priority was placed on the undisturbed areas. A systematic inspection of the area on foot along linear transects resulted in the maximum coverage of the proposed area. The fieldwork was conducted on Wednesday, 30 November 2017 by archaeologist Dr Matt Lotter. The survey focused on the study area as provided by the client.

Step III – Report: The final step involved the recording and documentation of relevant heritage resources, the assessment of resources in terms of the heritage impact assessment criteria as well as mapping and recommendations. All of this was undertaken as part of the report.

The significance of heritage sites was based on five 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 - <10/50m2
    - Medium - 10-50/50m2
    - High - >50/50m2
- Uniqueness; and

- Potential to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate development position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site.

3.1.1 Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region were used for the purpose of this report (see **Table 1**).

Table 1 - 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	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)		High/Medium	Mitigation before destruction
Generally Protected B (GP.B)		Medium	Recording before destruction
Generally Protected C (GP.C)		Low	Destruction

3.2 Methodology for Impact Assessment

In order to ensure uniformity, a standard impact assessment methodology has been 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.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors, along with the equivalent quantitative rating scale for each of the aforementioned criteria, is given in **Table 2**.

Table 2 - Quantitative rating and equivalent descriptors for the impact assessment criteria

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE
1	VERY LOW	*Isolated corridor / proposed corridor*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

3.2.1 Significance Assessment

The significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these, since their importance in the rating scale is very relative. For example, 10 structures younger than 60 years might be affected by a proposed development, and if destroyed the impact can be considered as VERY LOW in that the structures are all of Low Heritage Significance.

If two of the structures are older than 60 years and of historic significance, and as a result of High Heritage Significance, the impact will be considered to be HIGH to VERY HIGH.

A more detailed description of the impact significance rating scale is given in **Table 3** below.

Table 3 - Description of the significance rating scale

RATING		DESCRIPTION
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	ZERO	There is no impact at all - not even a very low impact on a party or system.

3.2.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in **Table 4**.

Table 4 - Description of the spatial significance rating scale

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional / Provincial	The spatial scale is moderate within the bounds of possible impacts, and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50 km from the proposed site / corridor.
3	Local	The impact will affect an area up to 5 km from the proposed site.
2	Study Area	The impact will affect an area not exceeding the boundary of the study area.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the site.

3.2.3 Temporal/Duration Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment.

The temporal or duration scale is rated according to criteria set out in **Table 5**.

Table 5 - Description of the temporal rating scale

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium-term	The environmental impact identified will operate for the duration of life of the project.
4	Long-term	The environmental impact identified will operate beyond the life of operation of the project.
5	Permanent	The environmental impact will be permanent.

3.2.4 Degree of Probability

The probability or likelihood of an impact occurring is outlined in **Table 6** below.

Table 6 - Description of the degree of probability of an impact occurring

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely
3	Could happen
4	Very likely
5	It's going to happen / has occurred

3.2.5 Degree of Certainty

As with all studies, it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used, as discussed in **Table 7**. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making.

Table 7 - Description of the degree of certainty rating scale

RATING	DESCRIPTION
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The consultant believes an assessment is not possible even with additional research.

3.2.6 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner, in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale, as described below:

Impact Risk = (SIGNIFICANCE +*Spatial*+ Temporal) X Probability

3 5

An example of how this rating scale is applied is shown below:

Table 8: Example of Rating Scale

IMPACT	SIGNIFICANCE	SPATIAL SCAL	TEMPORAL SCAL	PROBABILITY	RATING
	LOW	Local	Medium Term	Could Happen	**LOW**
Impact on sites	2	3	3	3	1.6

Note: The significance, spatial and temporal scales are added to give a total of 8, which is divided by 3 to give a criterion rating of 2.67. The probability (3) is divided by 5 to give a probability rating of 0.6. The criteria rating of 2.67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to 5 classes as described in the table below.

Table 9: Impact Risk Classes

RATING	IMPACT CLASS	DESCRIPTION
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High

Therefore, with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

4 CURRENT STATUS QUO

4.1 Description of Study Area

The study areas assessed for this report are located on the Remainder of the farm Sishen 543 (Aldag) and the Remainder of the farm Lylyveld 545. These properties are located 6.8km south-west and 13.9km south of the town of Kathu respectively (**Figure 5**). Combined, the study area comprises roughly 20 hectares.

The study area is characterised by mixed wooded tree and shrub species on a Kalahari Sand substrate (Kalahari Group) (**Figure 6**).

The area is presently disturbed by mining and related activities (**Figure 7**).

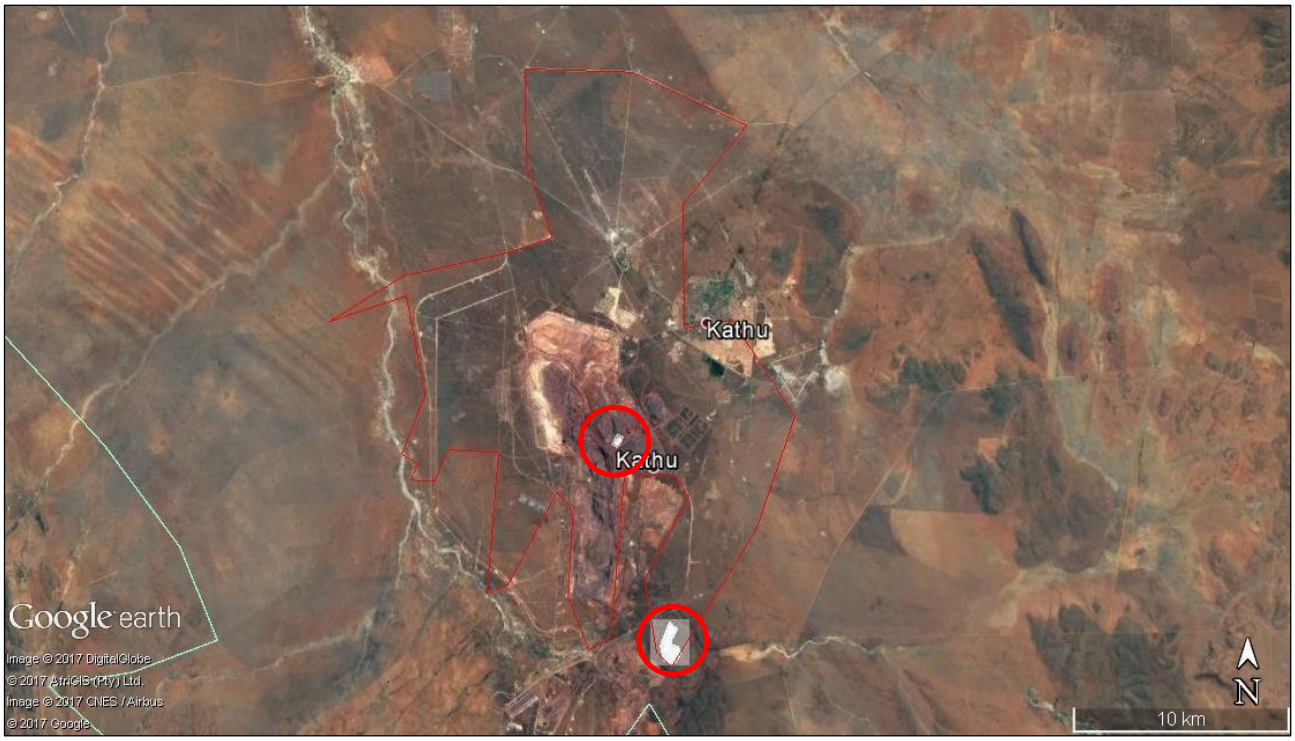


Figure 5 – Google Earth image depicting the general locality of the two study area portions in relation to each other. Aldag is located to the north, with Lylyveld to the south.

Figure 6 – General view of the study area at Lylyveld.

Figure 7 – Disturbance caused by mining and related activities as seen at Aldag.

5 DESKTOP STUDY FINDINGS

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore, an internet literature search was conducted and relevant archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

5.1 Previous Studies

Researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a great number of previous archaeological studies were conducted around Kathu. Several other previous archaeological or historical studies had been performed within the wider vicinity of the study area. A selection of previous studies for the area in the APM Report Mapping Project are listed in chronological order. Refer to **Figure 8** for a locality map of the studies completed in close vicinity to the current study area:

- Morris, D. & Beaumont, P.B. 1994. **Ouplaas 2 Rock Engravings, Daniëlskuil.** An unpublished report by the McGregor Museum on file at SAHRA as 1994-SAHRA-0025.
- Morris, D. 1999. **Proposed mining areas and properties at Ulco, Northern Cape, Including the vicinities of Gorrokop and Groot Kloof.** An unpublished report by the McGregor Museum on file at SAHRA as 1999-SAHRA-0055.
- Beaumont, P.B. 2000. **Archaeological Impact Assessment: Archaeological Scoping Survey for the purpose of an EMPR for the Sishen Iron Ore Mine.** An unpublished report by the McGregor Museum on file at SAHRA as 2000-SAHRA-0023.
- Morris, D. 2001. **Report on Assessment of Archaeological Resources in the vicinity of proposed mining at Morokwa.** An unpublished report by the McGregor Museum on file at SAHRA as 2001-SAHRA-0078.
- Beaumont, P.B. 2004. **Heritage EIA of two areas at Sishen Iron Ore Mine.** An unpublished report by the McGregor Museum on file at SAHRA as 2004-SAHRA-0067.
- Morris, D. 2005. **Report on a Phase 1 Archaeological Assessment of Proposed Mining Areas of the Farms Bruce, King, Mokaning and Parson, Between Postmasburg and Kathu, Northern Cape.** An unpublished report by the McGregor Museum on file at SAHRA as 2005-SAHRA-0032.
- Beaumont, P.B. 2005a. **Heritage Impact Assessment of an area of the Sishen Iron Ore Mine that may be covered by the Vliegveldt waste dump.** An unpublished report by the McGregor Museum on file at SAHRA as 2005-SAHRA-0230.

- Beaumont, P.B. 2005b. **Heritage Impact Assessment for EMPR Amendment for crusher at Sishen Iron Ore Mine.** An unpublished report by the McGregor Museum on file at SAHRA as 2005-SAHRA-0259.

- Beaumont, P.B. 2006a. **Phase 1 Heritage Impact Assessment Report on Erf 1439, Remainder of Erf 2974, Remainder of Portion 1 of the Farm Uitkoms 463, and Farms Kathu 465 and Sims 462 at and near Kathu in the Northern Cape Province.** An unpublished report by the McGregor Museum on file at SAHRA as 2006-SAHRA-0127.

- Beaumont, P.B. 2006b. **Phase 1 Heritage Impact Assessment Report on Portions A and B of the Farm Sims 462, Kgalagadi District, Northern Cape Province.** An unpublished report by the McGregor Museum on file at SAHRA as 2006-SAHRA-0165.

- Beaumont, P.B., 2006c. **Phase 1 Heritage Impact Assessment Report on Portion 48 and the remaining Portion of Portion 4 of the Farm Bestwood 459, Kgalagadi District, Northern Cape Province.** An Archaeological Impact Assessment report by the Archaeology Department, McGregor Museum, prepared for MEG Environmental Impact Studies.

- Dreyer, C. 2006. **First Phase Archaeological and Cultural Heritage Assessment of the proposed residential developments at the farm Hartnolls 458, Kathu, Northern Cape.** Accessed SAHRIS 14 August 2014.

- Beaumont, P.B. 2007. **Supplementary Archaeological Impact Assessment report on sites near or on the Farm Hartnolls 458, Kgalagadi District Municipality, Northern Cape Province.** Accessed SAHRIS 14 August 2014.

- Beaumont, P.B. 2008a. **Phase 1 Archaeological Impact Assessment Report on Portion 459/49 of the farm Bestwood 459 at Kathu, Kgalagadi District Municipality, Northern Cape Province.** Accessed SAHRIS 14 August 2014.

- Beaumont, P.B. 2008b. **Phase 1 Heritage Impact Assessment Report on a portion of the remainder of the farm Sekgame 461, Kathu, Gamagara Municipality, Northern Cape Province.** Accessed SAHRIS 14 August 2014.

- Dreyer, C. 2007. **First Phase Archaeological and Cultural Heritage Assessment of the Proposed Garona-Mercury Transmission Power Line, Northern Cape, North-West Province & Free State**. An unpublished report by Pr. Archaeologist/Heritage Specialist on file at SAHRA as 2007-SAHRA-0052.

- Dreyer, C. 2008a. **First Phase Archaeological and Cultural Heritage Assessment of the proposed residential developments at a portion of the remainder of the farm Bestwood 459 Rd, Kathu, Northern Cape.** An unpublished report by Pr. Archaeologist/Heritage Specialist on file at SAHRA as 2008-SAHRA-0433.

- Dreyer, C. 2008b. **First Phase Archaeological and Cultural Heritage Assessment of the proposed Bourke project, ballast site and crushing plant at Bruce Mine, Dingleton, near Kathu, Northern Cape.** An unpublished report by Pr. Archaeologist/Heritage Specialist on file at SAHRA as 2008-SAHRA-0666.

- Kaplan, J.M. 2008. Phase 1 **Archaeological Impact Assessment: proposed housing development, Erf 5168, Kathu, Northern Cape Province.** An unpublished report by the Agency for Cultural Resources Management on file at SAHRA as 2008-SAHRA-0487.

- Morris, D. 2008. **Archaeological and Heritage Phase 1 Impact Assessment for proposed upgrading of Sishen Mine diesel depot storage capacity at Kathu, Northern Cape.** An unpublished report by the McGregor Museum on file at SAHRA as 2008-SAHRA-0489.

- Morris, D. 2010. **Solar energy facilities. Specialist input for the environmental impact assessment phase and environmental management plan for the proposed Kathu-Sishen solar energy facilities, Northern Cape**. Accessed SAHRIS 13 August 2014.

- Van Schalkwyk, J. 2010. **Archaeological impact survey report for the proposed development of a solar power plant on the farm Bestwood 459, Kathu Region, Northern Cape Province**. Accessed SAHRIS 13 August 2014.

- Van der Ryst, MM & Küsel, SU. 2011. **Specialist report on the Stone Age and other heritage resources at Kolomela, Postmasburg, Northern Cape**. Commissioned by African Heritage Consultants.

- Van der Ryst, MM and Küsel, SU. 2012**. Phase 2 specialist study of affected Stone Age locality at site SA02, a demarcated surface area, on the farm Nooitgedacht 469 (Woon 469).** Commissioned by Sishen Iron Ore Mine and AGES (Pty) Ltd.

