



**PORTION 2 (REMAINING EXTENT),
PORTION 3 (REMAINING EXTENT),
PORTION 5 AND REMAINING EXTENT
OF THE FARM KAPSTEWEL 436**

Heritage Impact Assessment (HIA) Report

June 2020

CREDIT SHEET

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

Statement of Independence

As the duly appointed representative of G&A Heritage, I Stephan Gaigher, hereby confirm my independence as a specialist and declare that neither I nor G&A Heritage have any interests, be it business or otherwise, in any proposed activity, application or appeal in respect of which the Environmental Consultant was appointed as Environmental Assessment Practitioner, other than fair remuneration for work performed on this project.

SIGNED BY: STEPHAN GAIGHER

A handwritten signature in black ink, appearing to read 'S. Gaigher', written in a cursive style.

MANAGEMENT SUMMARY

Project Name and Location

Prospecting boreholes and trenches located on Portion 2 (Remaining Extent), Portion 3 (Remaining Extent), Portion 5 and Remaining Extent of the Farm Kapstewel 436, near Postmasburg in the Northern Cape Province.

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Jaco K Consulting



Jaco-K Consulting

Date of Report

1 June 2020

MANAGEMENT SUMMARY

The purpose of the management summary is to distil the information contained in the report into a format that can be used to give specific results quickly and facilitate management decisions. It is not the purpose of the management summary to repeat in shortened format all the information contained in the report, but rather to give a statement of results for decision making purposes.

This study focuses on the prospecting boreholes and trenches on Portion 2 (Remaining Extent), Portion 3 (Remaining Extent), Portion 5 and Remaining Extent of the farm Kapstewel 436, near Postmasburg in the Northern Cape Province.

This study encompasses the heritage impact investigation. A preliminary layout has been supplied to lead this phase of this study.

Scope of Work

A Heritage Impact Assessment (including Archaeological, Cultural heritage, Built Heritage and Basic Palaeontological Assessment to determine the impacts on heritage resources within the study area.

The following is required to perform this assessment:

- A desk-top investigation of the area;
- A site visit to the proposed development site;
- Identify possible archaeological, cultural, historic, built and palaeontological sites within the proposed development area;
- Evaluate the potential impacts of construction and operation of the proposed development on archaeological, cultural, historical resources; built and palaeontological resources; and
- Recommend mitigation measures to ameliorate any negative impacts on areas of archaeological, cultural, historical, built and palaeontological importance.
- Due to the high palaeontological sensitivity of the study area a stand-alone, field based Palaeontological Impact Assessment was commissioned and will be appended to this report.

The purpose of this study is to determine the possible occurrence of sites with cultural heritage significance within the study area. The study is based on archival and document combined with fieldwork investigations.

Findings and Recommendations

The area was investigated during a field visit and through archival studies. The areas under investigation comprised Portions 1,2,3,5,6,7 & 9 of the Farm Kapstewel 436 (referred to from hereon as Kapstewel). All the sections under investigation had been surveyed during preceding studies in 2009 and 2014. The 2014 survey was also conducted by G&A Heritage Properties (Pty) Ltd. During the preceding studies, 8 sites of heritage potential were identified. The current study could not identify any new sites except for some low-density Stone Age tool scatters.

Access to Portion 3 (Remaining Extent) of Kapstewel 436 could not be arranged during this study, however the area was extensively investigated during both the 2014 and 2009 studies and no sites of heritage significance could be identified. It is recommended that the 14 proposed boreholes and trenches on this section be cleared by a qualified heritage practitioner once permissions have been obtained and final placements been done.

Fatal Flaws

No fatal flaws were identified.

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ABBREVIATIONS

Abbreviation	Meaning
BP	Before Present
c.	circa
BCE	Before the Common Era
Bp	Before Present
CE	Common Era
EIA	Early Iron Age
ESA	Early Stone Age
ESMS	Environmental and Social Management System
ESSS	Environmental and Social Safeguard Standards
Fm	Femtometre (10^{-15}m)
GPS	Geographic Positioning System
HIA	Heritage Impact Assessment
ICP	Informed Consultation and Participation
ICOMOS	International Council on Monuments and Sites
LIA	Late Iron Age
LSA	Late Stone Age
MSA	Middle Stone Age
MYA	Million Years Ago
NHRA	National Heritage Resources Agency
PIA	Palaeontological Impact Assessment
PS	Performance Standard
SAHRA	South African Heritage Resource Agency
SAHRIS	South African Heritage Information System
S&EIR	Scoping and Environmental Impact Reporting
Um	Micrometre (10^{-6}m)
WGS 84	World Geodetic System for 1984

GLOSSARY OF TERMS

'Archaeological' means:

- a) Material remains resulting from human activity which are in a state of disuse and are in or on land and are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
- b) Rock art, being a 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 is older than 100 years including any area within 10 m of such representation; and
- c) Wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land or in the maritime cultural zone referred to in section 5 of the Maritime Zones Act 1994 (Act 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which are older than 60 years or which in terms of national legislation are considered to be worthy of conservation;
- d) Features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found.

'Circa' is used in front of a particular year to indicate an approximate date.

'Grave' means a place of interment and includes the contents, headstone or other marker of and any other structures on or associated with such place. The South African Heritage Resources Agency (SAHRA) will only issue a permit for the alteration of a grave if it is satisfied that every reasonable effort has been made to contact and obtain permission from the families concerned.

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

A **'place'** is defined as:

- a) A site, area or region;
- b) A building or other structure (which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure);
- c) A group of buildings or other structures (which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures); and (d) an open space, including a public square, street or park; and in relation to the management of a place, includes the immediate surroundings of a place.

'Structures' means any building, works, device, or other facility made by people and which is fixed to land and any fixtures, fittings and equipment associated therewith older than 60 years.

1. General

1.1 Project Description

G&A Heritage was appointed by *Jaco-K Consulting* to undertake a Heritage Impact Assessment (HIA) for the proposed prospecting boreholes and trenches on Portion 2 (Remaining Extent), Portion 3 (Remaining Extent) Portion 5 and Remaining Extent of the farm Kapstewel 436 located near Postmasburg in the Northern Cape Province.

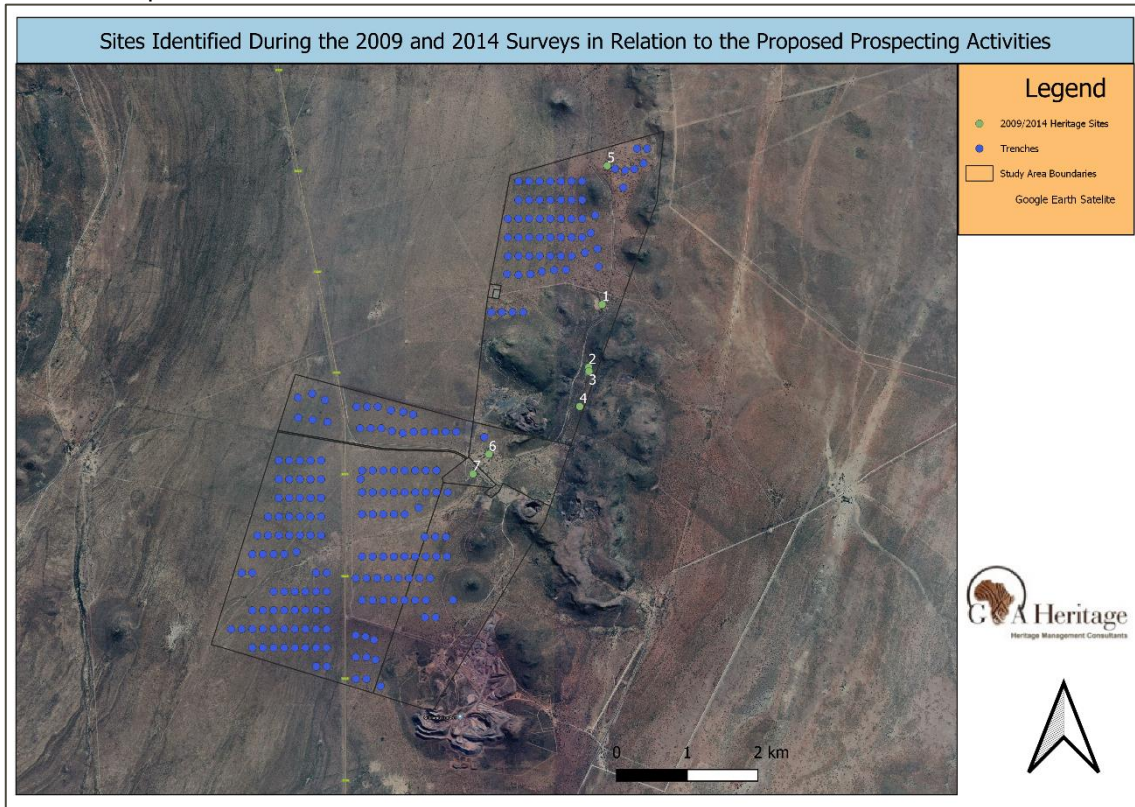


Figure 1. Prospecting boreholes and trenches on the farm Kapstewel 436

1.2 Technical Scope of HIA

This HIA focused only on the areas to be directly affected by the boreholes and trenches. This proved to be a very small portion of the proposed mining area. Boreholes will have a footprint of approximately 1m x 1m while the trenches will be 20m x 2m each.

The HIA is meant to deliver, evaluate and inform on the following aspects:

- (a) The identification and mapping of all heritage resources in the area affected;
- (b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in the relevant legal descriptions, development proponent requirements and as per international best practise approaches and charters;
- (c) An assessment of the impact of the development on such heritage resources;
- (d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
- (e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
- (f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
- (g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

The following categories of heritage objects are considered.

Graves: Places of interment including the contents, headstone or other marker of and any other structures on or associated with such place. This may include any of the following:

- 1) Ancestral graves,
- 2) Royal graves and graves of traditional leaders
- 3) Graves of victims of conflict i.e. graves of important individuals
- 4) Historical graves and cemeteries older than 60 years
- 5) Other human remains, buried or otherwise.

The removal of graves is subject to the following procedures:

- Notification of the impending removals (using local language media and notices at the grave site);
- Consultation with individuals or communities related or known to the deceased;
- Satisfactory arrangements for the curation of human remains and / or headstones in a museum, where applicable;
- Procurement of a permit from the relevant controlling body;
- Appropriate arrangements for the exhumation (preferably by a suitably trained archaeologist) and re-interment (sometimes by a registered undertaker, in a formally proclaimed cemetery);
- Observation of rituals or ceremonies required by the families.

Movable objects: This includes objects such as historic or rare books and manuscripts, paintings, drawings, sculptures, statuettes and carvings; modern or historic religious items; historic costumes, jewellery and textiles; fragments of monuments or historic buildings; archaeological material; and natural history collections such as shells, flora, or minerals. Discoveries and access resulting from a project may increase the vulnerability of cultural objects to theft, trafficking or abuse. This may include any of the following:

- 1) Objects recovered from the soil or water including archaeological and paleontological objects and material, meteorites and rare geological specimens;
- 2) Ethnographic art and objects
- 3) Military objects
- 4) Objects of decorative art
- 5) Objects of fine art
- 6) Objects of scientific or technological interest
- 7) Books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings
- 8) Any other prescribed categories, but excluding any object made by a living person.

Protection of Historic Battlefields

Heritage “Places”: A ‘place’ is defined as:

- a) A site, area or region;
- b) A building or other structure (which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure);
- c) A group of buildings or other structures (which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures); and
- d) An open space, including a public square, street or park; and in relation to the management of a place, includes the immediate surroundings of a place.
- e) Traditional Buildings used in cultural ceremonies.

Heritage Structures: Refers to single or groups of architectural works found in urban or rural settings providing evidence of a particular civilisation, a significant development or a historic event. It includes groups of buildings, structures and open spaces constituting past or contemporary human settlements that are recognised as cohesive and valuable from an architectural, aesthetic, spiritual or socio-cultural perspective. This may also include any building, works, device, or other facility made by people and which is fixed to land and any fixtures, fittings and equipment associated therewith older than 60 years.

Archaeological Sites

Archaeological sites comprise any combination of structural remains, artefacts, human or ecological elements and may be located entirely beneath, partially above, or entirely above the land or water surface. Archaeological material may be found anywhere on the earth’s surface, singly or scattered over large areas. Such material includes burial areas, human remains, artefacts and fossils. Archaeological sites may include:

- a) Material remains resulting from human activity which are in a state of disuse and are in or on land and are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
- b) Rock art, being a 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 is older than 100 years including any area within 10 m of such representation; and
- c) Wrecks, being any vessel or aircraft, or any part thereof, which was wrecked, whether on land or in the maritime cultural zone, and any cargo, debris or artefacts found or associated therewith, which are older than 60 years or which in terms of national legislation are considered to be worthy of conservation;
- d) Features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found.

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

Sacred or Spiritual Sites: Refers to natural features with cultural significance, which may include sacred hills, mountains, landscapes, streams, rivers, waterfalls, caves and rocks; sacred trees or plants, groves and forests; carvings or paintings on exposed rock faces or in caves; and paleontological deposits of early human, animal or fossilised remains. This heritage may have significance to local community groups or minority populations.

1.3 Geographical / Spatial Scope of HIA

The geographic and spatial scope of the HIA centres on the proposed prospecting boreholes and trenches on Portion 2 (Remaining Extent), Portion 3 (Remaining Extent) Portion 5 and Remaining Extent of the farm Kapstewel 436. Any sites within the directly impacted study area (borehole and trench footprints) that can be affected by the proposed development and, where known, are included in this report. Mitigation or secondary investigations take this footprint as the spatial parameters of the study area.

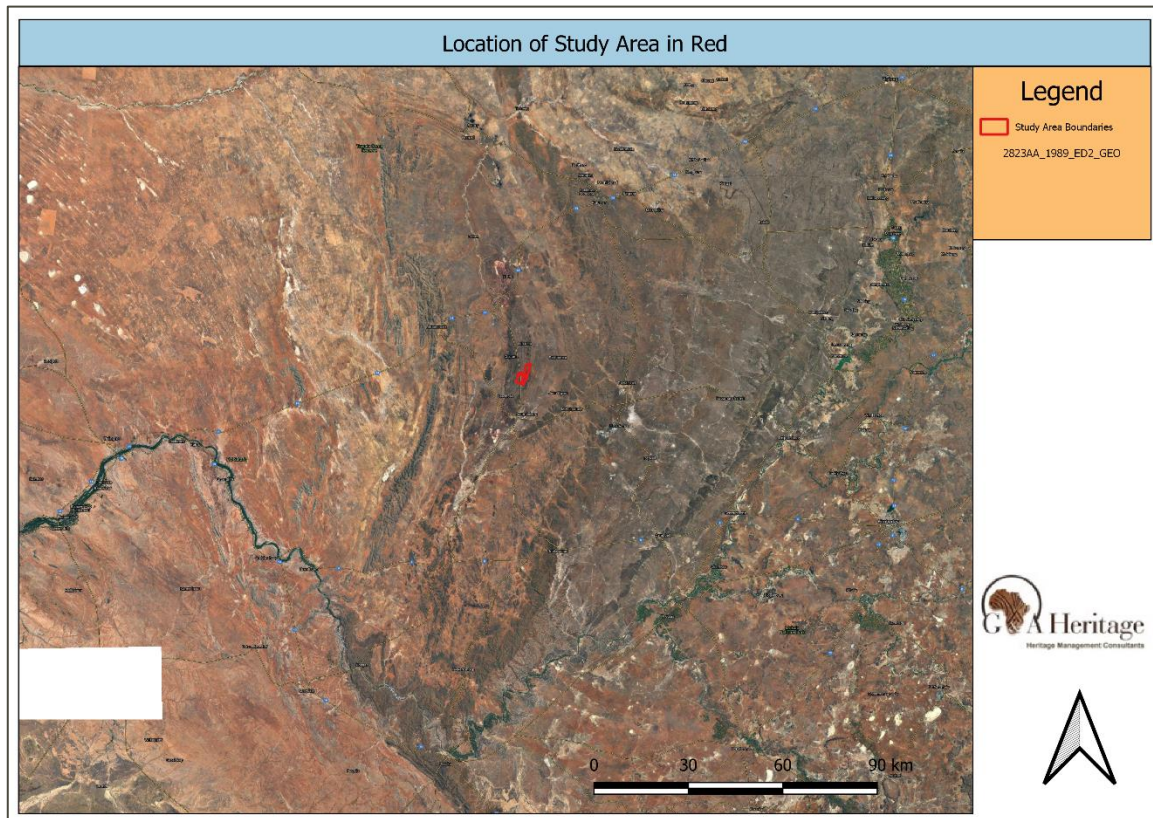


Figure 2. Location of study area

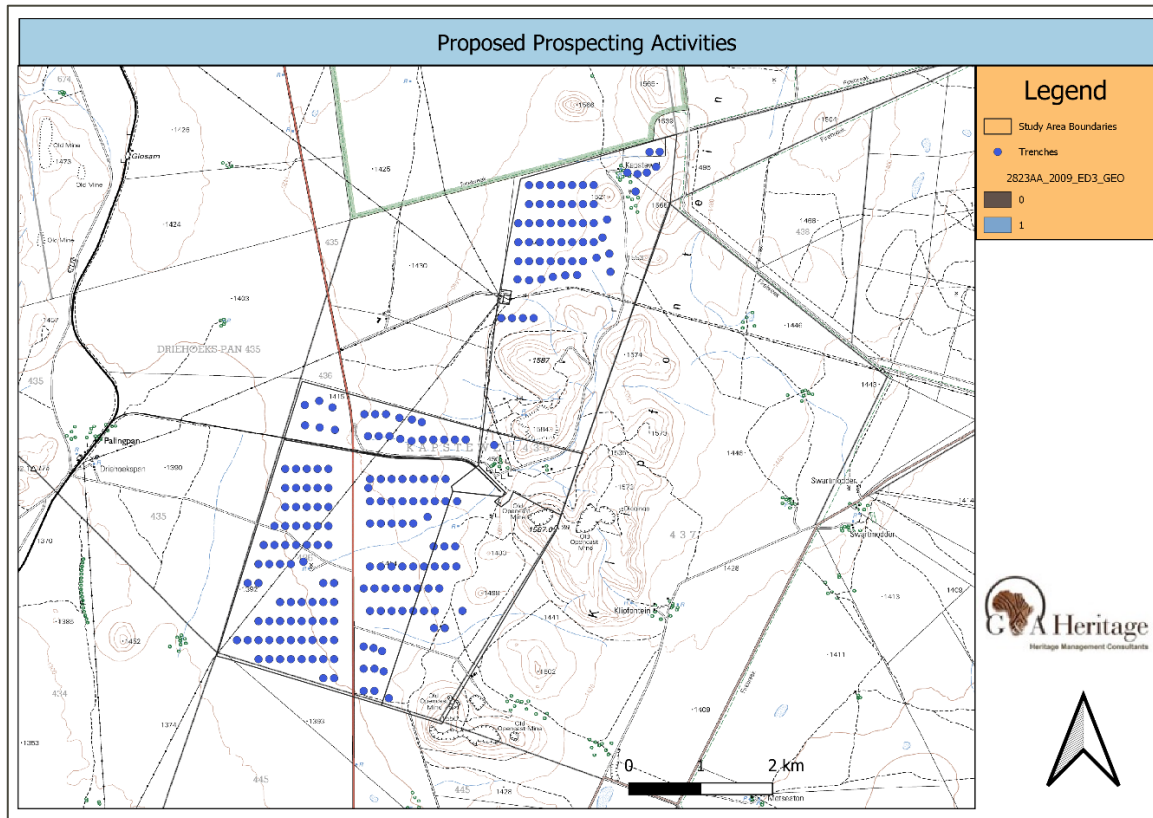


Figure 3. Location of proposed prospecting sites

1.4 GPS Track Path

The following image shows a plotting of the GPS track paths recorded during the fieldwork. Several files were combined, and this does not represent a single uninterrupted recording. GPX Files are available.