- Beaumont, P.B. 2013. **Phase 2 archaeological permit mitigation report on a ~0.7 ha portion of the farm Bestwood 549, situated on the eastern outskirts of Kathu, John Taolo Gaetsewe District Municipality, Northern Cape Province.** Accessed SAHRIS 14 August 2014.

- Walker S.J.H., Chazan M., Lukich V. & Morris D. 2013**. A second Phase 2 archaeological data recovery at the site of Kathu Townlands for Erf 5116: Kathu, Northern Cape Province.** Accessed on SAHRIS 12 August 2014.

- Walker, S.J., Chazan, M & Morris, D. 2013a. **Kathu Pan: location and significance. A report requested by SAHRA for the purpose of nomination.** Accessed SAHRIS 12 August 2014.

- Walker, S.J. Chazan, M., Lukich V., & Morris, D. 2013b. **A second Phase 2 archaeological data recovery at the site of Kathu Townlands for Erf 5116: Kathu, Northern Cape Province**. Accessed SAHRIS 11 December 2014.

- Kaplan, J. 2014. **Heritage Impact Assessment proposed mixed use development in Kathu, Northern Cape Province. Remainder & Portion 1 of the Farm Sims 462, Kuruman RD**. Prepared for: Enviroafrica. Accessed on SAHRIS 14 August 2014.

- Morris, D. 2014. **Rectification and/or regularisation of activities relating to the Bestwood township development near Kathu, Northern Cape: Phase 1 Archaeological Impact Assessment.** Accessed on SAHRIS 12 August 2014.

- Researching the SAHRIS online database (http://www.sahra.org.za/sahris) further studies were identified in the vicinity of the study area:

- SAHRIS case number 1063. **Consultation in terms of Section 40 of the Mineral and Petroleum Resources Development Act 2002, (Act 28 of 2002) for the approval of an Environmental Management Plan for prospecting right in respect of manganese and sugillite on Portions 1 and 2 of the farm Curtis No. 470, situated in Magisterial District of Kuruman, Northern Cape.**

- SAHRIS case number 1089. **Consultation in terms of Section 40 of the Mineral and Petroleum Resources Development Act 2002, (Act 28 of 2002) for the approval of an Environmental Management Programme for a mining right in respect of manganese and iron ore on Erf 416, 417, 418, 419, 420, 421, 422, remaining extent of Erf 423, 424, 426, 493, 548, 549, (a portion of Portion 548), 550 (a portion of Portion 548), 551(a portion of Portion 548), 569, 679 (a portion of Portion 548), and 681 (a portion of Portion 548) of farm Dingleton township (now Dingle) 543 remaining extent of Portion 2 (Doornvlei), Portions 7, 11 (a portion of Portion 2) and 13 (a portion of Portion 2) of the farm Gamagara 541, remaining extent of Portion 19 (a portion of Portion 1), Portion 24 (a portion of Portion 19) and 25 (a portion of Portion 19) of the farm Sishen 543, remaining extent of Portion 2 (Parson a) and Portion 6 (a portion of Portion 2) of the farm Parson 564, remaining extent, remaining extent of Portion 2 (Grensplaat) and Portion 4 (Stuk) of the farm Fritz No.540, situated in the Magisterial District of Kuruman, Northern Cape region.**

- SAHRIS case number 1332. **Resources Development Act 2002, (Act 28 of 2002) for the approval of an amendment to the Environmental Management Programme for a mining right in respect of iron ore on Portion 2, 6 and the remainder of farm Parson Po. 564, Portions 1,2,3 and the remainder of farm King No. 561, Portion 3,4,5 and the remainder of Bruce No.544, Portion 1,2,3,4,5 remainder of Mokaning No.560 situated in the Magisterial District of Kuruman, Northern Cape.**

- SAHRIS case number 1402. **Consultation in terms of Section 40 of the Mineral and Petroleum Resources Development Act of 2002, (Act 28 of 2002) for the approval of an Environmental Management Plan in respect of borrow pits 1,2,3,4,5,6,7,8 & 9 on Portion 19 of farm 543, remaining extent and Portion 1 of Gamagara 541, Portion 1 and Portion 2 of Fritz 540, remainder of Nooitgedacht 469 and remainder of Lylyveld 545, situated in the Magisterial District of Kuruman Northern Cape region.**

- SAHRIS case number 1411. **Consultation of scoping report submitted in terms of Section 22 of the Mineral and Petroleum Resources Development Act 2002, (Act 28 of 2002) in respect of remaining extent of Portion 1 (Barnadene) of farm sims No.462, remaining extent of and remaining extent and remaining extent of Portion 2 (Rusoord) and remaining extent of Portion 3 (Portion of Portion 1) of Farm Sacha No.468, remaining extent of Portion 4 of the farm Gamagara No.541, remaining extent of Portion 1 (lot a) of the farm Sishen No. 543, situated in the Magisterial District of Kuruman.**

- SAHRIS case number 1505. **Environmental Impact Assessment and Environmental Management Programme.**

- SAHRIS case number 2516. **Consultation in terms of Section 40 of the Mineral and petroleum Resources Development Act 2002, (Act 28 of 2002) for the approval of an Environmental Management Plan for mining permit for aggregate gravel on the remainder of the farm Galway No.431, situated in the Magisterial District of Kuruman, Northern Cape region.**

- SAHRIS case number 2769. **Proposed construction of 400kV transmission line from Ferrum substation (Kathu) to Garona substation (Groblershoop) in the Northern Cape.**

- SAHRIS case number 3029. **Proposed Development of 3 500 Erven on 280 Ha of Vacant Land on a Portion of Remainder of Farm Sekgame 461, Kathu.**

- SAHRIS case number 3157. **Consultation in terms of section 40 of the mineral and petroleum resources development act 2002, (act 28 of 2002) in respect of prospecting for manganese and**

iron ore on the farm Seldsden No.464 situated in the Magisterial District of Kuruman, Northern Cape Region.

- SAHRIS case number 3698. **Proposed relocation of the Vaal Gamagara water pipeline at the Sishen Iron Ore Mine.**

- SAHRIS case number 3701. **Proposed relocation of Rail and Associated Infrastructure at Sishen Iron Ore Mine.**

- SAHRIS case number 4456. **Proposed development of 380ha for residential uses, Kathu, Portion 175/1 and Portion 175/2, Joe Morolong Local Municipality, John Taolo District Municipality, Northern Cape Province.**

- SAHRIS case number 4785. **SAHRA comments for the Heritage Impact Assessment Report for the Kalahari Solar Power Project located on Farm Kathu 465, near Kathu within the Northern Province.**

- SAHRIS case number 4460. **Residential development on Remainder, and Portion 3 of Farm Bestwood 459 near the town of Kathu, Northern Cape.**

- SAHRIS case number 5323. **EIA and EMPr for the Proposed Solar CSP Integration Project: Project 2 - 400kV Power Line from Ferrum to the Solar Substation.**

- SAHRIS case number 5648. **The project will consist of the construction of an approximately 67km Double Circuit 400kV power line from the Manganore Substation to the Ferrum Substation, including the construction of the new Manganore TX (Transmission) Substation adjacent to the existing Manganore DX (Distribution) Substation. The line runs in a northerly direction through areas of the Tsantsabane, Ga-Segonyana and Gamagara Local Municipalities in the Northern Cape Province.**

Most of the studies listed above located surface scatters of Stone Age artefacts of limited significance (e.g. Dreyer 2008a, 2008b; Kaplan 2008; SAHRIS case number 3029) if not actual Stone Age sites. A few studies did not identify any heritage resources (e.g. Beaumont 2006; SAHRIS case number 1063; SAHRIS case number 2769; SAHRIS case number 5323) although in some cases this was possibly because the survey area had already been altered by mining activities (e.g. Dreyer 2008b). Many studies referred to the Kathu Pan site, an ancient limestone sinkhole formation, discovered in 1974 during the establishment of the town of Kathu and renowned for both significant palaeontological (including specimens from up to 850 000 years BP) and Stone Age deposits from 500 000 BP onwards (e.g. SAHRIS case number 4785). Equally, a number of studies consulted referred to the Uitkoms 1 site on Kathu Hill with its high number of Stone Age artefacts (e.g. SAHRIS case number 4785).

Four of the studies consulted on the SAHRIS website had no relevant documents available (SAHRIS case number 1089; SAHRIS case number 2516; SAHRIS case number 3157; SAHRIS case number 3701). One study referred to heritage sites listed in an earlier impact assessment document, the latter not being available on

the SAHRIS website (SAHRIS case number 1332). Some studies had documentation with no relevant heritage information (e.g. SAHRIS case number 1402) or documentation that referred to the need for completion of archaeological studies (e.g. SAHRIS case number 1411).

In a survey for the expansion of the Sishen Mine, located in proximity to the present study area, Beaumont (2000) recorded surface LSA lithics which he stated were not associated with living sites. This study also listed a large number of Stone Age artefacts as well as two Iron Age collections from the near vicinity of the study area and accessioned in the McGregor Museum. North of the present study area, Beaumont (2004) recorded only surface scatters of possible Acheulian lithics while later studies in approximately the same area located no heritage resources (Beaumont 2005a, 2005b) or, again, a few scattered stone tools of MSA appearance (Morris 2008). Morris (2001) undertook a survey a short distance south of the present study area, locating surface scatters of stone artefacts, but noting that the area between Postmasburg and Kathu is known for specularite workings and that any development should take cognisance of this. In another survey, between 8 (Lylyveld) and 17 (Aldag) kilometres south of the current study area, Morris (2005) located scatters of stone artefacts on hills and plains, ceramic remains reflecting a Tswana settlement, and four cemeteries.

To the north of the study area, Beaumont (2006) undertook a survey for the Kalahari Gholf en Jag development. While no significant new heritage resources were located in this survey, the author referred to previous surveys and excavations undertaken on the properties involving nine archaeological sites. These included six of the Kathu Pan sites characterised by Late Pietersburg, Howiesons Poort, Wilton and Fauresmith technologies, as well as Later Stone Age ceramics. Further, this includes the Kathu Townlands site, excavated in the 1980s and found to contain approximately 10 000 Acheulian artefacts per cubic metre, and finally a Late Iron Age site thought to be of Tswana origin (Beaumont 2006). A later survey for the same development concurred with the findings of this report that most of the area was devoid of heritage resources. However, it stressed the high importance of the Kathu Pan sites and recommended that its northern area be excluded from any development, especially as the use of GPS technology had improved the accuracy of mapping and it had been found that some of the sites now fell within the development area (SAHRIS case number 4456). Many of the other studies referred to these and other known heritage sites, for example specularite workings on the Gamagara River to the south-west of Kathu (e.g. SAHRIS case number 3029).

In a survey of two options for a power line route, Dreyer (2007) noted the wealth of stone tool sites in the vicinity of Kathu, particularly extensive ESA sites and the presence of the existing Kathu cemetery, suggesting mitigation measures to avoid these. A survey for the Kalahari Solar Power project some 21

(Lylyveld) and 12 (Aldag) kilometres to the north of the current study area located a number of Stone Age sites as well as surface scatters of lithics and referred to the possibility of significant sub-surface deposits in a number of localities (SAHRIS case number 4785). On the Ghaap Escarpment, Morris (1999) identified LSA and MSA lithics and referred to known rock painting sites at Groot Kloof. These paintings are of unusual quality and the most elaborate of their kind along the Ghaap escarpment (Morris 1999; SAHRIS case number 1505). Rock engravings at Lime Acres, more than 80 kilometres to the south-east, consist of 119 distinct images spread over some 22 dolomite rock slabs and are interesting in that they are fairly recent, depicting colonial scenes such as horses with riders and were likely engraved by Korana people descendants of Khoekhoen pastoralists (Morris & Beaumont 1994).

Van der Ryst & Küsel (2012) conducted a Phase 2 around a pan and surrounds for a proposed extension of the Sishen waste dump. Sampling of the lithics produced low to medium densities of MSA and LSA tool types on the plains and the periphery of the pan and surrounds. This is consistent with the results from several surveys as discussed above. Where Stone Age occurrences have been documented these are usually distributed either in fairly low scatters over large areas, or in very high densities where sources of, in particular, Banded Ironstone Formations (BIFs) outcrops are found. Surface sites around Kathu exhibit a palimpsest of prehistoric utilisation and may contain lithics from all periods in the Stone Age succession.

It is therefore important to note a concern raised by Morris (2014: unpaged) that a "*consistent issue in the assessment of the presence or absence of archaeological deposits in and around Kathu … is the fact that the landscape is often capped by (1) calcrete (not uniformly ancient – Walker et al 2013) and (2) younger Gordonia Formation Aeolian sands (Almond 2014)*". That subsurface archaeological remains may occur under overlying soils and calcretes should be taken into account when archaeological and heritage surveys are undertaken. The clearing of topsoils during development activities frequently exposes archaeological deposits. In areas where BIFs outcrop areas are located, extremely high densities of lithics are often found. BIFs are an excellent source of good toolstone. It was extensively used in the extraction of raw materials and the *in situ* manufacture of ESA Large Cutting Tools (LCT's) and for MSA assemblages. Significant exposures of siliceous BIFs in association with high levels of lithic production have been recorded at, for example, Kathu Townlands and Bestwood.

The LCT's from this area often contain very fine handaxes with some superb examples produced on banded ironstone. Lithics in some of the Acheulian deposits, but also in MSA levels, display a shiny silica skin. At Kathu Townlands an outcropping of banded ironstone that covers a large area of around 25 km contains enormous quantities of flaked items. This phenomenon is ascribed to the use of the high-grade bedrock ironstone as a source for raw materials and is supported by the high incidence of handaxe roughouts

(Beaumont 2004b). The prepared core technique was used to produce the spectacular small handaxes, long blades, convergent flakes/points and scrapers found in Fauresmith collections.

The Kathu Complex sites contain important ESA Acheulian and transitional ESA/MSA Fauresmith assemblages (Beaumont, 1990, 2004, 2013; Herries, 2011; Chazan et al, 2012; Wilkins & Chazan, 2012, Walker et al, 2014). Walker et al (2014) suggest that the intensive occupation of the Kathu region can be linked to the availability of water resources. Current research projects are yielding important data on typologies, lithic technologies, technological innovations, complex spatial organisation and also dates for the ESA Acheulian and for the MSA assemblages. Research at Kathu Pan 1 established a date of 500 000 years for a Fauresmith blade assemblage where blades were systematically removed from prepared cores (Wilkins & Chazan, 2012).