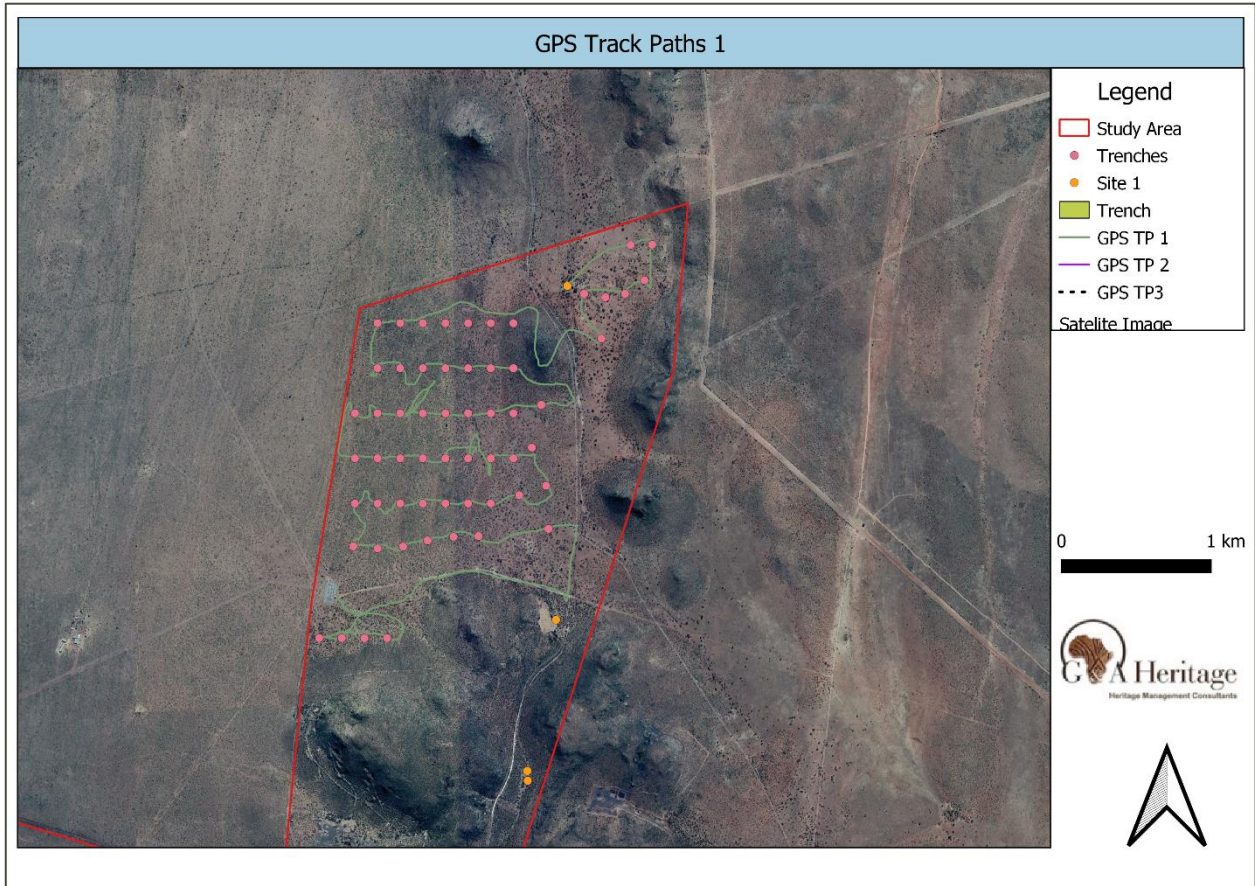


Figure 4. GPS Track Path 1

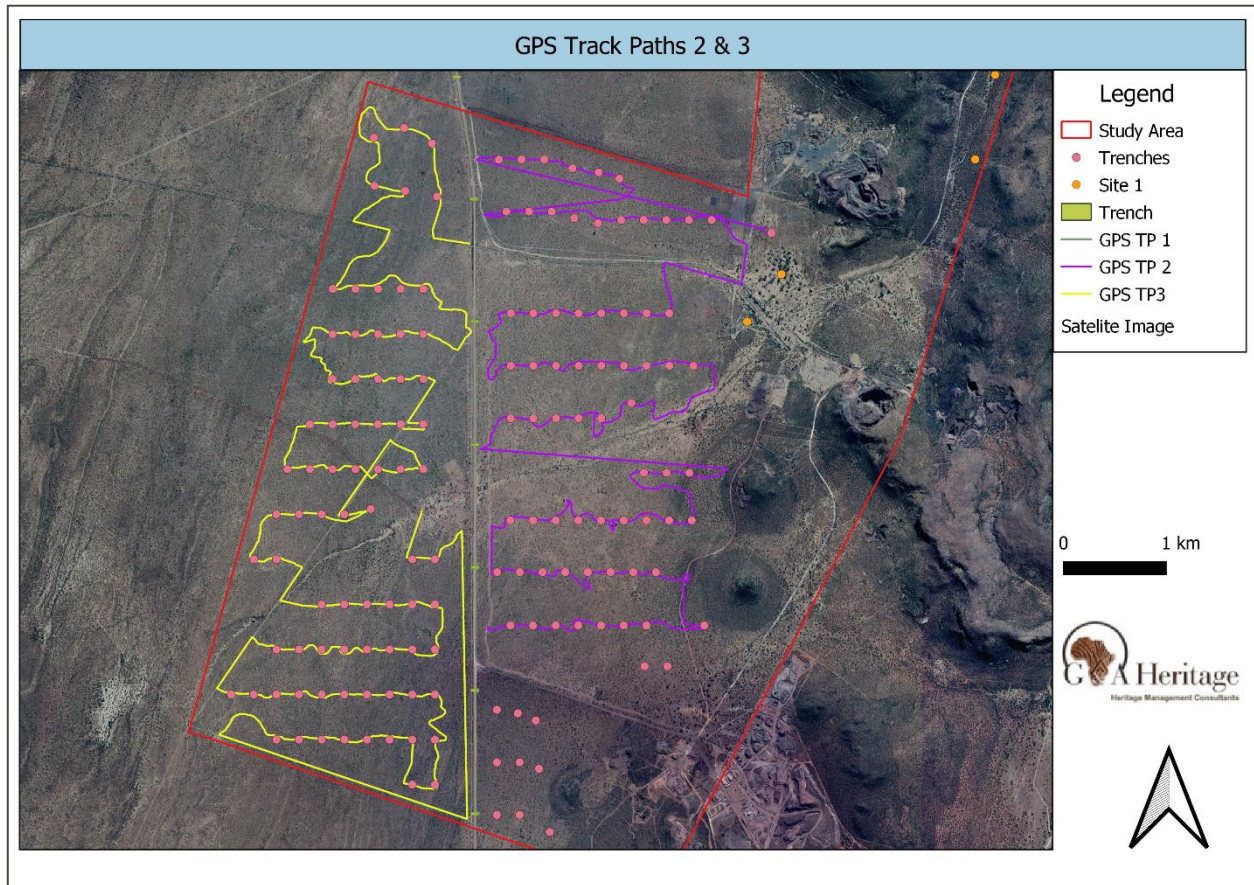


Figure 5. GPS Track Paths 2 & 3

1.5 Temporal Scope

The proposed project will consist of three phases;

- 1) Planning
- 2) Development
- 3) Operational

Due to the nature of the proposed development impacts on heritage sites are only anticipated during the development phase of the proposed project. The operational phase will not result in any further alterations to heritage on any significant scale and at present there is still no defined decommissioning phase.

2. Legislative Context

2.1 National Legislation

Section 38(1) of the South African Heritage Resources Act (25 of 1999) requires that a heritage study is undertaken for:

- (a) Construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- (b) Construction of a bridge or similar structure exceeding 50 m in length; and
- (c) Any development, or other activity which will change the character of an area of land, or water –
 - (1) Exceeding 10 000 m² in extent;
 - (2) Involving three or more existing erven or subdivisions thereof; or
 - (3) Involving three or more erven, or subdivisions thereof, which have been consolidated within the past five years; or
 - (d) The costs of which will exceed a sum set in terms of regulations; or
 - (e) Any other category of development provided for in regulations.

While the above describes the parameters of developments that fall under this Act., Section 38 (8) of the NHRA is applicable to this development. This section states that;

- (8) *The provisions of this section do not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act 50 of 1991), or any other legislation: Provided that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.*

In regard to a development such as this that falls under Section 38 (8) of the NHRA, the requirements of Section 38 (3) applies to the subsequent reporting, stating that;

- (3) *The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2) (a): Provided that the following must be included:*
 - (a) *The identification and mapping of all heritage resources in the area affected;*
 - (b) *An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7;*
 - (c) *An assessment of the impact of the development on such heritage resources;*
 - (d) *An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;*
 - (e) *The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;*
 - (f) *If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and*
 - (g) *Plans for mitigation of any adverse effects during and after the completion of the proposed development.*
 - (1) Ancestral graves,
 - (2) Royal graves and graves of traditional leaders,
 - (3) Graves of victims of conflict (iv) graves of important individuals,
 - (4) Historical graves and cemeteries older than 60 years, and
 - (5) Other human remains which are not covered under the Human Tissues Act, 1983 (Act No.65 of 1983 as amended);
 - (h) Movable objects, including ;
 - (1) Objects recovered from the soil or waters of South Africa including archaeological and paleontological objects and material, meteorites and rare geological specimens;
 - (2) Ethnographic art and objects;
 - (3) Military objects;
 - (4) Objects of decorative art;

- (5) Objects of fine art;
- (6) Objects of scientific or technological interest;
- (7) Books, records, documents, photographic positives and negatives, graphic, film or video material or sound recordings; and
- (8) Any other prescribed categories, but excluding any object made by a living person;
- (i) Battlefields;
- (j) Traditional building techniques.