Archaeological and palaeoenvironmental data from Kathu Pan and Kathu Townlands were used to reconstruct changes over time in the prehistoric environment (Beaumont 2004b). Associated faunal remains with some of the Acheulian include *Elephas recki recki*. These animals disappeared at sites in East Africa such as at Olorgesailie, Kenya, at around 600 000/800 000 years ago (Beaumont, 2004b; McNabb, 2004). Biostratigraphy or faunal correlation is often used to date the southern African sites and gives some indication of the approximate age of some of the associated assemblages. More recently a combination of OSL and ESR/U-series dating (Porat et al, 2010; Herries, 2011; Walker et al, 2014) were used to date the transition to MSA tool forms. At Kathu Pan the transitional Fauresmith has been dated to ca. 500 000 BP (Porat et al, 2010). Kathu Pan is formed by a shallow depression with an internal drainage and a high water table.

North-east of Kathu several newly-found ESA sites with LCT's and an associated range of tools occur in sand quarries and on a hilltop at Uitkoms Farm and the Bestwood locality (**Figure 7**) (Chazan et al, 2012). The residential and commercial developments at Bestwood and close to the Townlands demonstrate the importance of Phase 2 heritage studies in the Kathu region.

The concerns that Walker et al (2014:8) raise with regard to the impact of the exponential development should feature in any survey that is undertaken around Kathu. With reference to the Townlands locality they urge that a "…*broader landscape-based effort of subsurface testing including palaeo-landscape and paleo-environmental reconstruction is essential to our understanding of this extraordinary record. Sources of this information must be protected along with archaeological remains. Together with the other components of the Kathu Complex, this site represents a high density of hominin occupation that presents a challenge to reconstructions of hominin adaptations during the Early-Middle Pleistocene*."

The surrounding area was previously studied by Beaumont (**Table 10**), and lithic densities and debitage frequencies found at Uitkoms 1 (**Figure 8**) was comparable to those found at Kathu Townlands 1. He describes Uitkoms 4 (**Figure 8**) as a buried site approximately 100 meters wide. No controlled excavations have been done at Uitkoms 4.

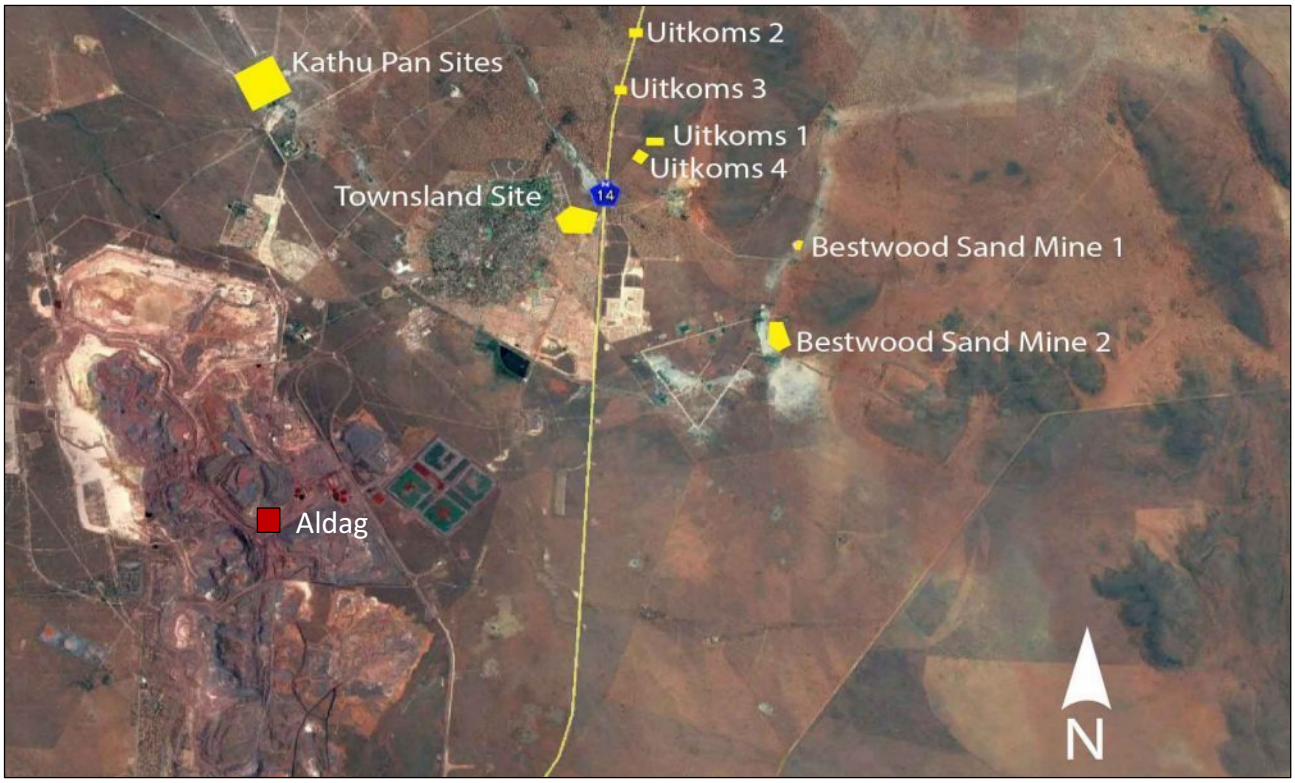


Figure 8 – Map of archaeological sites (yellow) in the Kathu region. The position of the nearest component of the study area to these archaeological sites, namely Aldag, is indicated in red. The Lylyveld component of the study area is located further south.

Table 10 - Table of studies associated with the map depicted in Figure 7 (Walker et al., 2013b)

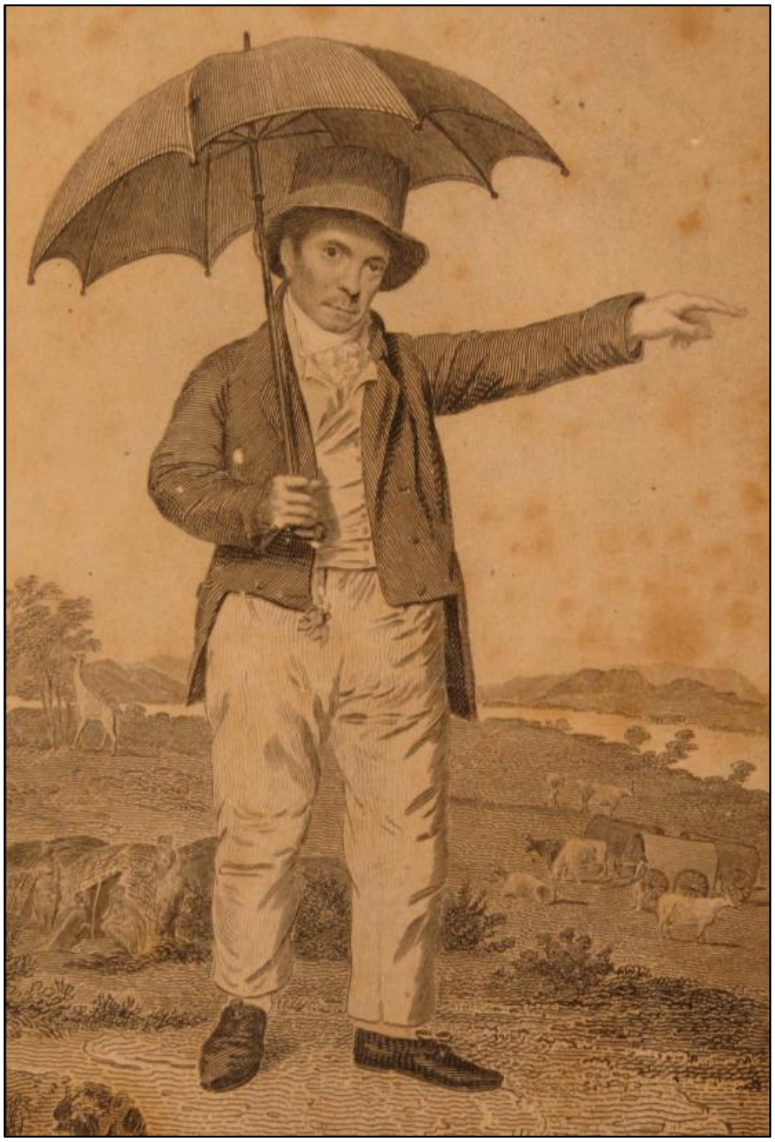
RMP	Report Date	Project name	Reference
MAPID_00906	30-Apr-06	Kalahari Golf en Jag Expansion	(Beaumont, 2006a)
Not mapped	29-May-06	Bestwood 459 Portion 48	(Beaumont, 2006c)
MAPID_00918	30-May-06	Uitkoms 463, Portion 5	(Beaumont, 2006b)
MAPID_00997	28-Jun-06	Hartnolls 458, 1st Phase 1	(Dreyer, 2006)
MAPID_00998	17-Jan-07	Hartnolls 458, 2ndPhase 2	(Beaumont, 2007)
MAPID_01686	06-Feb-08	Portion of Sekgame 461	(Beaumont, 2008b)
MAPID_01687	07-Feb-08	Uitkoms 463, Portion 8	(Beaumont, 2008a)
MAPID_01692	12-Jun-08	Bestwood 459 Portion 49	(Beaumont, 2008c)
MAPID_01617	11-Aug-08	Bestwood Estates	(Dreyer, 2008)

5.2 Archaeological & Historical Sequence

DATE	DESCRIPTION
3.2 million to 250 000 years ago	The Earlier Stone Age (ESA) is the first and oldest phase identified in South Africa's archaeological history and here it comprises two technological phases. The earliest of these, known only from sites outside of southern Africa, is the Lomekwian industry (3.2 Myr) and is associated with percussive tools and large flakes. Occurring in South Africa is the Oldowan industry (2.6 – 1.5 Myr), characterised by expedient, yet organised flaking systems with primarily core- and flake-based assemblages. Finally, the Acheulian industry (1.7 Myr – 250 kyr) is the last ESA industry to develop, comprised by Large Cutting Tools (i.e. handaxes and cleavers) and organised core reduction (i.e. Levallois). A number of important ESA sites are known from the general vicinity, including the very significant ESA Kathu Pan and Kathu Townlands localities and also the Bestwood sites (Chazan et al, 2012) respectively 17km north-west, 13km north-east and 12km-14.5km north-east of the study area. Research at Kathu Townlands was first undertaken by P.B. Beaumont (1990, 2004). The locality has a remarkable high lithic density containing millions of ESA artefacts (Mitchell, 2002; Walker et al, 2013 Walker et al. 2014). Moreover, the interface between the ESA and MSA is also represented at Kathu Pan by the transitional lithic industry of the Fauresmith (Porat et al 2010).
>250 000 to 40 000 years ago	The Middle Stone Age (MSA) is associated with flakes, points and blades manufactured by means of the prepared core technique. This phase is furthermore associated with modern humans and complex cognition (Wadley 2013). MSA sites and occurrences have been identified in the Kathu area, including the very significant Kathu Pan localities (Wilkins & Chazan, 2012). See also, for example, Beaumont (2009) and Kruger (2014).
40 000 years ago to the historic past	The Later Stone Age (LSA) is the third archaeological phase identified and is associated with an abundance of very small stone tools known as microliths. A number of Later Stone Age sites are known from the direct vicinity of the existing Kathu area. According to Beaumont (2000) pecked engravings, originally from the farms Sishen 543 and Bruce 544, were donated to the McGregor Museum with some engravings located on the grounds of the Sishen Iron Ore Mine as well. The Aldag component of the study area is located on the farm Sishen 543. More engraving sites are known from further afield including one on the farm Palingpan. This farm is situated roughly 44.7km south of the present study area.
800 AD – 820 AD	The archaeological excavations undertaken by Beaumont and Bashier (1974) and Thackeray et al (1983) have revealed that the mining of specularite at Doornfontein and Tsantsabane/Blinkklipkop commenced during this time. Blinkklipkop for example is located 66.7km south of the study area. During this initial period the mining activities would have been undertaken by San hunter-gatherers and Kora pastoralists. Only after the 17th century were such mining activities likely also undertaken by the Iron Age Tswana groups.

DATE	DESCRIPTION
Early 1600s	The Tswana groups known as the Thlaping and Thlaro moved southward into the area presently known as the Northern Cape. A century later they were settled in areas as far south as Majeng (Langeberg), Tsantsabane (Postmasburg) and Tlhaka le Tlou (Daniëlskuil) (Snyman, 1986). In terms of the Thlaro specifically, Breutz (1963) states that after they broke away from the Hurutshe during the period between 1580 and 1610, they travelled along the Molopo River and the Southern Kalahari before arriving at the confluence of the Kudumane, Mosaweng and Molopo. From here they established themselves at Tsowe (west of Morokweng), Gatlhose (10.9km south-east of the study area), Majeng (Langberg), Khoiise (Khuis on the Molopo River) and Tlhaka-la-Tlou (present day Danielskuil situated roughly 72km south-east of the study area). It is evident that the study area and surrounding landscape would be been central within the overall settlement area of the two Tswana groups at the time.
c. 1770	During this time, the Kora moved into the area. Due to their superior firearms they applied increasing pressure on the Thlaping and Thlaro groups. In the end, the Thlaping moved into a north-eastern direction to settle in the general vicinity of Dithakong, north-east of present-day Kuruman. The Thlaro settled in areas to the west and north-west of the Thlaping (Snyman, 1986).
c. 1786 – c. 1795	The German deserter by the name of Jan Bloem established himself at Tsantsabane (Blinkklip) (Legassick, 2010). This place is located 5km north-east of the present-day town of Postmasburg. The settlement of Jan Bloem at the specularite mine may have been a way in which to control the valuable site and any trading activities associated with it.
c. 1795	Legassick (2010) confirms the presence of the Thlaping, Thlaro and Kora in the general vicinity of the study area during this time. This said, the study area and surrounding landscape would have represented a western peripheral area of the overall landscape occupied by especially the Thlaping and Thlaro groups at the time. From a map depicted in Leggassick (2010:338), it is evident that at the time the Kora started moving in north-eastern direction from the areas along the central Orange river to the banks of the Harts River.
Early 1800s	After the threat of the Kora became less intensive, the Thlaping moved to the vicinity of present-day Kuruman. The Thlaro returned to the Langeberg, establishing them on a permanent basis there during the 1820s (Snyman, 1986). The settlement of the Thlaping in the vicinity of Kuruman occurred during the reign of Molehabangwe. This period in the history of the Thlaping was seen as a period of wealth and power, and at the time they even had control of the *sibello* quarry near Blinkklip (Legassick, 2010).
1801	The first known visit to this area by European explorers (i.e. excluding European renegades and fugitives such as Jan Bloem) took place in 1801. The journey was undertaken by P.J. Truter and Dr W. Somerville. They crossed over the Orange River in the vicinity of Prieska, and passed Blinkklip on their way to present-day Kuruman (Bergh, 1999). Although their exact route is not known, it is possible that their journey from present-day Postmasburg to Kuruman would have passed some distance to the east of the proposed cemetery.

DATE	DESCRIPTION
1802 - 1813	During this period William Anderson and Cornelius Kramer, both of the London Missionary Society, established a mission station at a place called Leeuwenkuil. The focus of their work was a group known as the Bastards (Erasmus, 2004). This group could be described as a cultural conglomeration descending not only from relationships between different cultures and races (i.e. European and Khoi), but also comprised remnants of Khoi and San groups as well as freed slaves. The particular group later became known as the Griqua. Due to the problems caused by the presence of lions at Leeuwenkuil, the mission station was moved in 1805 to Klaarwater. On 7 August 1813 the name of the settlement which had sprung up here was renamed Griquatown. This came about as a result of a number of proposals made by Reverend John Campbell, the Director of the London Missionary Society who was visiting the mission stations from this area at the time. He suggested that "...*the Bastards change their name to 'Griqua' and that Klaarwater became Griquatown. This was because 'on consulting among themselves they found a majority were descended from a person of the name Griqua'*..." (Legassick, 2010). Griquatown is located 114km south of the present study area.
1805	During this year German explorer Martin Hinrich Carl Lichtenstein travelled through the general vicinity of the study area. After crossing the Orange River in the vicinity of present-day Prieska, Lichtenstein's party visited present-day Daniëlskuil, 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 utilisation of this particular rich source (Thackeray, et al 1983). 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 his way to the Kuruman River (and to the south thereof), Lichtenstein visited a small settlement consisting of "*…about thirty flat spherical huts.*" Although the people staying 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, 1930). Although Lichtenstein was certainly not the first European explorer to travel through this area (the Truter & Somerville expedition had for example passed through this area in 1801), or for that matter the last (Burchell travelled through the area in 1811 followed by John Campbell in 1813) (Bergh, 1999), Lichtenstein did leave behind a written record of this journey providing a valuable glimpse into the early history of the general surroundings of the study area. What is also significant about the visit of Lichtenstein is that his journey took him from present-day Postmasburg to a place known as Tsenin which is located north-west of Kuruman. As a result, he would have passed in close proximity to the present study area.
1813	During 1813 John Campbell of the London Missionary Society also visited the general vicinity of the study area. He arrived at Klaarwater on 9 June 1813, where he rested for a few days before continuing in a northern direction toward present-day Kuruman, passing through Blinkklip on the way (Bergh, 1999).

DATE	DESCRIPTION
	 *Figure 9 – Reverend John Campbell (Campbell, 1815). He passed through the general vicinity of the study area during his travels from Klaarwater to Kuruman.*
20 December 1820	On this day Andries Waterboer was elected as leader of Griquatown in the place of Berend Berends (Legassick, 2010). This period saw fission within the Griqua community, and it is not surprising that two long-term leaders moved away from Griquatown to establish autonomous settlements away from their former town. Berend Berends for example moved to Danielskuil (72km south-east of the study area), whereas Adam Kok II established himself in the vicinity of Campbell (138km south-east of the study area) (Legassick, 2010).
1821 – August 1828	During this period a group of Griqua became dissatisfied with Waterboer and moved away from Griquatown to settle along the Modder River. They were known as the Bergenaars and were supported by Kora and San elements (Cope, 1977). A section of the Bergenaars known as the Klein Bergenaars (Little Bergenaars), settled along the Langberg. This mountain range is located roughly 31km west of the present study area.

DATE	DESCRIPTION
	The Bergenaars constantly attacked the Thlaro, Thlaphing as well as the Griqua. On three separate occasions (Late 1824, July 1827 and December 1827) they attacked Griquatown itself. They also attacked the London Missionary Society station at Kuruman on several occasions with the last attack taking place in August 1828 (Cope, 1977).
1824	Robert Moffat of the London Missionary Society established the mission station at Kuruman (Erasmus, 2004).
Early 1830s	During this time Andries Waterboer stationed a number of Griqua families at a fountain north of Tsantsabane (Blinkklip) as well as at Danielskuil (Legassick, 2010).
22 April 1842	On this day a treaty was signed between Griqua leader Andries Waterboer and Thlaping leader Mahura at Mahura's settlement near Taungs. The agreement included a definition of the boundary between the two groups. The section of the agreed upon boundary closest to the study area ran from "...*the northerly point of the Langeberg and extending a little south of Nokaneng, and further half-way between Maremane and Klipfontein*..." (Legassick, 2010:291). While the exact location of Nokaneng is not currently known, the farms Klipfontein 437 and Maremane 678 are situated 38km and 21km to the south. This suggests that the present study area was located north of the boundary line between the Griqua and the Thlaping as defined in the treaty. As such, the study area was defined within this treaty as forming part of the land of the Thlaping. However, it must be noted that this boundary line was not cast in stone. This boundary was very similar to an earlier one that was thought to have been agreed to during the 1820s as a boundary between the Griqua and the Thlaping (Legassick, 2010).
1850	During this time a Thlaro leader by the name of Molete and his baThlaro baga Keakopa moved away from the Korannaberg and established themselves at Gathlose, some 10.9km south-east of the study area. Breutz (1963) states that the land around Gathlose and Maremane used to belong to the Kora (Koranna) people and that they gave permission to Molete to settle here. After his death between 1885 and 1890, Molete was succeeded by Holele who ruled until his death during the Langberg Rebellion of 1897. Holele was succeeded by Kebiditswe John Holele who filled the post until 1912 when he was succeeded by his younger brother Kgosieng. Kgosieng ruled until he was pensioned on 28 February 1937, and was succeeded by Kebiditswe's son, Kgosietsiele Smous. Kgosietsiele died on 30 June 1956 and was succeeded by his son Frank Motsewakgosi Holele (Breutz, 1963). Likely between 1850 and 1860 the area known as Maremane (located directly north of Gathlose) was an outpost grazing area of the BaThlaro chief Makgolokwe and his son Toto. The first designated leader of this area was Isaak Thupane Thupane, followed by Toto's son Robanyane who fled to present-day Namibia after the Langberg Rebellion of 1897. He was succeeded by his father's brother Jan Molebane Toto. However, the government only recognised him as chief in 1912 up to which point John Holele of the Gathlose Reserve was appointed by the government to act for the Maremane area as well. Molebane was dismissed in 1925 and was succeeded in 1926 by his brother David Makgolokwe. David Makgolokwe remained at his post until his death in 1942 when he was succeeded by Puso Togelo who remained as leader until his death in 1954. He in turn was succeeded by Felix Kgosithebe Toto (Breutz, 1963).

DATE	DESCRIPTION
1850 – 1855	During this period a Thlaro chief by the name of Isaak Thupane Thupane established himself at Logageng (Gatkoppies) near Postmasburg. He subsequently moved with his followers to Groenwater 453. During the time that Thupane was living at Logageng, Kgangeng discovered the fountain at Metsematale. Subsequently, the land was ceded by Waterboer to the Thlaro and Kgangeng and his followers settled at Groenwater as well. The farm Groenwater 453 is located 54km south-east of the present study area.
13 December 1852	After the death of Andries Waterboer, his son Nicolaas Waterboer became the leader of Griquatown. He ruled Griquatown until the annexation of the area by the British in 1871 (see below) (Legassick, 2010). It was during the rule of Nicolaas Waterboer that diamonds were discovered in the area which led to a period of claims and counter-claims between the Griqua, the Orange Free State as well as the Zuid-Afrikaansche Republiek and which eventually led to the annexation of the area.

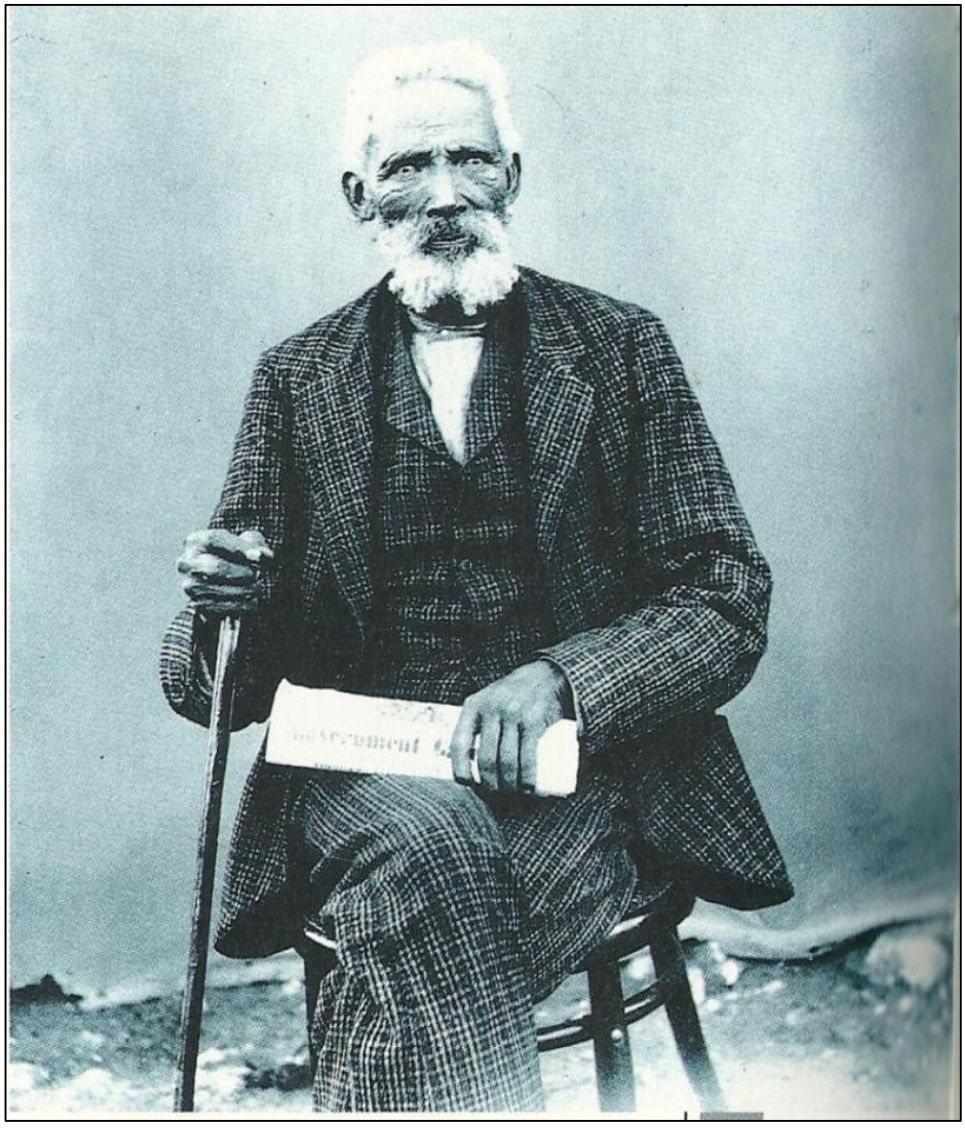


Figure 10 - Nicolaas Waterboer, who succeeded as leader of Griquatown in 1852 after the death of his father Andries Waterboer (Reader's Digest, 1994:168).

DATE	DESCRIPTION
Before 1856	During the period before 1856 the Thlaro leader Masibi occupied the area known as Skeyfontein, which is located 73km south of the study area.
1867	Diamonds were discovered for the first time in South Africa near Hopetown. Alluvial diamonds were also discovered along both banks of the Orange River (Van Staden, 1983).
27 October 1871	The area located in general terms between the Orange and Vaal Rivers and south of Kuruman was proclaimed as British Territory and named Griqualand West (www.wikipedia.org). The study area fell outside and to the north of this territory at the time.
1878	A rebellion broke out amongst some of the Tswana communities living in Griqualand West. This rebellion, which was a response to British expansion and colonialism, spread to the Langberg. A British force left Griqualand West in October 1878 and defeated the "rebels" at the Langberg (Snyman, 1986).
30 September 1885	Sir Charles Warren proclaims the area between the Molopo River and the northern boundary of Griqualand West as the Crown Colony of British Bechuanaland. Its western boundary was defined by the Molopo River and its eastern extremity reached as far as Mafeking. The proclamation followed on a military operation under Warren's command to occupy the Boer Republics of Stellaland and Goosen. As a result, the Crown Colony of British Bechuanaland included the lands of the two republics as well as the land of various Tswana groups. (www.wikipedia.org). At the time the study area was located near the southern boundary of this newly proclaimed territory.

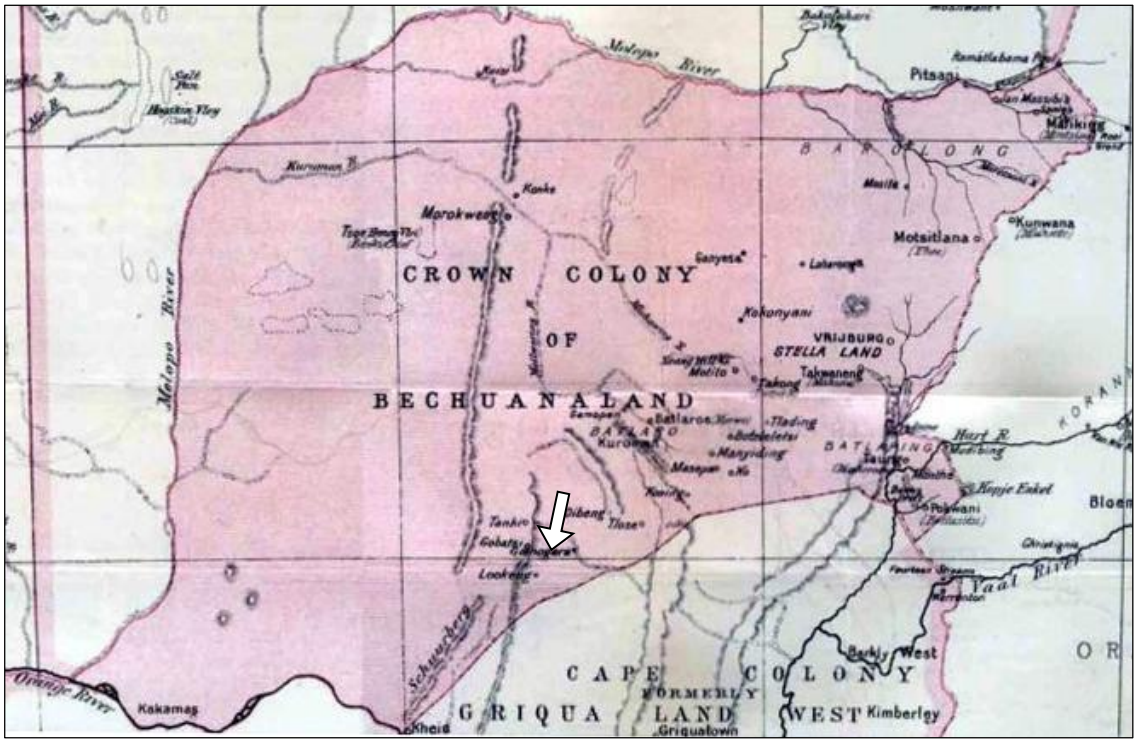


Figure 11 - Section of a map titled "Sketch Map of British Bechuanaland" which is dated to May 1887 (www.wikipedia.com) (www.kaiserscross.com). The approximate position of the study area is shown.