A **'place'** is defined as:

- a) A site, area or region;
- b) A building or other structure (which may include equipment, furniture, fittings and articles associated with or connected with such building or other structure);
- c) A group of buildings or other structures (which may include equipment, furniture, fittings and articles associated with or connected with such group of buildings or other structures); and (d) an open space, including a public square, street or park; and in relation to the management of a place, includes the immediate surroundings of a place.

'Structures' means any building, works, device, or other facility made by people and which is fixed to land and any fixtures, fittings and equipment associated therewith older than 60 years.

'Archaeological' means:

- a) Material remains resulting from human activity which are in a state of disuse and are in or on land and are older than 100 years, including artefacts, human and hominid remains and artificial features and structures;
- b) Rock art, being a 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 is older than 100 years including any area within 10 m of such representation; and
- c) Wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land or in the maritime cultural zone referred to in section 5 of the Maritime Zones Act 1994 (Act 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which are older than 60 years or which in terms of national legislation are considered to be worthy of conservation;
- d) Features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found.

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

'Grave' means a place of interment and includes the contents, headstone or other marker of and any other structures on or associated with such place. The South African Heritage Resources Agency (SAHRA) will only issue a permit for the alteration of a grave if it is satisfied that every reasonable effort has been made to contact and obtain permission from the families concerned.

The removal of graves is subject to the following procedures as outlined by the SAHRA:

- Notification of the impending removals (using English, Afrikaans and local language media and notices at the grave site);
- Consultation with individuals or communities related or known to the deceased;
- Satisfactory arrangements for the curation of human remains and / or headstones in a museum, where applicable;
- Procurement of a permit from the SAHRA;
- Appropriate arrangements for the exhumation (preferably by a suitably trained archaeologist) and re-interment (sometimes by a registered undertaker, in a formally proclaimed cemetery);
- Observation of rituals or ceremonies required by the families.

The limitations and assumptions associated with this heritage impact assessment are as follows;

- Field investigations were performed on foot and by vehicle where access was readily available.
- Sites were evaluated by means of description of the cultural landscape, direct observations and analysis of written sources and available databases.
- It was assumed that the site layout as provided by M&S Consulting is accurate.

- We assumed that the public participation process performed as part of the Basic Assessment process was sufficiently encompassing not to be repeated in the Heritage Assessment Phase.

Table 1. Impacts on the NHRA Sections

Act	Section	Description	Possible Impact	Action
National Heritage Resources Act (NHRA)	34	Preservation of buildings older than 60 years	No impact	None
	35	Archaeological, paleontological and meteor sites	No impact	None
	36	Graves and burial sites	No impact	None
	37	Protection of public monuments	No impact	None
	38	Does activity trigger a HIA?	Yes	HIA

Table 2. NHRA Triggers

Action Trigger	Yes/No	Description
Construction of a road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length.	No	N/A
Construction of a bridge or similar structure exceeding 50m in length.	No	N/A
Development exceeding 5000 m ²	Yes	Prospecting Boreholes and Trenches
Development involving more than 3 erven or sub divisions	No	N/A
Development involving more than 3 erven or sub divisions that have been consolidated in the past 5 years	No	N/A
Re-zoning of site exceeding 10 000 m ²	No	N/A
Any other development category, public open space, squares, parks or recreational grounds	No	N/A

3. Methodology

3.1 Heritage Management

This study defines the heritage component of the EIA process being undertaken for the proposed prospecting boreholes and trenches on Portion 2 (Remaining Extent), Portion 3 (Remaining Extent) Portion 5 and Remaining Extent of the farm Kapstewel 436.

It is described as a first phase (HIA). This report attempts to evaluate both the accumulated heritage knowledge of the area and information derived from direct physical observations.

3.2 Inventory

Inventory studies involve the in-field survey and recording of archaeological resources within a proposed development area. The nature and scope of this type of study is defined primarily by the results of the overview study. In the case of site-specific developments, direct implementation of an inventory study may preclude the need for an overview.

There are a number of different methodological approaches to conducting inventory studies. Therefore, the proponent, in collaboration with the archaeological consultant, must develop an inventory plan for review and approval by the SAHRA prior to implementation (*Dincause, Dena F., H. Martin Wobst, Robert J. Hasenstab and David M. Lacy 1984*).

3.3 Evaluating Heritage Impacts

A combination of document research as well as the determination of the geographic suitability of areas and the evaluation of aerial photographs determined which areas could and should be accessed.

After plotting of the site on a GPS the areas were accessed using suitable combinations of vehicle access and access by foot.

Sites were documented by digital photography and geo-located with GPS readings using the WGS 84 datum. An aerial drone was used to evaluate the site from different heights and to improve coverage of the area.

Further techniques (where possible) included interviews with local inhabitants, visiting local museums and information centers and discussions with local experts. All this information was combined with information from an extensive literature study as well as the result of archival studies based on the SAHRA (South African Heritage Resource Agency) provincial databases.

This Heritage Impact Assessment relies on the analysis of written documents, maps, aerial photographs and other archival sources combined with the results of site investigations and interviews with effected people. Site investigations are not exhaustive and often focus on areas such as river confluence areas, elevated sites or occupational ruins.

The following documents were consulted in this study;

- South African National Archive Documents
- SAHRIS (South African Heritage Resources Information System) Database of Heritage Studies
- Internet Search
- Historic Maps
- 1982 and 2009 Surveyor General Topographic Map series
- 1952 1:10 000 aerial photo survey
- Google Earth 2019 imagery
- Published articles and books
- JSTOR Article Archive

3.4 Site Visit / Fieldwork Details

Fieldwork for the HIA was done on the 27th and 28th of May 2020. Most of the areas were found to be accessible by foot. Vehicular access was possible in most areas. Areas of possible significance were investigated on foot. The survey was tracked using GPS and a track file in GPX format is available on request. An aerial drone was used to increase coverage of the site. It has been found that high resolution aerial photography is much more effective than transect walks (which is usually prohibitively expensive in terms of time and cost). A meshed image of the site is compiled from a mosaic of photos taken from a height of 60m. This gives a resolution of 2cm/pixel. These photographs were compiled on site, analysed and anomalous areas investigated on foot. The current position of the proposed boreholes and trenches were used to guide the investigation, however any areas of high potential outside of these were also investigated.



Figure 6. Aerial view of study area

Where sites were identified it was documented photographically and plotted using GPS with the WGS 84 datum point as reference. GPX files are available on request from G&A Heritage.

The study area was surveyed using standard archaeological surveying methods. The area was surveyed using directional parameters supplied by the GPS and surveyed by foot and aerial drone. This technique has proven to result in the maximum coverage of an area.

Standard archaeological documentation formats were employed in the description of sites. Using standard site documentation forms as comparable medium, it enabled the surveyors to evaluate the relative importance of sites found. Furthermore, GPS (Global Positioning System) readings of all finds and sites were taken. This information was then plotted using a **Garmin Colorado** GPS (WGS 84- datum).

Indicators such as surface finds, plant growth anomalies, local information and topography were used in identifying sites of possible archaeological importance. Test probes were done at intervals to determine sub-surface occurrence of archaeological material. The importance of sites was assessed by comparisons with published information as well as comparative collections.

Test excavation is that form of archaeological excavation where the purpose is to establish the nature and extent of archaeological deposits and features present in a location, which it is proposed to develop (though not normally to fully investigate those deposits or features) and allow an assessment to be made of the archaeological impact of the proposed development. It may also be referred to as archaeological testing' (DAHGI 1999a, 27).

'Test excavation should not be confused with, or referred to as, archaeological assessment which is the overall process of assessing the archaeological impact of development. Test excavation is one of the techniques in carrying out archaeological assessment which may also include, as appropriate, documentary research, field walking, examination of upstanding or visible features or structures, examination of aerial photographs, satellite or other remote sensing imagery, geophysical survey, and topographical assessment' (DAHGI 1999b, 18).

3.5 Consultations

Signage indicating the HIA performed and the planned development actions were placed on site. The heritage component was also included in the larger ESIA advertisements placed by the lead consultant. On Thursday the 28th of May a meeting was held with the Community Council of the Maremane Property Owners Association. This association controls access to Portion 2 (Remaining Extent) of Kapstewel 436 and permission was obtained from the council to access the area. An attendance register of this meeting is appended to this report.

3.6 Assumptions

It was assumed that the impacted areas will be limited to the proposed borehole and trench footprints. It is furthermore assumed that the Paleo Sensitivity Map provided on the SAHRIS platform is comprehensive enough to inform on actions in this regard. It is assumed that activities will be limited to prospecting. It is furthermore assumed that the client will have the final prospecting site locations on Portion 3 (Remaining Extent) cleared by a heritage practitioner before prospecting commences.

3.7 Gaps / Limitations / Uncertainty

The area was readily accessible. The only area where access permission could not be obtained was on Portion 3 (Remaining Extent) of Kapstewel 436. The current layout indicates 14 possible prospecting targets within this property. It is assumed that the two heritage studies in 2009 and 2014 was comprehensive enough to conclude that there are no sites of heritage significance within this property.

3.8 Specialist Specific Methodology

The scope of work includes:

- the identification and assessment of archaeological, cultural, historic, built and paleontological sites within the study area
- Interrogation of project-specific Drone data and aerial imagery
- Archival study of existing data and information for the study area
- Site inspection and fieldwork along the 100m wide corridor.
- This site work includes communicating with local inhabitants to confirm possible locations of heritage and cultural sites.
- Impact assessment has been performed according to the methodology as described in the relevant Section.

3.9 Impact Assessment Methodology

Degrees of Significance – Significance Criteria

There are several kinds of significance, including scientific, public, ethnic, historic and economic, that need to be taken into account when evaluating heritage resources. For any site, explicit criteria are used to measure these values. Checklists of criteria for evaluating pre-contact and post-contact archaeological sites are provided in Appendix B and Appendix C. These checklists are not intended to be exhaustive or inflexible. Innovative approaches to site evaluation which emphasize quantitative analysis and objectivity are encouraged. The process used to derive a measure of relative site significance must be rigorously documented, particularly the system for ranking or weighting various evaluated criteria.