DATE	DESCRIPTION
1886	As a result of the work of a commission appointed by the British rulers of the Crown Colony of British Bechuanaland, a number of so-called "native reserves" were established in this area. These included Deben (between 21 and 30km north-west of the study area), Gatlhose (14 and 16km east of the study area), Maremane (23 and 30km south-east of the study area), Langberg (directly south-west of the farm Sekgame) as well as Kathu (directly west of the farm Sekgame) (Snyman, 1986). The establishment of so many "native reserves" in close proximity to the study area clearly support the suggestion made earlier that the study area was centrally located in the historic and prehistoric territories of Tswana groups such as the Thlaro and Thlaping. In the same year a trader by the name of John Ryan established a shop on the farm Bishop's Wood. This farm is located 18km north-west of the study area.
16 November 1895	The Crown Colony of British Bechuanaland was annexed by the Cape Colony (www.wikipedia.org).
September 1896	During this time a viral disease affecting cattle (and some other species of even-toed ungulates) known as Rinderpest swept through Southern Africa (www.wikipedia.org). Although attempts were made to halt the spread of the disease from the north by erecting a fence between the boundaries of Griqualand West and Bechuanaland, this proved unsuccessful. Incidentally, only three gates were placed in the above-mentioned fence, namely at Gatlhose, Nelsonsfontein and Blikfontein (Snyman, 1988). Of these three places, Gatlhose is the closest and is situated 14km east of the study area.

Figure 12 - An everyday scene during the Rinderpest Epidemic (Snyman, 1983:20).

1897	The Rinderpest epidemic did not only have a massive socio-economic impact on the landscape, it also resulted in the Langberg Rebellion of 1897. During this time

DATE	DESCRIPTION
	conflict broke out between the authorities and a Thlaping leader from Taung, namely Galeshiwe. The conflict arose after infected cattle belonging to him were destroyed by representatives of the government as a way of kerbing the spread of the disease. After killing an officer, Galishewe fled to the Thlaro leader Toto of the Langberg. Subsequently, a full-scale rebellion broke out (Breutz, 1963). The British authorities eventually mustered a military force which included sections of the Cape Mounted Rifles and Bechuanaland Field Force and which on 14 March 1897 stood at roughly 1,000 men. Opposing this formidable and well equipped force supported by artillery the Tswana rebels possessed an army of roughly 1,500 men who from the start of the rebellion already experienced serious shortages in the way of provisions and ammunitions (Snyman, 1986). Although most of the activities associated with the rebellion took place some distance to the west of the study area, the impact of the rebellion was felt throughout the surrounding landscape. Some noteworthy skirmishes took place on 9 May 1897 at Puduhush (some 31.8km south-west of the study area) and on 30 July 1897 at Gamaluse and Gamasep (29.9km west of the study area). Furthermore, the main British force under the overall command of Lieutenant-Colonel E.H. Dalgety used the farm Bishop's Wood as a base of operations (Snyman, 1986). The farm Bishop's Wood is located 11.9km west of the study area. The rebellion was suppressed and came to an end with the surrender of rebel leader Toto, his son Robanyane and their Thlaro followers on 2 August 1897 (Snyman, 1986).

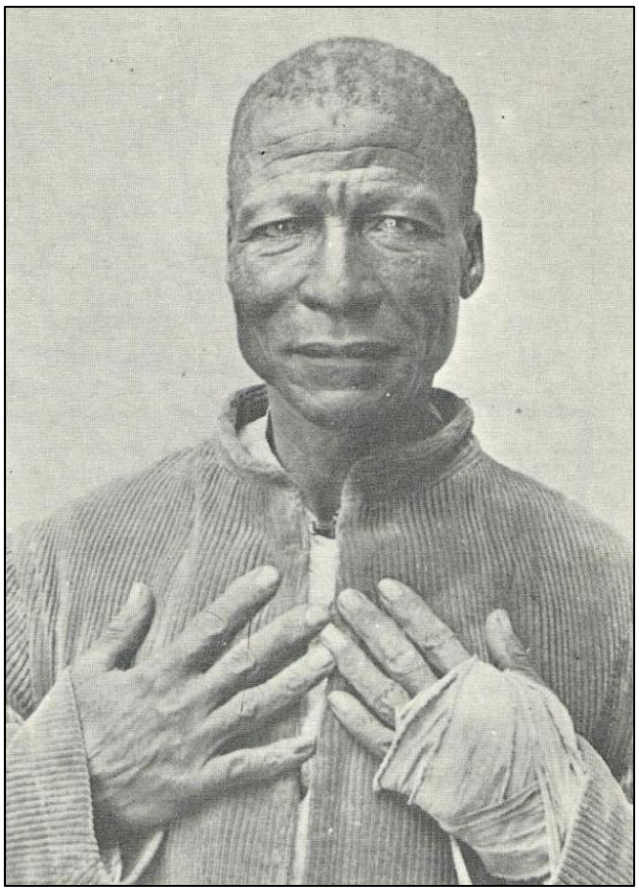
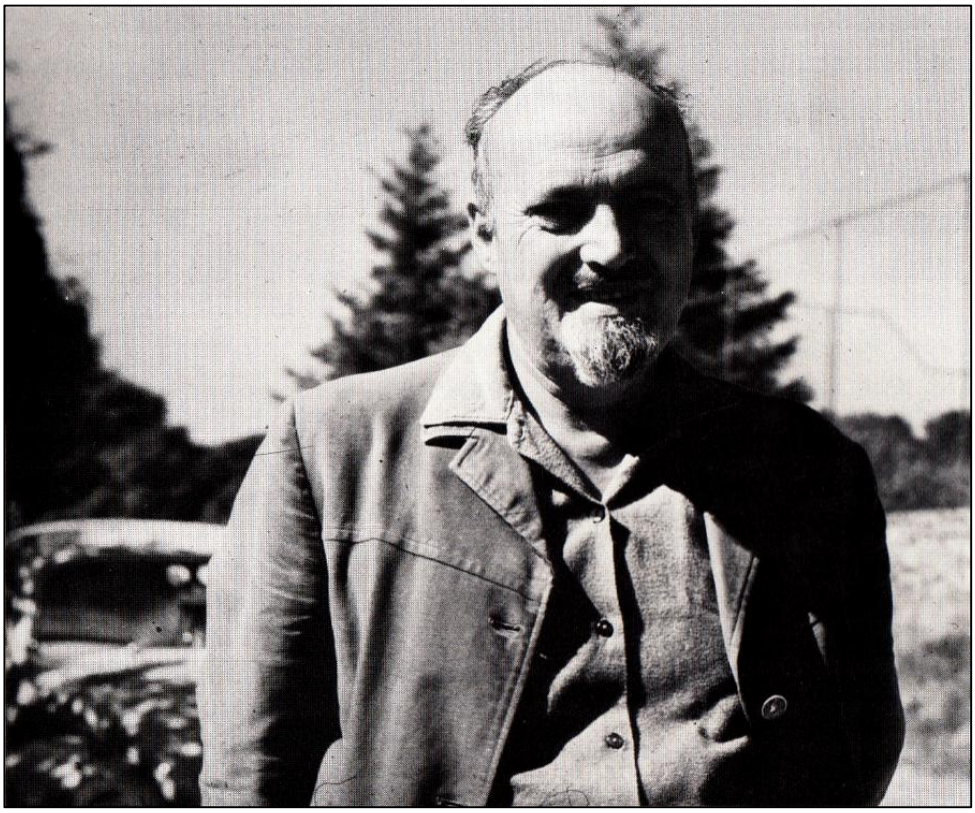


Figure 13 - Toto, leader of the Thlaro along the Langberg (Snyman, 1986:17).

DATE	DESCRIPTION
1899 - 1902	The South African War was fought between Great Britain and the Boer republics of the Zuid-Afrikaansche Republiek and Orange Free State. However, no skirmishes or battles from this war are known from the direct vicinity of the study area. The closest known battles and skirmishes to the present study area include Kareepan on 10 August 1901 and Doornfontein in February 1902 (Snyman, 1983). These farms are located roughly 52 to 61km south and 52 and 59km south-east of the study area, respectively.
1907	A number of trekboers from the southern Free State arrived in the general vicinity of the present study area (Erasmus, 2004).
1913	In this year the so-called "Native Locations" of Skeyfontein and Groenwater were established by Proclamation 131 of 1913 (Breutz, 1963).
1914	The town of Dibeng was laid out in 1914 on the banks of the Ga-Mogara river. This followed on the establishment of the Dibeng Dutch Reformed Church parish in 1909 (Erasmus, 2004).
1927	Gamagara Manganese Corporation Ltd and Central Manganese Ltd obtained options on farms in the vicinity of Lomoteng and Sishen (Snyman, 1988).
4 November 1930	On this day the extension of the railway line from Koopmansfontein to Postmasburg was officially opened by the Minister of Railways, C.W. Malan. This meant that Postmasburg was now one of the few towns in the Northern Cape which boasted a direct rail link. While the extension of the railway line to Beeshoek was built by the Manganese Corporation further extensions to Lohatla and Manganore (1936), Sishen (1953) and Hotazel (1961) were undertaken by the South African Railways (Snyman, 1983).
1930 - 1932	During 1930 an Englishman by the name of Pringle-Smith was appointed by S.A. Manganese to devise and execute a "...*thorough prospecting programme of S.A. Manganese's properties*..." (S.A. Manganese, 1977:46). This meant that the prospecting work undertaken in 1927 and which had been halted due to the poor financial climate and the lack of a railway link could now be proceeded with. Within a relatively short spate of time Pringle-Smith started opening up the beds on the farms Kapstewel and Doornput. However, the company did not have the market, which for example the Manganese Corporation possessed at the time, and as a result the ore was stockpiled at these two farms. Pringle-Smith left the Postmasburg area in 1932 after the financial implications of the Great Depression worsened the situation for S.A. Manganese to such an extent that he was asked to agree to a much lower salary (S.A. Manganese, 1977).
Early 1930s	Due to the financial impacts of the Great Depression, a number of smaller manganese mining companies were closed down. A period of amalgamation followed which resulted in the South African Manganese Limited as well as the Associated Manganese Miners of South Africa Limited becoming the leaders in the manganese mining industry (Snyman, 1983).
c. 1932 - 1937	During this approximate period a geological assessment of the minerals and ore deposits of the Postmasburg District was undertaken by the South African Geological Survey. One member of the geological team was Dr Leslie Gray

DATE	DESCRIPTION
	Boardman. His responsibility was to work on manganese and haematite deposits in the district. Apart from the manganese deposits near Postmasburg, Dr Boardman also identified large deposits of iron ore deposits on farms along the northern end of their area of study including Sishen, Bruce and King (S.A. Manganese, 1977). The Aldag component of the study area is located on the farm Sishen 543, with the farms Bruce and King located in close proximity to the Lylyveld component of the study area.
	 *Figure 14 - Dr Leslie Gray Boardman, the geologist who during the 1930s realized the immense potential of the Sishen area for iron ore mining (S.A. Manganese, 1977:65).*
c. 1936	After the willingness of the South African Railways Administration to extend the railway line from Postmasburg to Kapstewel and Lohatla became known, the entire manganese industry north of Postmasburg changed for the better. An example of this was that S.A. Manganese stepped up operations on the farm Kapstewel. The work here was overseen by Captain T.L.H. Shone (S.A. Manganese, 1977). The promise of railway extensions to this area also resulted in other mining activities such as the establishment of a mining company by the name of Gloucester Manganese. This company was established to mine the manganese deposits on the farm Gloucester. Shortly thereafter an amalgamation took place between Gloucester Manganese and the Manganese Corporation which resulted in the formation of the Associated Manganese Mines of South Africa Limited (Ammosal). Ammosal re-erected the old ore handling plant from Beeshoek on the farm Gloucester and the operations here represented a large portion of the total manganese production of 250,000 tons (S.A. Manganese, 1977). The farm Gloucester is situated about between 23 and 30km south of the study area.

DATE	DESCRIPTION
1937	The farm to the east of Gloucester, named Lohatla, was now being viewed more favourably by S.A. Manganese. During this year they reached an agreement with the owner, which eventually resulted in the acquisition of the farm (S.A. Manganese, 1977). During the same year the company bought the freehold of the farm Klipfontein and also bought 600 morgen of the farm Kapstewel in order to build a staff village. This village was named Manganore (S.A. Manganese, 1977). The Lohatla mine village was also established during this time (Snyman, 1983). Furthermore, the African Metals Corporation Limited (Amcor) was established "*…to manufacture semi-processed iron and steel products*…" and in 1937 obtained the farm Demaneng for this purpose. However, this venture was a failure (Snyman, 1988:84). The farm Demaneng is located 18km south-east of the study area.
Late 1940s	During this time the decision was made by two of the bigger role players in the manganese mining industry around Postmasburg for the mining of haematite iron ore to commence in earnest. S.A. Manganese in conjunction with the African Metals Corporation (Amcor) established a new company known as Manganore Iron Mining Ltd. to work on the iron ore deposits owned by them. These deposits were *inter alia* located on the farms Klipfontein, Kapstewel and Doornput (S.A. Manganese, 1977). All three these farms are located roughly 35km south of the present study area.
c. 1950	At the time D. L.G. Boardman was assessing the ore reserves at Manganore and Lohathla as well as the farm Lylyveld for S.A. Manganese. He found that the latter farm contained large quantities of haematite iron ore and persuaded the directors of S.A. Manganese to acquire the farm (S.A. Manganese, 1977). The component of the study area known as Lylyveld is located on the farm Lylyveld 545.
1953	Iscor commenced iron production at Sishen (Snyman, 1983). In the same year the railway line from Postmasburg to Sishen was extended to haul ore to Iscor's plants in Pretoria, Vanderbijlpark and Newcastle (Erasmus, 2004).
1958	At least by 1958 Manganore Iron Mining also owned mineral and surface rights on the farm Sekgame, approximately 5km to the east.
1973	In this year a second mine was opened at Sishen to supply export iron ore to Saldanha Bay. During the same year the town of Kathu was established to accommodate employees for the new mine (Erasmus, 2004).
1976 - 1977	During this time the Gatlhose and Maremane Communities were removed from their land and taken to the Shipton Farms in the then homeland of Bophutatswana. After their removal, the South African Government decided to establish a Battle School here. As the Khosis Community was still staying on the land, they were moved to a section of the original land roughly 14 000 hectares in extent. The Lohatla Battle School was subsequently established (www.lrc.org.za/Docs/Judgments/khosis.doc).
1977	During this year the 860km long Sishen-Saldanha railway line was completed (Erasmus, 2004).
1980	In 1980 the town of Kathu received municipal status (Erasmus, 2004).