Site integrity, or the degree to which a heritage site has been impaired or disturbed as a result of past land alteration, is an important consideration in evaluating site significance. In this regard, it is important to recognize that although an archaeological site has been disturbed, it may still contain important scientific information.

Heritage resources may be of scientific value in two respects. The potential to yield information, which, if properly recovered, will enhance understanding of Southern African human history, is one appropriate measure of scientific significance. In this respect, archaeological sites should be evaluated in terms of their potential to resolve current archaeological research problems. Scientific significance also refers to the potential for relevant contributions to other academic disciplines or to industry.

Public significance refers to the potential a site has for enhancing the public's understanding and appreciation of the past. The interpretive, educational and recreational potential of a site are valid indications of public value. Public significance criteria such as ease of access, land ownership, or scenic setting are often external to the site itself. The relevance of heritage resource data to private industry may also be interpreted as a particular kind of public significance.

Ethnic significance applies to heritage sites which have value to an ethnically distinct community or group of people. Determining the ethnic significance of an archaeological site may require consultation with persons having special knowledge of a particular site. It is essential that ethnic significance be assessed by someone properly trained in obtaining and evaluating such data.

Historic archaeological sites may relate to individuals or events that made an important, lasting contribution to the development of a particular locality or the province. Historically important sites also reflect or commemorate the historic socioeconomic character of an area. Sites having high historical value will also usually have high public value.

The economic or monetary value of a heritage site, where calculable, is also an important indication of significance. In some cases, it may be possible to project monetary benefits derived from the public's use of a heritage site as an educational or recreational facility. This may be accomplished by employing established economic evaluation methods; most of which have been developed for valuating outdoor recreation. The objective is to determine the willingness of users, including local residents and tourists, to pay for the experiences or services the site provides even though no payment is presently being made. Calculation of user benefits will normally require some study of the visitor population (*Smith, L.D. 1977*).

- **Rarity**
 - It possesses uncommon, rare or endangered aspects of natural or cultural heritage.
 - Importance for rare, endangered or uncommon structures, landscapes or phenomena.
- **Representivity**
 - It is important in demonstrating the principal characteristics of a particular class of natural or cultural places or objects.
 - Importance in demonstrating the principal characteristics of a range of landscapes or environments, the attributes of which identify it as being characteristic of its class.
 - Importance in demonstrating the principal characteristics of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province, region or locality.

The table below illustrates how a site's heritage significance is determined

Table 3. Site's Heritage Significance

Spheres of Significance	High	Medium	Low
International			
National			
Provincial			
Regional			
Local			
Specific Community			

4. Assessment of Heritage Potential

4.1 Assessment Matrix

4.1.1 Determining Archaeological Significance

In addition to guidelines provided by the National Heritage Resources Act (Act No. 25 of 1999), a set of criteria based on Deacon (J) and Whitelaw (1997) for assessing archaeological significance has been developed for Eastern Cape settings (Morris 2007a). These criteria include estimation of landform potential (in terms of its capacity to contain archaeological traces) and assessing the value to any archaeological traces (in terms of their attributes or their capacity to be construed as evidence, given that evidence is not given but constructed by the investigator).

Estimating site potential

Table 1 (below) is a classification of landforms and visible archaeological traces used for estimating the potential of archaeological sites (after J. Deacon and, National Monuments Council). Type 3 sites tend to be those with higher archaeological potential, but there are notable exceptions to this rule, for example the renowned rock engravings site Driekopseiland near Kimberley which is on landform L1 Type 1 – normally a setting of lowest expected potential. It should also be noted that, generally, the older a site the poorer the preservation, so that sometimes any trace, even of only Type 1 quality, could be of exceptional significance. In light of this, estimation of potential will always be a matter for archaeological observation and interpretation.

Table 4. Classification of landforms and visible archaeological traces for estimating the potential for archaeological sites (after J. Deacon, NMC as used in Morris)

Class	Landform	Type 1	Type 2	Type 3
L1	Rocky Surface	Bedrock exposed	Some soil patches	Sandy/grassy patches
L2	Ploughed land	Far from water	In floodplain	On old river terrace
L3	Sandy ground, inland	Far from water	In floodplain or near features such as hill/dune	On old river terrace
L4	Sandy ground, coastal	>1 km from sea	Inland of dune cordon	Near rocky shore
L5	Water-logged deposit	Heavily vegetated	Running water	Sedimentary basin
L6	Developed urban	Heavily built-up with no known record of early settlement	Known early buildings have basements	Buildings without extensive basements over known historical sites
L7	Lime/dolomite	>5 myrs	<5000 yrs	Between 5000 yrs and 5 myrs
L8	Rock shelter	Rocky floor	Loping floor or small area	Flat floor, high ceiling
Class	Archaeological traces	Type 1	Type 2	Type 3
A1	Area previously excavated	Little deposit remaining	More than half deposit remaining	High profile site
A2	Shell of bones visible	Dispersed scatter	Deposit <0.5 m thick	Deposit >0.5 m thick; shell and bone dense
A3	Stone artefacts or stone walling or other feature visible	Dispersed scatter	Deposit <0.5m thick	Deposit >0.5 m thick

Table 5. Site attributes and value assessment (adopted from Whitelaw 1997 as used in Morris)

Class	Landforms	Type 1	Type 2	Type 3
1	Length of sequence /context	No sequence Poor context Dispersed distribution	Limited sequence	Long sequence Favourable context High density of arte / ecofacts
2	Presence of exceptional items (incl. regional rarity)	Absent	Present	Major element

3	Organic preservation	Absent	Present	Major element
4	Potential for future archaeological investigation	Low	Medium	High
5	Potential for public display	Low	Medium	High
6	Aesthetic appeal	Low	Medium	High
7	Potential for implementation of a long-term management plan	Low	Medium	High

4.2 Assessing site value by attribute

Table 2 is adapted from Whitelaw (1997), who developed an approach for selecting sites meriting heritage recognition status in KwaZulu-Natal. It is a means of judging a site's archaeological value by ranking the relative strengths of a range of attributes (given in the second column of the table). While aspects of this matrix remain qualitative, attribute assessment is a good indicator of the general archaeological significance of a site, with Type 3 attributes being those of highest significance.

4.3 Impact Statement

4.3.1 Assessment of Impacts

A heritage resource impact may be broadly defined as the net change between the integrity of a heritage site with and without the proposed development. This change may be either beneficial or adverse.

Beneficial impacts occur wherever a proposed development actively protects, preserves or enhances a heritage resource. For example, development may have a beneficial effect by preventing or lessening natural site erosion. Similarly, an action may serve to preserve a site for future investigation by covering it with a protective layer of fill. In other cases, the public or economic significance of an archaeological site may be enhanced by actions, which facilitate non-destructive public use. Although beneficial impacts are unlikely to occur frequently, they should be included in the assessment.

More commonly, the effects of a project on heritage sites are of an adverse nature. Adverse impacts occur under conditions that include:

- (a) destruction or alteration of all or part of a heritage site;
- (b) isolation of a site from its natural setting; and
- (c) introduction of physical, chemical or visual elements that are out-of-character with the heritage resource and its setting.

Adverse effects can be more specifically defined as direct or indirect impacts. Direct impacts are the immediately demonstrable effects of a project which can be attributed to particular land modifying actions. They are directly caused by a project or its ancillary facilities and occur at the same time and place. The immediate consequences of a project action, such as slope failure following reservoir inundation, are also considered direct impacts.

Indirect impacts result from activities other than actual project actions. Nevertheless, they are clearly induced by a project and would not occur without it. For example, project development may induce changes in land use or population density, such as increased urban and recreational development, which may indirectly impact upon heritage sites. Increased vandalism of heritage sites, resulting from improved or newly introduced access, is also considered an indirect impact. Indirect impacts are much more difficult to assess and quantify than impacts of a direct nature.

Once all project related impacts are identified, it is necessary to determine their individual level-of-effect on heritage resources. This assessment is aimed at determining the extent or degree to which future opportunities for scientific research, preservation, or public appreciation are foreclosed or otherwise adversely affected by a proposed action. Therefore, the assessment provides a reasonable indication of the relative significance or importance of a particular impact. Normally, the assessment should follow site evaluation since it is important to know what heritage values may be adversely affected.

The assessment should include careful consideration of the following level-of-effect indicators, which are defined below:

- magnitude
- severity
- duration
- range
- frequency
- diversity
- cumulative effect
- rate of change

4.4 Indicators of Impact Severity

Magnitude

The amount of physical alteration or destruction, which can be expected. The resultant loss of heritage value is measured either in amount or degree of disturbance.

Severity

The irreversibility of an impact. Adverse impacts, which result in a totally irreversible and irretrievable loss of heritage value, are of the highest severity.

Duration

The length of time an adverse impact persists. Impacts may have short-term or temporary effects, or conversely, more persistent, long-term effects on heritage sites.

Range

The spatial distribution, whether widespread or site-specific, of an adverse impact.

Frequency

The number of times an impact can be expected. For example, an adverse impact of variable magnitude and severity may occur only once. An impact such as that resulting from cultivation may be of recurring or on-going nature.

Diversity

The number of different kinds of project-related actions expected to affect a heritage site.

Cumulative Effect

A progressive alteration or destruction of a site owing to the repetitive nature of one or more impacts.

Rate of Change

The rate at which an impact will effectively alter the integrity or physical condition of a heritage site. Although an important level-of-effect indicator, it is often difficult to estimate. Rate of change is normally assessed during or following project construction.

The level-of-effect assessment should be conducted and reported in a quantitative and objective fashion. The methodological approach, particularly the system of ranking level-of-effect indicators, must be rigorously documented and recommendations should be made with respect to managing uncertainties in the assessment. (*Zubrow, Ezra B.A., 1984*).

4.4.1 Pre-Contact Sites

The study area contained some areas with stone tools in limited quantities. Compared to the areas further south and west this site has very few Stone Tools. Some smaller microliths, fractured blades and cores were found in the area in concentrations with little matrix. The main substrate seems to be banded iron stone. None of the tool scatters identified could be regarded as constituting a Stone Age Site. Scatters were as low as 1 tool per two square meters. No cores and very few flakes were noted.

4.4.2 Post-Contact Sites

The farm homestead, associated graves and labour housing are all of high heritage value. It has been agreed between the mine and the landowner that this whole area will be part of an exclusion zone and as a result no impact on these structures are anticipated. If the mine planning changes in the future these recommendations will have to be reviewed.

4.4.3 Built Environment

Historic Significance

No	Criteria	Significance Rating
1	Are any of the identified sites or buildings associated with a historical person or group? No	N/A
2	Are any of the buildings or identified sites associated with a historical event? No	N/A
3	Are any of the identified sites or buildings associated with a religious, economic social or political or educational activity? No	N/A
4	Are any of the identified sites or buildings of archaeological significance? No	N/A
5	Are any of the identified buildings or structures older than 60 years? No	N/A

Architectural Significance

No	Criteria	Rating
1	Are any of the buildings or structures an important example of a building type? No	N/A
2	Are any of the buildings outstanding examples of a particular style or period? No	N/A
3	Do any of the buildings contain fine architectural details and reflect exceptional craftsmanship? No	N/A
4	Are any of the buildings an example of an industrial, engineering or technological development? No	N/A
5	What is the state of the architectural and structural integrity of the building? No	N/A
6	Is the building's current and future use in sympathy with its original use (for which the building was designed)? N/A	-
7	Were the alterations done in sympathy with the original design? N/A	-
8	Were the additions and extensions done in sympathy with the original design? N/A	-
9	Are any of the buildings or structures the work of a major architect, engineer or builder? No.	N/A

Spatial Significance

Even though each building needs to be evaluated as a single artefact the site still needs to be evaluated in terms of its significance in its geographic area, city, town, village, neighbourhood or precinct. This set of criteria determines the spatial significance.

No	Criteria	Rating
1	Can any of the identified buildings or structures be considered a landmark in the town or city? No	-

2	<i>Do any of the buildings contribute to the character of the neighborhood?</i> No	-
3	<i>Do any of the buildings contribute to the character of the square or streetscape?</i> No	-
4	<i>Do any of the buildings form part of an important group of buildings?</i> No	-

5. Impact Evaluation

This HIA Methodology assists in evaluating the overall effect of a proposed activity on the heritage environment. The determination of the effect of a heritage impact on a heritage parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the heritage practitioner through the process of heritage impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

5.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics, which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

5.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the heritage environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact will be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

5.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue, the following criteria (including an allocated point system) is used:

NATURE		
Including a brief description of the impact of the heritage parameter being assessed in the context of the project. This criterion includes a brief written statement of the heritage aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).

3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on a heritage parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which heritage resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the heritage parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the heritage parameter. A cumulative effect/impact is an effect, which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects.
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects.
3	Medium Cumulative impact	The impact would result in minor cumulative effects.
4	High Cumulative Impact	The impact would result in significant cumulative effects.
INTENSITY / MAGNITUDE		

Describes the severity of an impact.		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE		
<p>Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the heritage parameter. The calculation of the significance of an impact uses the following formula:</p> <p>(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.</p> <p>The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.</p>		
Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

5.3 Assessing Visual Impact

Visual impacts of developments result when sites that are culturally celebrated are visually affected by a development. The exact parameters for the determination of visual impacts have not yet been rigidly defined and are still mostly open to interpretation. CNdV Architects and The Department of Environmental Affairs and Development Planning (2006) have developed some guidelines for the management of the visual impacts of wind turbines in the Western Cape, although these have not yet been formalised. In these

guidelines they recommend a buffer zone of 1km around significant heritage sites to minimise the visual impact.

Due to the fact that the project will mainly involve sub-surface infrastructure it is not anticipated that any visual impacts will be encountered.

6. Assessment of Impacts

6.1 Impact Statement

6.1.1 Built Environment

Some structures associated with rural living were identified;

- Brick outbuildings (modern and historic)
- Barb-wire fences (modern)
- Dirt roads (modern)
- Footpaths

Mitigation

None of the structures will be affected by the pipeline construction activities.

6.1.2 Cultural Landscape

The following landscape types were identified during the study.

Landscape Type	Description	Occurrence still possible?	Likely occurrence?
1 Paleontological	Mostly fossil remains. Remains include microbial fossils such as found in Baberton Greenstones	Yes, sub-surface	Unlikely
2 Archaeological	Evidence of human occupation associated with the following phases – Early-, Middle-, Late Stone Age, Early-, Late Iron Age, Pre-Contact Sites, Post-Contact Sites	Yes	Unlikely
3 Historic Built Environment	<ul style="list-style-type: none"> - Historical townscapes/streetscapes - Historical structures; i.e. older than 60 years - Formal public spaces - Formally declared urban conservation areas - Places associated with social identity/displacement 	No	No
4 Historic Farmland	These possess distinctive patterns of settlement and historical features such as: <ul style="list-style-type: none"> - Historical farm yards - Historical farm workers villages/settlements - Irrigation furrows - Tree alignments and groupings - Historical routes and pathways - Distinctive types of planting - Distinctive architecture of cultivation e.g. planting blocks, trellising, terracing, ornamental planting. 	No	No
5 Historic rural town	<ul style="list-style-type: none"> - Historic mission settlements - Historic townscapes 	No	No
6 Pristine natural landscape	<ul style="list-style-type: none"> - Historical patterns of access to a natural amenity - Formally proclaimed nature reserves - Evidence of pre-colonial occupation - Scenic resources, e.g. view corridors, viewing sites, visual edges, visual linkages - Historical structures/settlements older than 60 years - Pre-colonial or historical burial sites - Geological sites of cultural significance. 	No	No

7 Relic Landscape	<ul style="list-style-type: none"> - Past farming settlements - Past industrial sites - Places of isolation related to attitudes to medical treatment - Battle sites - Sites of displacement, 	No	No
8 Burial grounds and grave sites	<ul style="list-style-type: none"> - Pre-colonial burials (marked or unmarked, known or unknown) - Historical graves (marked or unmarked, known or unknown) - Graves of victims of conflict - Human remains (older than 100 years) - Associated burial goods (older than 100 years) - Burial architecture (older than 60 years) 	Yes,	Unlikely
9 Associated Landscapes	<ul style="list-style-type: none"> - Sites associated with living heritage e.g. initiation sites, harvesting of natural resources for traditional medicinal purposes - Sites associated with displacement & contestation - Sites of political conflict/struggle - Sites associated with an historic event/person - Sites associated with public memory 	No	No
10 Historical Farmyard	<ul style="list-style-type: none"> - Setting of the yard and its context - Composition of structures - Historical/architectural value of individual structures - Tree alignments - Views to and from - Axial relationships - System of enclosure, e.g. defining walls - Systems of water reticulation and irrigation, e.g. furrows - Sites associated with slavery and farm labour - Colonial period archaeology 	No	No
11 Historic institutions	<ul style="list-style-type: none"> - Historical prisons - Hospital sites - Historical school/reformatory sites - Military bases 	No	No
12 Scenic visual	<ul style="list-style-type: none"> - Scenic routes 	No	No
13 Amenity landscape	<ul style="list-style-type: none"> - View sheds - View points - Views to and from - Gateway conditions - Distinctive representative landscape conditions - Scenic corridors 	No	No

7. Measuring Impacts

In 2003 the SAHRA (South African Heritage Resources Agency) compiled the following guidelines to evaluate the cultural significance of individual heritage resources:

- **Type of Resource**
 - Place
 - Archaeological Site
 - Structure
 - Grave
 - Palaeontological Feature
 - Geological Feature

- **Type of Significance**
 - Historic Value
 - Important in the community, or pattern of history
 - Important in the evolution of cultural landscapes and settlement patterns
 - Important in exhibiting density, richness or diversity of cultural features illustrating the human occupation and evolution of the nation, province, region or locality.
 - Important for association with events, developments or cultural phases that have had a significant role in the human occupation and evolution of the nation, province, region or community.
 - Important as an example for technical, creative, design or artistic excellence, innovation or achievement in a particular period.
 - It has strong or special association with the life or work of a person, group or organisation of importance in history
 - Importance for close associations with individuals, groups or organisations whose life, works or activities have been significant within the history of the nation, province, region or community.
 - It has significance relating to the history of slavery
 - Importance for a direct link to the history of slavery in South Africa.

 - Aesthetic Value
 - It is important in exhibiting particular aesthetic characteristics valued by a community or cultural group.
 - Important to a community for aesthetic characteristics held in high esteem or otherwise valued by the community.
 - Importance for its creative, design or artistic excellence, innovation or achievement.
 - Importance for its contribution to the aesthetic values of the setting demonstrated by a landmark quality or having impact on important vistas or otherwise contributing to the identified aesthetic qualities of the cultural environs or the natural landscape within which it is located.
 - In the case of an historic precinct, importance for the aesthetic character created by the individual components which collectively form a significant streetscape, townscape or cultural environment.

 - Scientific Value
 - It has potential to yield information that will contribute to an understanding of natural or cultural heritage
 - Importance for information contributing to a wider understanding of natural or cultural history by virtue of its use as a research site, teaching site, type locality, reference or benchmark site.
 - Importance for information contributing to a wider understanding of the origin of the universe or of the development of the earth.
 - Importance for information contributing to a wider understanding of the origin of life; the development of plant or animal species, or the biological or cultural development of hominid or human species.

- Importance for its potential to yield information contributing to a wider understanding of the history of human occupation of the nation, Province, region or locality.
- It is important in demonstrating a high degree of creative or technical achievement at a particular period
- Importance for its technical innovation or achievement.

a) Does the site contain evidence, which may substantively enhance understanding of culture history, culture process, and other aspects of local and regional prehistory?