5.3 Cartographic Evidence

5.3.1 First Edition of the 1:50 000 2723CA and 2723CC Topographical Sheets

The figures below depict sections of the First Editions of the 2723CA and 2723CC Topographical Sheets. The 2723CA sheet was printed in 1974 whereas the 2723CC sheet was based on aerial photography conducted in 1972, was surveyed in 1974 and printed in 1975 by the Director General of Surveys.

The following observations can be made from the depiction of the Aldag section of the study area on the 2723CA map:

- No heritage sites or features are depicted within the study area.
- At the time almost the entire study area had been prospected, as shown by the prospecting cut lines depicted on the map.
- A race track is shown some 500m west of the study area.
- A power line passed very close to the study area at the time.

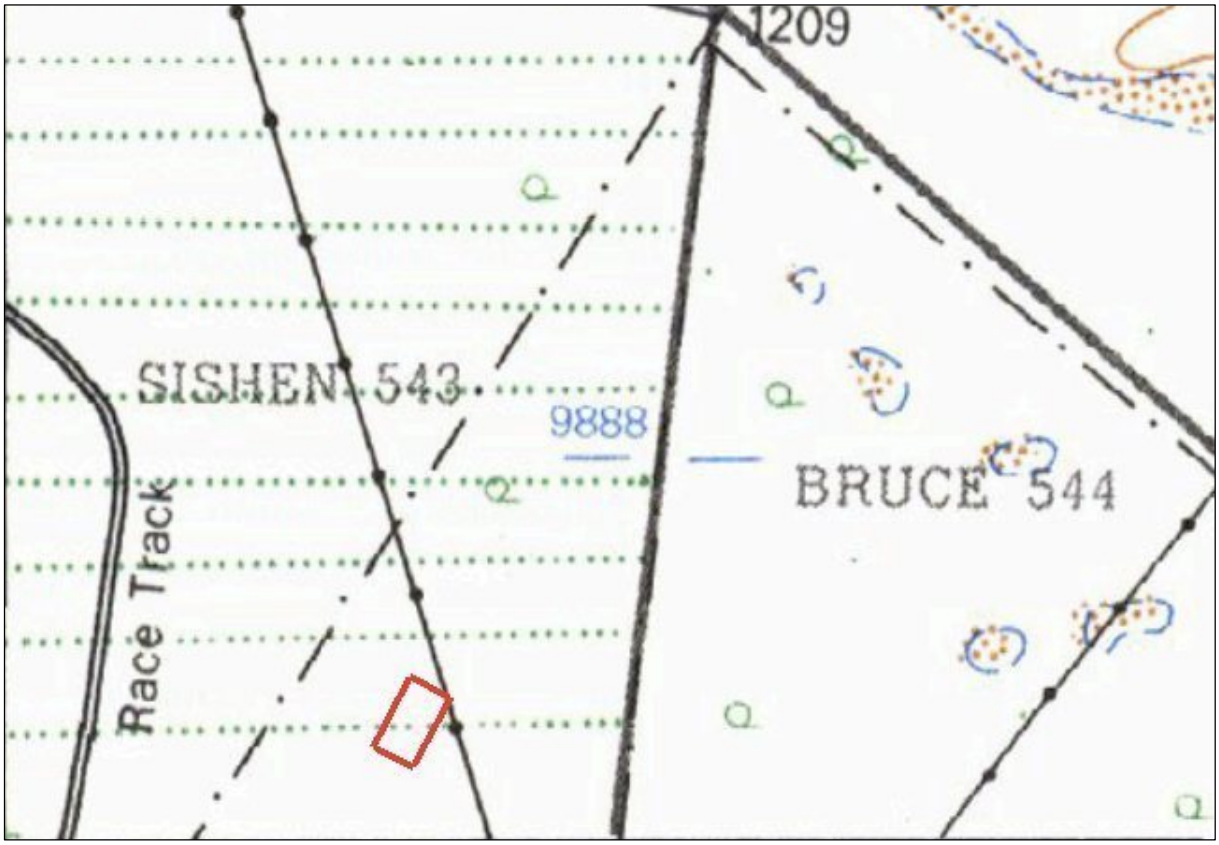


Figure 15 – Section of the First Edition of the 2723CA Topographical Sheet that depicts the Aldag component of the study area. This map was printed in 1974. The approximate boundaries of Aldag are depicted in red.

The following observations can be made from the depiction of the Lylyveld section of the study area on the 2723CC map:

- No heritage sites or features are depicted within the study area.
- The Ga-Mogara river is shown passing immediately north of the study area.
- Two relatively extensive excavations are shown approximately 276m west and north-west of the present study area boundaries at Lylyveld.

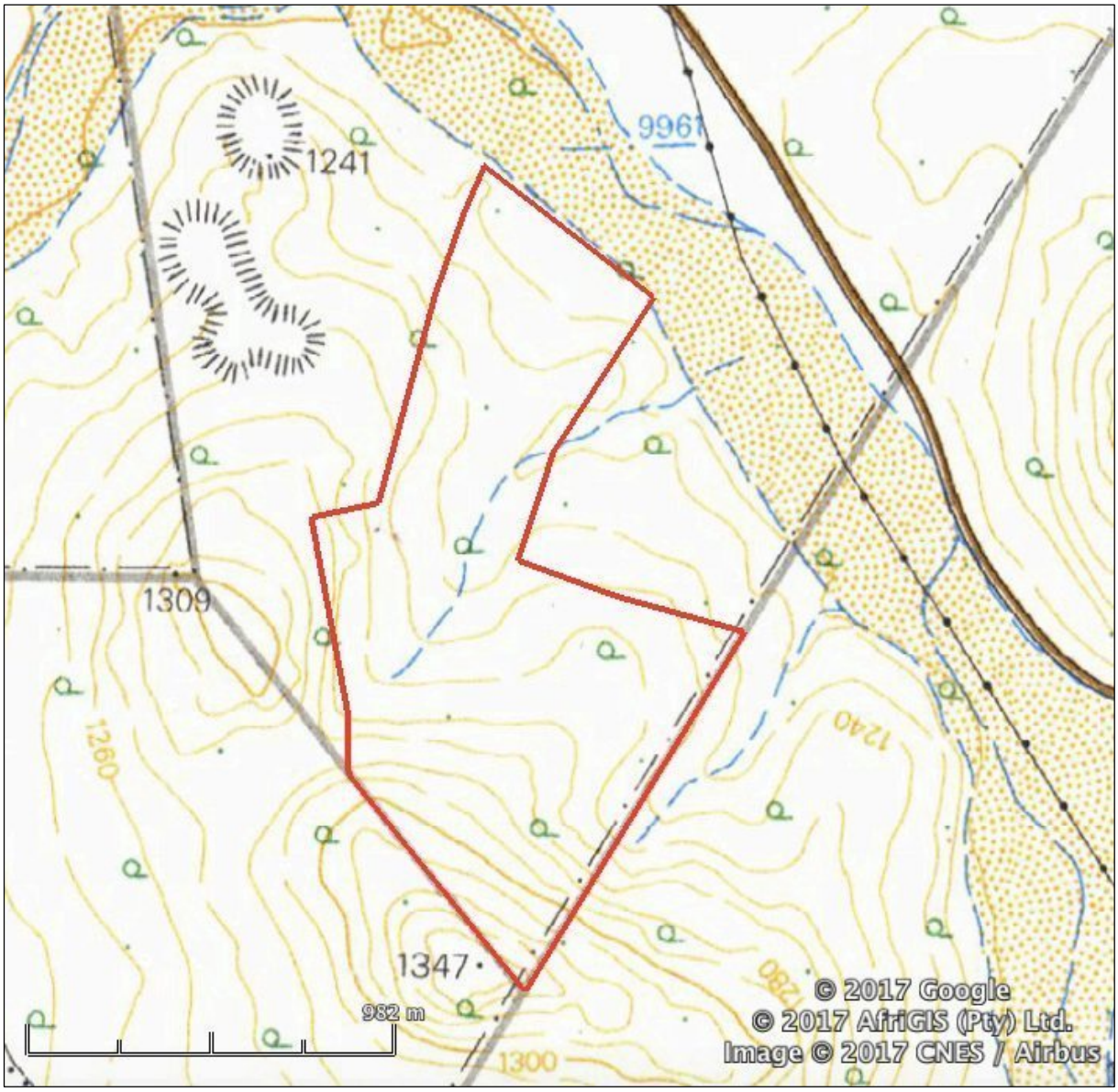


Figure 16 – Section of the First Edition of the 2723CC Topographical Sheet that depicts the Lylyveld component of the study area. This map was printed in 1975. The approximate boundaries of Lylyveld are depicted in red. Please note that the boundaries used here are inclusive of all the development footprint areas at Lylyveld, but do not reflect the exact boundaries of the study area assessed for this report.

5.3.2 Second Edition of the 1:50 000 2723CA and 2723CC Topographical Sheets

The figures below depict sections of the Second Editions of the 2723CA and 2723CC Topographical Sheets. Both the 2723CA and 2723CC sheets were surveyed in 2001.

The following observations can be made from the depiction of the Aldag section of the study area on the 2723CA map:

- No heritage sites or features are depicted within the study area.
- Sections of the study area, if not the entire Aldag section of the study area, had been disturbed by excavations and activities associated with the Sishen Mine.
- The immediate and wider surroundings of the study area are characterised by intensive mining activities

Figure 17 – Section of the Second Edition of the 2723CA Topographical Sheet that depicts the Aldag section of the study area. This map was surveyed in 2001. The approximate boundaries of Aldag are shown in red.

The following observations can be made from the depiction of the Lylyveld section of the study area on the 2723CC map:

- No heritage sites or features are depicted within the study area.
- The Ga-Mogara river is shown passing immediately north of the study area.
- A track is shown crossing over the study area.
- A relatively extensive excavation is shown approximately 130m west and north-west of the present study area boundaries at Lylyveld.
- The N14 highway is shown passing the study area in proximity to its northern end. At its closest point, this highway is located 305m north of the present study area.

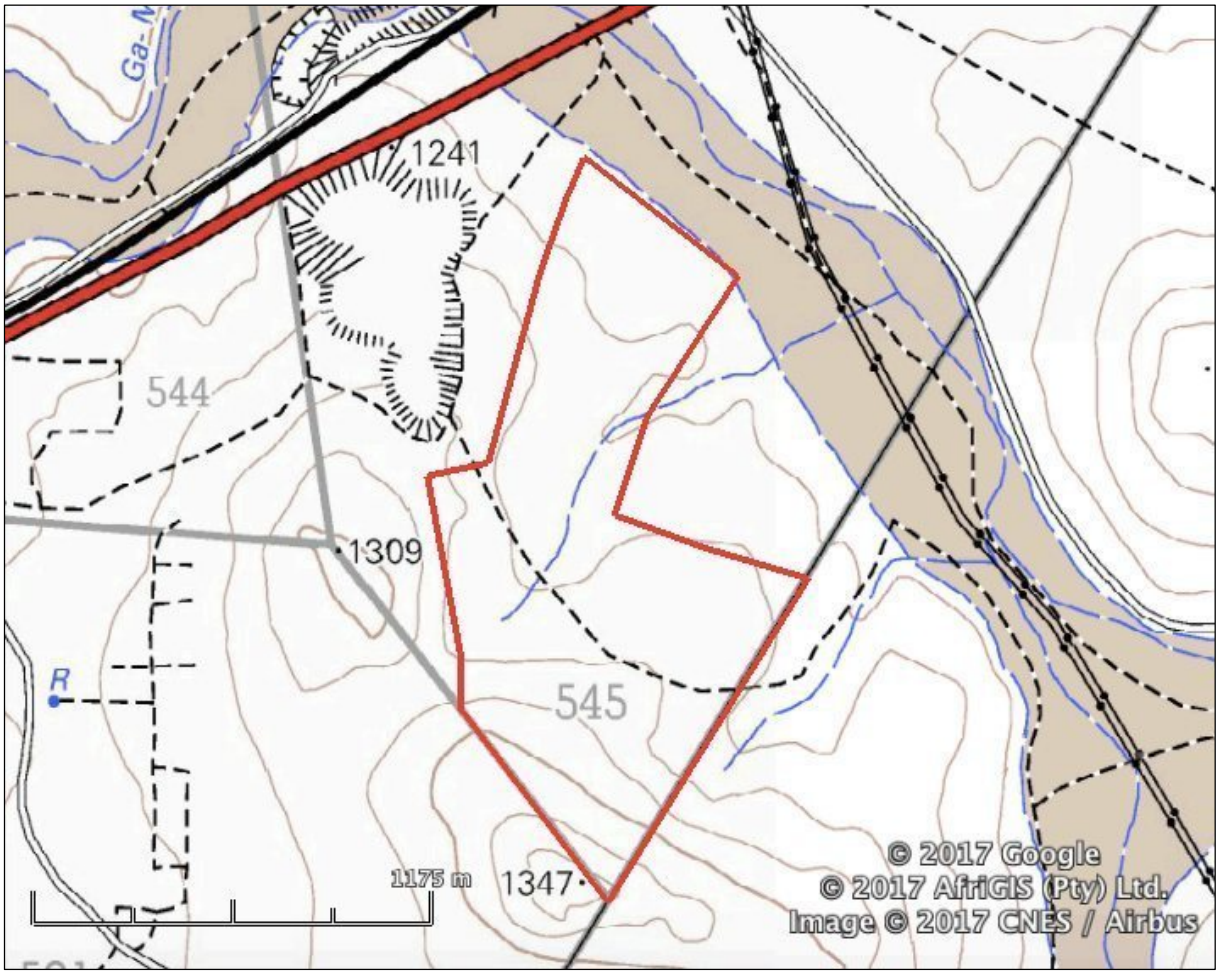


Figure 18 – Section of the Second Edition of the 2723CC Topographical Sheet that depicts the Lylyveld component of the study area. This map was surveyed in 2001. The approximate boundaries of Lylyveld are depicted in red. Please note that the boundaries used here are inclusive of all the development footprint areas at Lylyveld, but do not reflect the exact boundaries of the study area assessed for this report.

5.4 Palaeontology

A palaeontological desktop study was completed by Dr. Matt Caruana (**Annexure C**).

The study found that the proposed development site is completely underlain by sediments of the Early Precambrian, Transvaal Supergroup, Ghaap Group and Campbell Rand Subgroup.

The Campbell Rand Subgroup sediments were deposited on the shallow submerged Kaapvaal Craton, approximately 2.6 to 2.5 Ga (billion years ago). The development site near Kathu consists of a flat-lying terrain and vegetation cover of grassy thornveld.

The PalaeoMap (SAHRA website) indicates that the palaeontological significance of the Transvaal Group, Campbell Rand Subgroup is moderate and thus the overall impact of the proposed developments is rated as negative moderate significance.

6 FIELDWORK FINDINGS

The areas to be impacted were surveyed thoroughly and one point on Aldag (AD001) and two on Lylyveld (LV001 & LV002) were identified for further discussion (**Figure 19**) (Also refer to **Annexure B** for an enlarged map). AD001 represents a highly modified landscape with no significant Stone Age finds, and LV002 is a geological trench which demonstrates a lack of Stone Age material at depth. LV001 is the only identified point exhibiting archaeological residues in the form of a low-density surface scatter of what may be Middle Stone Age stone tools. However, a number of studies and past HIAs in the Kathu area have found significant finds as this area is of critical importance to ESA and MSA archaeological research and should be viewed as a continuous cultural landscape. Thus, despite this area containing few finds, the possibility that further finds will be made when development begins remains high.

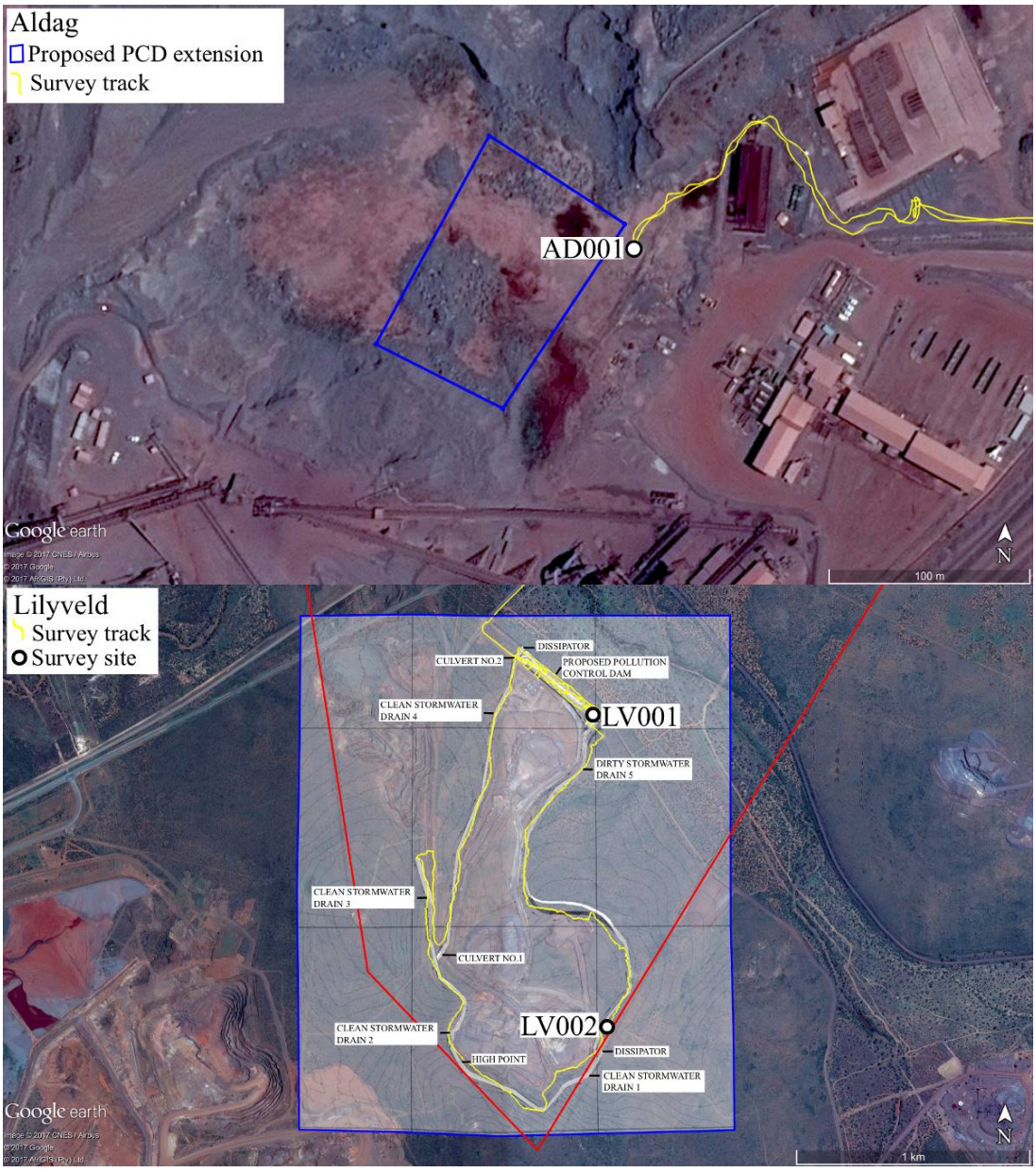


Figure 19 – Map indicating transects and find spots.

6.1 Find spot descriptions

6.1.1 AD001

Site type: Pollution Control Dam (PCD) infrastructure

Chronology: Modern

Description: Large 80 x 70 m area of disturbed deposits (**Figure 15**), the site of a previous dump that has subsequently been re-processed. Due to the extensive modification of this entire area there is no preservation of Stone Age remains in any kind of primary context.

Significance: None

Figure 20 – General view of the AD001 find spot. Note the heavily disturbed ground that by now would have irreparably damaged any archaeological finds.

Figure 21 – Another view of the AD001 find spot. Again, note the heavily disturbed ground that by now would have irreparably damaged any archaeological finds

6.1.2 LV001

Site type: Low-density Stone Age scatter

Chronology: Stone Age, possibly Middle Stone Age

Description: Low-density surface scatter of Stone Age flakes across a highly disturbed area approximately 30 x 10 m (**Figure 16**). Artefacts are made on chert and have been exposed at the surface for a great deal of time, hence their context is poor (**Figure 17**). A single flake appeared to retain some retouch (shaping), although this may likely be natural concussion damage. Associated with these sporadic artefacts are a high number of natural ironstone pebbles and cobbles, as well as geofacts (natural rocks that appear to look like artefacts), in a deflated context (**Figure 17**). These geofacts are most frequent alongside the mine roads where passing vehicles have damaged the rocks and caused percussion of the edges, thus giving the appearance of Stone Age artefacts. A nearby trench dug along the northern edge of the proposed PCD extension for Lylyveld confirms the surface Stone Age artefacts do not occur at depth (buried).

Significance: Low

Figure 22 – A view of LV001

Figure 23 – Example of stone tool (right) and geofact (left) found at LV001

6.1.3 LV002

Site type: Geo-trench

Chronology: Modern

Description: Large 6 x 2 x 1 m trench of indeterminate purpose (**Figure 18**). No artefacts were recovered within or alongside this feature, however this further confirms the lack of Stone Age artefacts at depth.

Significance: None

Figure 24 – A view of LV002 showing the excavated geo-technical trench.

7 IMPACT OF PROPOSED DEVELOPMENT ON HERITAGE RESOURCES

7.1 Archaeological Resources

Based on the data of previous studies in the Kathu area as well as the fieldwork undertaken for the present study, the possible impact of the proposed developments on the identified archaeological material is rated as LOW. However, because this area is a continuous cultural landscape and the occurrence of artefacts in the proposed area more than likely suggests more will be found, especially once excavations begin. It is very likely that the development will have a permanent negative high impact on subsurface archaeological resources.

With the implementation of mitigation measures this impact and risk can be reduced from HIGH negative to MODERATE positive. The mitigation measures will enable the identification of additional archaeological resources and the collection of data that could add to the current research questions.

Table 11 - Impact Evaluation – Archaeological resources

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
Impact on archaeological deposits					
No mitigation	HIGH	Local	Permanent	Very Likely	High Negative
	4	3	5	4	3.20
With mitigation	MODERATE	Local	Permanent	Could happen	Moderate Positive
	3	3	5	3	2.20

7.2 Palaeontological Resources

Significance - The site is underlain by the Ghaap Group (Campbell Rand Subgroup). Stromatolites are known (from the literature) to be present in the development area and the likelihood of significant fossil heritage in the Kathu area is considered to be medium.

Spatial Scale - The impact on fossil materials and thus palaeontological heritage will be limited to the construction phase when new excavations into fresh potentially fossiliferous bedrock take place. The

extent of the area of potential impact is thus restricted to the project site and therefore categorised as local.

Temporal Scale - The expected duration of the impact is assessed as potentially permanent to long term. In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be permanent.

Probability - Stratigraphic and geographical distribution of Archaean stromatolites within the Campbell Rand Subgroup has been documented in the literature. Stromatolite assemblages may be present within the development site. By taking a precautionary approach, an insignificant loss of fossil resources is expected. Since concentrations of small to large stromatolites might occur within the site, the probability of impacts on palaeontological heritage during the construction phase is probable.

Table 12 - Impact Evaluation – Palaeontological resources

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
Impact on palaeontological deposits					
No mitigation	MODERATE	Study Area	Permanent	Could Happen	
	3	2	5	3	2.00
With mitigation	LOW	Study Area	Permanent	Could Happen	Moderate Positive
	2	2	5	3	1.80

8 MITIGATION MEASURES AND GENERAL RECOMMENDATIONS

8.1 Mitigation Measures required for Archaeology

The following conclusions were drawn from the fieldwork:

- The study area is already highly disturbed;
- Only a single low significance Stone Age scatter was found; and
- At depth (LV002) no archaeological residues were noted.

As a result, no pre-construction phase mitigation measures are required. Nevertheless, certain general recommendations are suggested:

- If a deposit is identified a controlled sampling of the material found should be done;
- This work must be done in such a way as to augment the current research questions and field work such as the excavations at the Kathu Townlands Site and Kathu Pan;
- These test excavations and sampling must be done after a permit has been granted under Section 35 of the NHRA (Act 25 of 1999) to a qualified and experienced Stone Age archaeologist;
- In the event that substantive material is uncovered, it is recommended that a display is considered in a convenient location;
- An archaeologist suitably qualified in Stone Age fieldwork and research must be appointed to undertake an Archaeological Watching Brief during the Construction Phase[2] of the project. The appointed archaeologist will be responsible for the following:
    - Provide training to the project Environmental Control Office (ECO) in Stone Age archaeology and the identification of Stone Age artefacts and sites. The ECO will be responsible for daily on-site monitoring during the Construction Phase with the appointed archaeologist visiting the site every two weeks.
    - Conduct an archaeological monitoring program whereby the construction site is visited once every two weeks for at least the first three months of the project.
    - On-site assessment of any Stone Age material exposed during construction and the provision of recommendations for the way in which the exposed material must be mitigated.
    - Compile and submit an archaeological monitoring report at the end of the monitoring process.

[2] *the initial site establishment when the area is cleared and support infrastructure is established.*

Archaeological monitoring during the Construction Phase is also required. The following measures must be undertaken:

- During the monitoring undertaken everyday on-site by the ECO and once every two weeks by the appointed archaeologist, all construction work must be closely monitored;
- Should any Stone Age material or any archaeological material be identified, all construction work in that area must immediately stop and the ECO or archaeologist (if already present on site) must demarcate a construction free area around the discovery;
- If the ECO made the discovery, the archaeologist must be contacted immediately to visit the construction site to assess the exposed material. After assessing the exposed material, the archaeologist would provide recommendations for the exposed material that may range from destruction without mitigation (if the exposed material is found to be of little significance) to archaeological mitigation (if the exposed material is found to be significant).

8.2 Mitigation Measures required for Palaeontology

As per the palaeontological desktop assessment (**Annexure C**), the proposed development is unlikely to pose a substantial threat to local fossil heritage. However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the following measures must be implemented:

- The ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

- The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

9 CONCLUSIONS

PGS Heritage (Pty) Ltd was appointed by EXM Advisory Services (Pty) Ltd to undertake a Heritage Impact Assessment (HIA), which forms part of the Basic Assessment (BA) for the development of a new pollution control dam at Aldag, on the remainder of farm Sishen 543, and the expansion of a currently planned pollution control dam on the remainder of farm Lylyveld 545, near the southern side of the town of Kathu, Northern Cape.

Due to the significance of the Stone Age sites from the surrounding landscape, Drs. Matt Lotter and Tim Forssman were appointed to conduct the field survey and prepare the report and Dr. Matt Caruana was appointed to perform the palaeontological desktop study.

An archival and historical desktop study was undertaken and was used to compile a historical layering of the study area within its regional context. This component indicated that the landscape within which the project area is located has a rich and diverse history.

The proposed National Heritage Site Nomination of the Kathu Archaeological Complex demonstrates the importance of the archaeological heritage of the region (Walker et al, 2013; SAHRIS accessed August 2014). The scientific and heritage significance as well as the occurrence of archaeological material was taken into account in the HIA under review (Beaumont, 1990, 2004, 2013; Porrat et al, 2010; Herries, 2012; Chazan et al, 2012; Wilkins & Chazan, 2012; Walker et al, 2013; Walker et al 2014).

The heritage desktop study component of the project was followed by fieldwork. The methodology comprised a detailed walkthrough of the study area by an experienced archaeologist. No heritage sites were identified within the study area boundaries during the fieldwork.