- internal stratification and depth
- chronologically sensitive cultural items
- materials for absolute dating
- association with ancient landforms
- quantity and variety of tool type
- distinct intra-site activity areas
- tool types indicative of specific socio-economic or religious activity
- cultural features such as burials, dwellings, hearths, etc.
- diagnostic faunal and floral remains
- exotic cultural items and materials
- uniqueness or representativeness of the site
- integrity of the site

b) Does the site contain evidence which may be used for experimentation aimed at improving archaeological methods and techniques?

- monitoring impacts from artificial or natural agents
- site preservation or conservation experiments
- data recovery experiments
- sampling experiments
- intra-site spatial analysis

c) Does the site contain evidence which can make important contributions to paleo environmental studies?

- topographical, geomorphological context
- depositional character
- diagnostic faunal, floral data

d) Does the site contain evidence which can contribute to other scientific disciplines such as hydrology, geomorphology, pedology, meteorology, zoology, botany, forensic medicine, and environmental hazards research, or to industry including forestry and commercial fisheries?

○ Social Value / Public Significance

- It has strong or special association with a particular community or cultural group for social, cultural or spiritual reasons
- Importance as a place highly valued by a community or cultural group for reasons of social, cultural, religious, spiritual, symbolic, aesthetic or educational associations.
- Importance in contributing to a community's sense of place.

a) Does the site have potential for public use in an interpretive, educational or recreational capacity?

- integrity of the site
- technical and economic feasibility of restoration and development for public use
- visibility of cultural features and their ability to be easily interpreted
- accessibility to the public
- opportunities for protection against vandalism
- representativeness and uniqueness of the site
- aesthetics of the local setting

- proximity to established recreation areas
- present and potential land use
- land ownership and administration
- legal and jurisdictional status
- local community attitude toward development

b) Does the site receive visitation or use by tourists, local residents or school groups?

○ Ethnic Significance

Does the site presently have traditional, social or religious importance to a particular group or community?

- ethnographic or ethno-historic reference
- documented local community recognition or, and concern for, the site

○ Economic Significance

What value of user-benefits may be placed on the site?

- visitors' willingness-to-pay
- visitors' travel costs

○ Scientific Significance

a) Does the site contain evidence, which may substantively enhance understanding of historic patterns of settlement and land use in a particular locality, regional or larger area?

b) Does the site contain evidence, which can make important contributions to other scientific disciplines or industry?

○ Historic Significance

a) Is the site associated with the early exploration, settlement, land use, or other aspect of southern Africa's cultural development?

b) Is the site associated with the life or activities of a particular historic figure, group, organization, or institution that has made a significant contribution to, or impact on, the community, province or nation?

c) Is the site associated with a particular historic event whether cultural, economic, military, religious, social or political that has made a significant contribution to, or impact on, the community, province or nation?

d) Is the site associated with a traditional recurring event in the history of the community, province, or nation, such as an annual celebration?

○ Public Significance

a) Does the site have potential for public use in an interpretive, educational or recreational capacity?

- visibility and accessibility to the public
- ability of the site to be easily interpreted
- opportunities for protection against vandalism
- economic and engineering feasibility of reconstruction, restoration and maintenance
- representativeness and uniqueness of the site
- proximity to established recreation areas
- compatibility with surrounding zoning regulations or land use
- land ownership and administration
- local community attitude toward site preservation, development or destruction
- present use of site

b) Does the site receive visitation or use by tourists, local residents or school groups?

○ Other

▪ Is the site a commonly acknowledged landmark?

▪ Does, or could, the site contribute to a sense of continuity or identity either alone or in conjunction with similar sites in the vicinity?

- Is the site a good typical example of an early structure or device commonly used for a specific purpose throughout an area or period of time?
- Is the site representative of a particular architectural style or pattern?

For each predicted impact, criteria are described. These criteria include the **magnitude** (size or degree scale), which also includes the **type** of impact, being either a positive or negative impact; the **duration** (temporal scale); and the **extent** (spatial scale), as well as the **probability** (likelihood). The methodology is quantitative and generated through a spreadsheet but requires professional judgement in the application of the criteria.

When assessing impacts, broader considerations are also considered, these include the **confidence** with which the assessment was undertaken, the **reversibility** of the impact and the resource **irreplaceability**.

Calculations
(as applied in the excel spreadsheet 'Kapstewel.xls')

For each predicted impact, certain criteria are applied to establish the likely **significance** of the impact, firstly in the case of no mitigation being applied and then with the most effective mitigation measure(s) in place.

These criteria include the **magnitude** (size or degree scale), which also includes the **type** of impact, being either a positive or negative impact; the **duration** (temporal scale); and the **extent** (spatial scale). These numerical ratings are used in an equation whereby the **consequence** of the impact can be calculated. Consequence is calculated as follows:

Consequence = type x (magnitude + duration + extent).

To calculate the significance of an impact, the **probability** (or likelihood) of that impact occurring is applied to the consequence.

Significance = consequence x probability

Depending on the numerical result, the impact would fall into a significance category as negligible, minor, moderate or major, and the type would be either positive or negative.

The following tables show the scales used to classify the above variables and define each of the rating categories.

7.1 Magnitude

The magnitude refers to the degree of alteration of the affected environmental receptor. The relevant descriptor for magnitude is selected by the user (refer to Table).

Table 6. Description of magnitude and assigned numerical values

Numerical Rating	Magnitude	
	Category	Descriptors
1	Negligible	Natural and/ or social functions and/ or processes are negligibly altered
2	Very low	Natural and/ or social functions and/ or processes are slightly altered
3	Low	Natural and/ or social functions and/ or processes are somewhat altered
4	Moderate	Natural and/ or social functions and/ or processes are moderately altered
5	High	Natural and/ or social functions and/ or processes are notably altered
6	Very high	Natural and/ or social functions and/ or processes are majorly altered
7	Extremely high	Natural and/ or social functions and/ or processes are severely altered

*NOTE: Where applicable, the magnitude of the impact is related to a relevant standard or threshold or is based on specialist knowledge and understanding of that particular field.

7.2 Duration

The duration refers to the length of permanence of the impact on the environmental receptor. The relevant descriptor for duration is selected by the user (refer to Table).

Table 7. Description of duration and assigned numerical values

Numerical Rating	Duration	
	Category	Descriptors
1	Immediate	Impact will self-remedy immediately
2	Brief	Impact will not last longer than 1 year
3	Short term	Impact will last between 1 and 5 years
4	Medium term	Impact will last between 5 and 10 years
5	Long term	Impact will last between 10 and 15 years
6	On-going	Impact will last between 15 and 20 years
7	Permanent	Impact may be permanent, or in excess of 20 years

7.3 Extent

The extent refers to the geographical scale of impact on the environmental receptor. The relevant descriptor for extent is selected by the user (refer to Table).

Table 8. Description of extent and assigned numerical values

Numerical Rating	Extent	
	Category	Descriptors
1	Very limited	Impacts very limited / felt in isolated areas of the study area
2	Limited	Impacts limited to specific parts of the study area
3	Local	Impacts felt mostly throughout the study area
4	Municipal area	Impacts felt outside the study area, at a municipal level
5	Regional	Impacts felt outside the study area, at a regional / provincial level
6	National	Impacts felt outside the study area, at a national level
7	International	Impacts felt outside the study area, at an international level

7.4 Probability

To calculate the significance of an impact, the probability (or likelihood) of that impact occurring is also taken into account. (Refer to Table).

Table 9. Definition of probability ratings

Numerical Rating	Probability	
	Category	Descriptors
1	Highly unlikely / None	Expected never to happen
2	Rare / improbable	Conceivable, but only in extreme circumstances, and/or might occur for this project although this has rarely been known to result elsewhere
3	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur
4	Probable	Has occurred here or elsewhere and could therefore occur
5	Likely	The impact may occur
6	Almost certain / Highly probable	It is most likely that the impact will occur
7	Certain / Definite	There are sound scientific reasons to expect that the impact will definitely occur

7.5 Significance

These are auto-calculated in the spreadsheet as described above and includes the following categories in Table 11. This table is for illustration only.

Table 10. Application of significance ratings

Range		Significance rating
-147	-109	Major (-)
-108	-73	Moderate (-)
-72	-36	Minor (-)
-35	-1	Negligible (-)
0	0	Neutral
1	35	Negligible (+)
36	72	Minor (+)
73	108	Moderate (+)
109	147	Major (+)

The following, broader considerations will also be considered. These include the level of confidence in the assessment rating; the reversibility of the impact; and the irreplaceability of the resource as set out in Tables 12, 13 and 14 respectively.

Table 11. Definition of confidence ratings

Rating	Descriptor
Low	Judgement is based on intuition
Medium	Determination is based on common sense and general knowledge
High	Substantive supportive data exists to verify the assessment

Table 12. Definition of reversibility ratings

Rating	Descriptor
Low	The affected environment will not be able to recover from the impact - permanently modified
Medium	The affected environment will only recover from the impact with significant intervention
High	The affected environmental will be able to recover from the impact

Table 13. Definition of irreplaceability ratings

Rating	Descriptor
Low	The resource is not damaged irreparably or is not scarce
Medium	The resource is damaged irreparably but is represented elsewhere
High	The resource is irreparably damaged and is not represented elsewhere

8. Description of Affected Environment

8.1 Map of Key Features

No sites were identified within the proposed study area and as such a Key Features Map would be redundant.

8.1.1 Findings

Several small microliths of the Late Stone Age is found scattered over the property. None of these scatters defined a stone age site. Although some Middle to Late Stone Age cores were noticed, very few reworking flakes could be identified. Much of the stone used for these tools are some kind of volcanic glass. There are no known sources of this rock on the property. Most of the other tools recovered were of banded ironstone and obsidian.

Large areas of the study area are covered in red Kalahari sand. Some LSA tools of banded iron stone was also identified. None of these stone tool scatters can be considered a stone age site. Very few cores and no reworking flakes were observed. Some of the small tools were manufactured from volcanic glass (obsidian) – type stone, the exact type could not be determined, however it was obvious that these materials were brought into the study area from an unknown source.



Figure 7. Part of the study area with mining activities

9. Baseline

Context Relevant to Project Location, Design, Operation, or Mitigation Decisions

9.1 Palaeontology

The Palaeontology of the area forms the subject of a stand-alone study appended to this report.