Despite the fact that subterranean Stone Age material is known from the surroundings of the study area, no mitigation is needed. However, the following general recommendations are required:

- If a deposit is identified, a controlled sampling of the material found should be done;
- This work must be done in such a way as to augment the current research questions and field work such as the excavations at the Kathu Townlands Site and Kathu Pan;
- These test excavations and sampling must be done after a permit has been granted under Section 35 of the NHRA (Act 25 of 1999) to a qualified and experienced Stone Age archaeologist;
- In the event that substantive material is uncovered, it is recommended that a display is considered

in a convenient location;

- An archaeologist suitably qualified in Stone Age fieldwork and research must be appointed to undertake an Archaeological Watching Brief during the Construction[3] Phase of the project. The appointed archaeologist will be responsible for the following:

    - Provide training to the project Environmental Control Office (ECO) in Stone Age archaeology and the identification of Stone Age artefacts and sites. The ECO will be responsible for daily on-site monitoring during the Construction Phase with the appointed archaeologist visiting the site every two weeks.
    - Conduct an archaeological monitoring program whereby the construction site is visited once every two weeks for at least the first three months of the project.
    - On-site assessment of any Stone Age material exposed during construction and the provision of recommendations for the way in which the exposed material must be mitigated.
    - Compile and submit an archaeological monitoring report at the end of the monitoring process.

- During the monitoring undertaken everyday on-site by the ECO and once every two weeks by the appointed archaeologist, all construction work must be closely monitored. Should any Stone Age material or any archaeological material be identified, all construction work in that area must immediately stop and the ECO or archaeologist (if already present on site) must demarcate a construction free area around the discovery. If the ECO made the discovery, the archaeologist must be contacted immediately to visit the construction site to assess the exposed material. After assessing the exposed material, the archaeologist would provide recommendations for the exposed material, which may range from destruction without mitigation (if the exposed material is found to be of little significance) to archaeological mitigation (if the exposed material is found to be significant).

As per the palaeontological desktop assessment (**Annexure C**), the proposed development is unlikely to pose a substantial threat to local fossil heritage. However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

[3] *the initial site establishment when the area is cleared and support infrastructure is established.*

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

The proposed developments at Aldag and Lylyveld can continue if the recommendations as outlined in this report are adhered to.

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10.5 Historic Topographic Maps

All the historic topographic maps used in this report were obtained from the Directorate: National Geo-spatial Information of the Department of Rural Development and Land Reform in Cape Town.

10.6 Google Earth

All the aerial depictions and overlays used in this report are from Google Earth.

ANNEXURE A – LEGISLATIVE REQUIREMENTS: TERMINOLOGY AND ASSESSMENT CRITERIA

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 terms of the heritage legislation, permits are required to damage, destroy, alter, or disturb them. Furthermore, individuals who already possess heritage material are required to register it. The management of heritage resources is integrated 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 located in a cemetery (such as ancestral graves in rural areas), are protected. The legislation also protects the interests of communities that have an interest in the graves: they should be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle are to be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resources 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 prehistoric cultural remains, including graves and human remains.

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 are under 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 reinternment 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 are under the jurisdiction of the South African Heritage Resources 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.

ANNEXURE B – HERITAGE RESOURCES DISTRIBUTION MAP

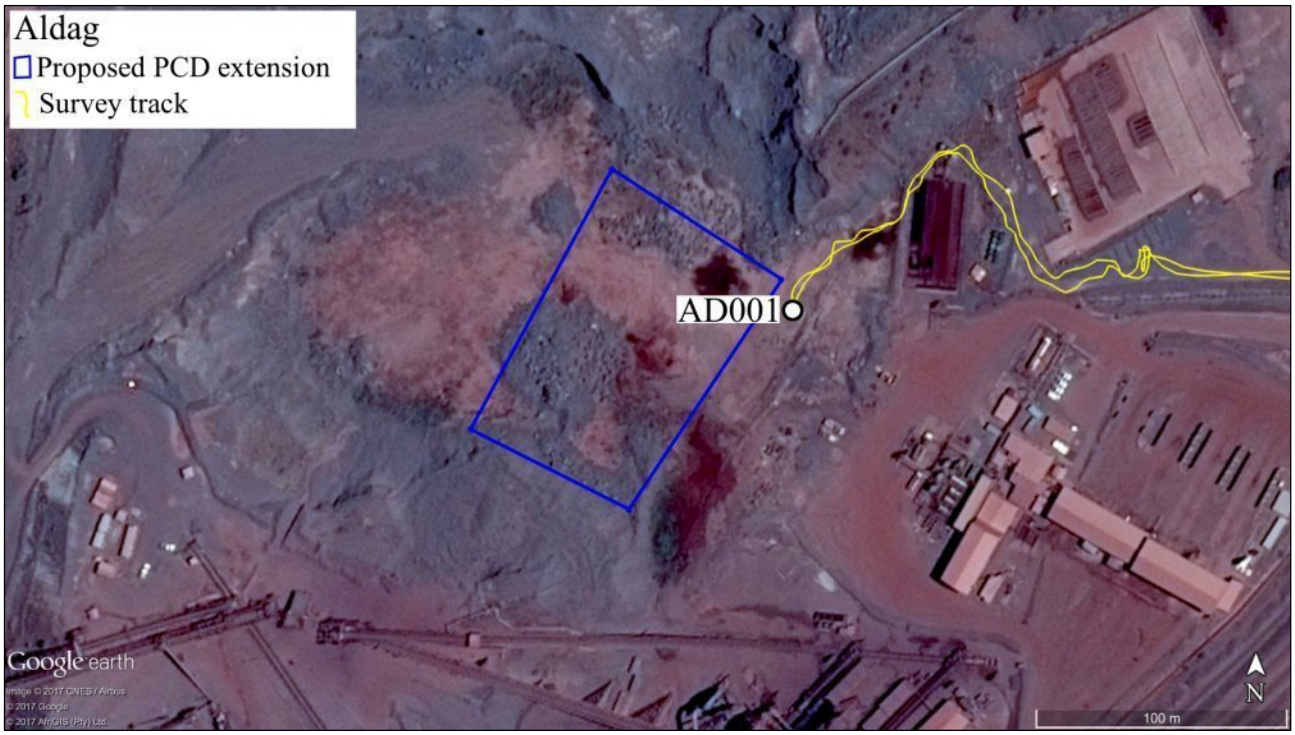

Figure 25 – Enlarged Map of Aldag.

Figure 26 – Enlarged Map of the northern portion of Lylyveld.

Figure 27 – Enlarged Map of the southern portion of Lylyveld.

ANNEXURE C – PALAEONTOLOGICAL DESKTOP STUDY

The 'study area' referred to in this desktop study is defined as the boundaries for proposed developments on Farms Lylyveld and Aldag (see above), situated outside of Kathu. This region of the Northern Cape is underlain by a complex geological sequence, including the Kalahari Group sediments from the Mesozoic Era to the Holocene period (~200Ma – 10ka), with outcrops of much older Transvaal Supergroup from the Archean Eon (~4 – 2.4Ga) (Eriksson & Altermann, 1998; Sumner & Bowring, 1996). The Transvaal Supergroup in this area is represented by the Ghaap Group (~2.5 – 2.4 Ga), which includes numerous sedimentary formations (Alterman & Schopf, 1996). Further, ore deposits associated with the Ghaap Group are also prevalent in this area including banded ironstone formations (BIF) (Hälbich et al., 1993; Eriksson & Altermann, 1998; Altermann & Schopf, 1996). Most of this basement rock has been overlain by the sedimentary formation of the Kalahari Group in recent geological history, which are mostly comprised of sand and clay deposits (Thomas & Shaw, 1990).

Ghaap Group (Griqualand West Sequence)

The Ghaap Group is largely composed of sedimentary formations rich in diamictites, silicates and iron (Beukes, 1980; Kendall et al., 2013). In the region south of the Kuruman hills, where Kathu is located, a complex stratigraphic sequence of the Ghaap Group is exposed, including the Campbellrand, Asbestos, Kuruman and Koegas Subgroups (Beukes, 1980; Hälbich et al., 1993). In general, these subgroups were formed through shallow, low-energy seas occupying the interior of Gondwanaland (Eriksson & Altermann, 1998). The carbonate-rich formations of the Ghaap Group have also influenced the modern setting of the landscape in the Kathu area, which is known for its superficial duricrust formations, including calcrete and ferricrete pans. These features are formed as groundwater leaches carbonates from the Ghaap Group and then precipitates these minerals through evaporation, typically around freshwater springs. In terms of palaeontology, The Ghaap Group only preserves trace, microbal fossils including stromatolites, oolites and other eukaryotes (Wright & Altermann, 2000). These fossils have been important for understanding the formation of the Transvaal Supergroup, having only been significantly exposed due to drilling at depths of over 100m (Waldbauer et al., 2009; Altermann & Schopf, 1996).

Kalahari Group

The Kalahari Group is comprised of sandy and clay-rich sediments that have been deposited in the Griqualand West basin, over the ancient Ghaap Group in the area near Kathu. The Kalahari Group is comprised of Jurassic to Holocene sedimentary formations, including alluvial and aeolian sands, terrace

gravels, surface limestones, calcretes and silcretes. This geological group was largely formed through fluvial and aeolian processes, depositing sediments from the Kalahari Basin in central southern Africa. In general, the Kalahari Group is low in fossil content and diversity (Almond, 2016). Recent palaeontological impact assessments in the Northern Cape have found trace fossils including termite mounds, as well as gastropods (Almond, 2016). However, most academic sources confer that fossils-bearing deposits in the Kalahari Group sediments are rare.

Northern Cape Palaeontological Sites

Taung World Heritage Site

The most well-known palaeontological locality near the Kathu area is the Taung World Heritage site (hereafter Taung) outside of Kuruman (Kuhn et al., 2016). This is where the type specimen for *Australopithecus africanus* (Taung Child) was discovered and soon after described by Dart (1925). The Taung locality is comprised of successive tufa formations (Thabaseek, Norlim, Oxland and Blue Pools carapaces) that house 22 palaeontological and archaeological sites spanning the late Pliocene to the Holocene (McKee, 1994; Kuhn et al., 2016). These tufa formations developed from freshwater springs leaching carbonates from nearby dolomites comprising the Ghaap Plateau. The type site within Taung is comprised of two pinnacles (Dart and Hrdlicka), which have been dated to 3.03 - 2.58 Ma and are rich in faunal fossil remains (Kuhn et al., 2016). There are numerous other localities within the Taung site complex that are constrained to the Middle Pleistocene to Holocene (~1Ma - 2ka) by tufa formations, including Oxland Large Mammal site, Satan's Cave, Equus Cave, Tobias's Pinnacle and Black Earth Cave (McKee, 1994; Kuhn et al., 2016). Of these lesser known sites, only Equus Cave and Black Earth Cave have produced human remains (Kuhn et al., 2016).

Groot Kloof

Groot Kloof is another palaeontological site, dated to the Middle Pleistocene 100km southwest of Taung (Curnoe et al., 2006). U-Th produced a date of ~248ka with faunal remains derived from the Florisian Land Mammal Age. Groot Kloof is geologically comprised of tufa formed by a waterfall complex stemming from the Ghaap Plateau (Curnoe et al., 2006). While Groot Kloof has been preliminarily described as a fossil locality that is equal in age to Florisbad, it has yet to be systematically investigated and thus its palaeontological significance remains unknown.

Previous Palaeontological Studies in the Kathu Area

- Almond, J.E. 2010a. Proposed 100 MW concentrating solar power (CSP) generation facility: Copperton, Northern Cape Province. Palaeontological impact assessment: desktop study.

- Almond, J.E. 2010b. Proposed photovoltaic power generation facility: Prieska PV Site 1, Copperton, Northern Cape Province. Palaeontological impact assessment: desktop study.

- Pether, J. 2011. Brief Palaeontological Impact Assessment Proposed Kathu & Sishen Solar Energy Facilities Portions 4 & 6 of the Farm Wincanton 472 Kuruman District, Northern Cape. Palaeontological impact assessment.

- Almond, J.E. 2011a. Proposed Plan 8 wind energy facility near Copperton, Northern Cape Province. Palaeontological impact assessment: desktop study.

- Almond, J.E. 2011b. Proposed Mainstream wind farm near Prieska, Pixley ka Seme District Municipality, Northern Cape Province. Palaeontological impact assessment: desktop study.

- Almond, J.E. 2012a. Proposed photovoltaic energy plant on Farm Klipgats Pan (Portion 4 of Farm 117) near Copperton, Northern Cape Province. Palaeontological specialist assessment: combined desktop & field assessment study.

- Almond, J.E. 2012b. Proposed photovoltaic energy plant on Farm Hoekplaas (Remainder of Farm 146) near Copperton, Northern Cape Province. Palaeontological specialist assessment: combined desktop & field assessment study.

- Almond, J.E. 2013. Proposed PV2 to PV11 photovoltaic energy plants on the Farm Hoekplaas near Copperton, Northern Cape. Palaeontological specialist assessment: combined desktop & field assessment study.

- Birkholtz, P. 2015. Palaeontological Desktop Assessment of Portion of the Farm Marsh 467, Kathu, Northern Cape. Heritage Impact Assessment.

- Banzai Environmental 2017. Palaeontological desktop assessment for the proposed development of a new cemetery, near Kathu, Gamagara Local Municipality and John Taolo Gaetsewe District Municipality, Northern Cape. Palaeontological impact assessment.

Results of the Archival Findings

The SAHRIS Palaeo-Sensitivity Map (http://www.sahra.org.za/sahris/map/palaeo) shows a moderate to high rating for fossil deposits for the study area. These ratings indicate that fieldwork will likely be necessary after the desktop study is complete. After researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris) it was determined that no previous palaeontological studies overlapped with the study area, although three palaeontological impact assessments (PIAs) were conducted in the vicinity of Kathu. None of these impact assessments recorded important fossils nor recommended mitigation. Furthermore, most of these reports confer with the academic sources discussed above that the potential for significant fossil deposits being discovered in this

area, outside of core drilling, is unlikely. Based on literature for the Transvaal Supergroup, the only significant fossil to be discovered in the Kathu area are microbal and only exposed at significant depth (~100m). In terms of the Kalahari Group, very few fossil deposits have been located in general and most of those relate to insects and gastropods that are not found in large concentrations. As such, it is unlikely that development in this area will have a significantly negative impact on development. In conclusion, because the study areas have been previously mined and there is a low chance of uncovering significant fossil deposits in this area, no mitigation is recommended or needed at this time.

Recommendations

The proposed developments are unlikely to pose a substantial threat to local fossil heritage. However, should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted immediately. Such discoveries ought to be protected (preferably in situ) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional paleontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

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