9.2 Stone Age

This area is home to all three of the known phases of the Stone Age, namely: The Early- (2.5 million – 250 000 years ago), Middle- (250 000 – 22 000 years ago) and Late Stone Age (22 000 – 200 years ago). The Late Stone Age in this area also contains sites with rock art from the San and Khoi San cultural groups. Early to Middle Stone Age sites are less common in this area, however rock-art sites and Late Stone Age sites are much better known (Clark 1959).

During the Middle Stone Age, 200 000 years ago, modern man or Homo sapiens emerged, manufacturing a wider range of tools, with technologies more advanced than those from earlier periods (Deacon 1984). This enabled skilled hunter-gatherer bands to adapt to different environments. From this time onwards, rock shelters and caves were used for occupation and reoccupation over very long periods of time.

The Late Stone Age, considered to have started some 20 000 years ago, is associated with the predecessors of the San and Khoi Khoi. Stone Age hunter-gatherers lived well into the 19th century in some places in SA. Stone Age sites may occur all over the area where an unknown number may have been obliterated by mining activities, urbanisation, industrialisation, agriculture and other development activities during the past decades.

Specifically, The Wonderwerk Cave in the Kururman hills has provided much Stone Age information (Beaumont 1984, 2006).

Specularite mining is noted by Beaumont and Bashier (1974) at Doornfontein and Blinkklipkop between 800AD – 820AD.

A limited number of Rock-Art sites are located in this area, mostly due to the lack of suitable shelter sites.

9.3 Iron Age

Although there is documentary evidence of a large Iron Age Tswana village – Dithakong, located in the general area of the site the occurrence of this is still hotly contested and the findings of Cobbing have been largely discredited (Cobbing 1988, SAHRA ARC pers. comm).

More recent research by Jacobs shows occupational Tswana sites to occur during the later “Bantu Expansion” and “Proto-Difiqane between c1750 and 1830 in the study area. Specifically, the Tlhaping and Tlharo chiefdoms are referred to here (N. J. Jacobs, 199). It is even suggested that some Sotho-Tswana people might have preceded the Tlhaping and Tlharo in this region. This is however not a recent postulation since Ellenberger and MacGregor already proposed earlier Iron Age communities in these areas as early as 1912 (Ellenberger & MacGregor, 1912).

Tswana Industry groups might have continued the specularite mining noted in the Stone Age during the Iron Age in this area from 1600 on.

According to Breutz (1963) Iron Age settlements could be found as far south as Gatlhose and Majeng, which are both within 25km of the study area. Such sites have also been identified at Danielskuil (Snyman, 1986). These groups were eventually driven from the area by the Kora (Snyman, 1986).

9.4 Historic Era

The area of Postmasburg was originally known only for the site of Blinkklipkop where the pre-colonial specularite mines were located. The site at Blinkklipkop was successively occupied by vagrants to explorers

(often the same category during this time) and Carl Lichtenstein gives colourful descriptions of this site during his visit of 1805 (Lichtenstein 1930).

The Blinkklipkop (Blinkklip) site researched by Thackeray and Beaumont in the 1980's, could also be identified from sketches and descriptions by Burchell documented during his 1813 expedition through the area (Thackeray, 1983).

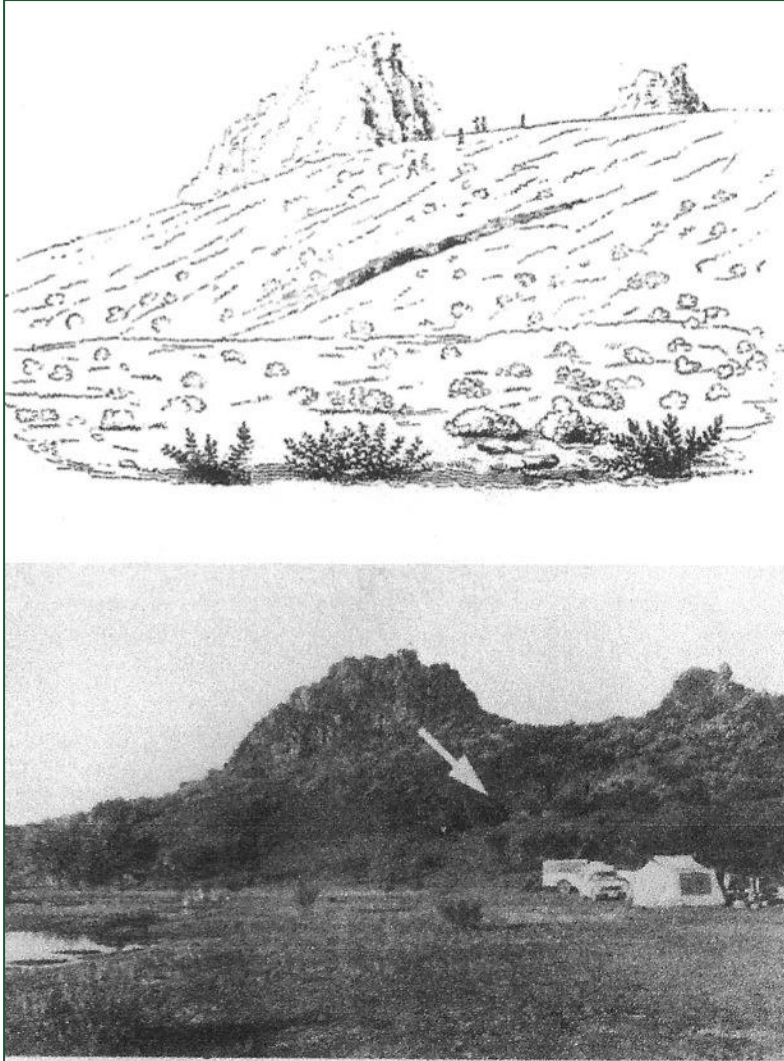
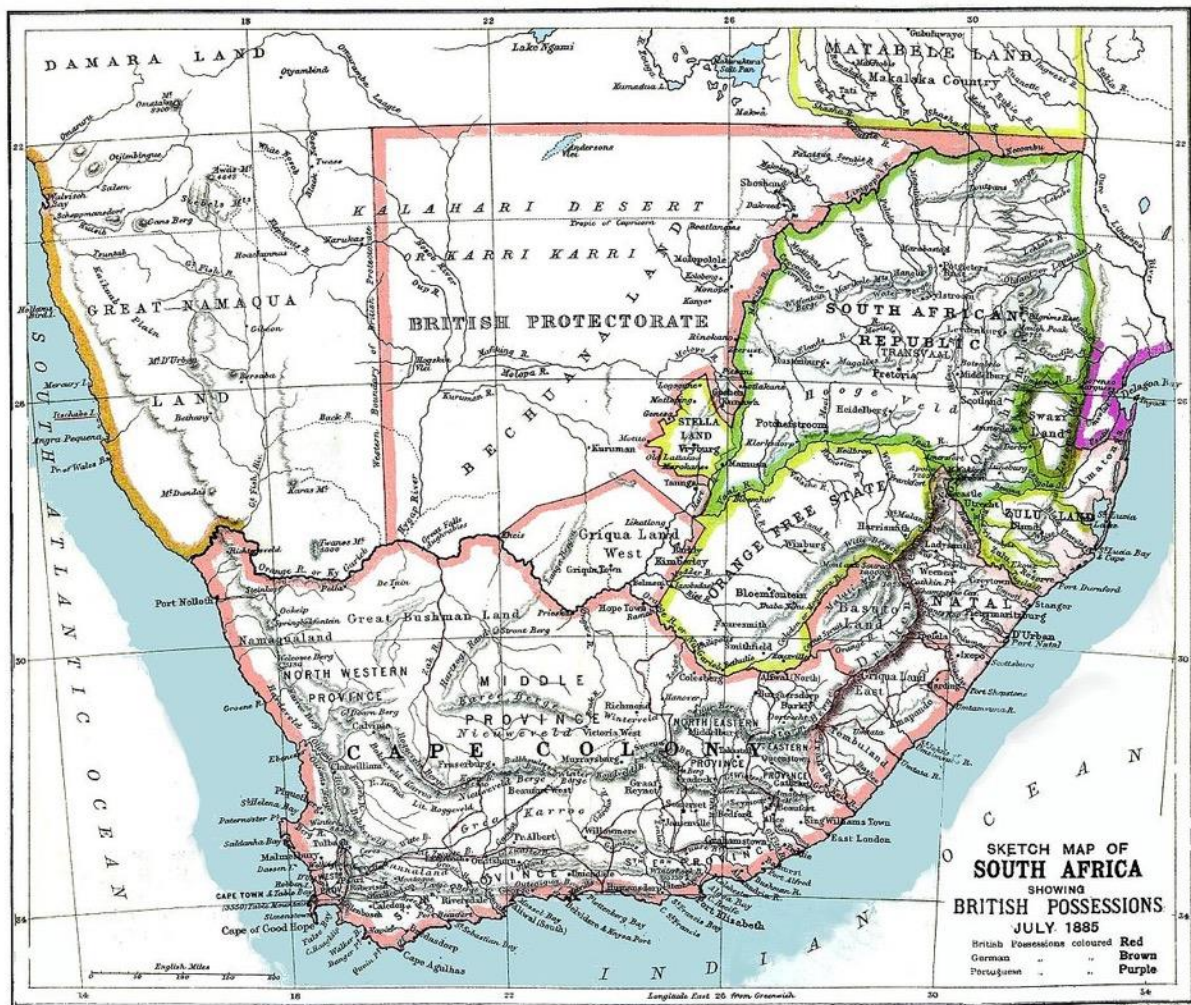


Figure 8. Sketch by Burchell compared by Thakeray (Thakeray, Tjackeray & Beaumont, 1983)

By 1820 the Griqua was settling in the Blinkklipkop area (Legassick, 2010) to be followed by the Thlaro group under Isaak Thupane who settled close to present day Postmasburg (Breutz 1963). During the 1860's diamonds were discovered in the area leading to the British annexation of Griqualand in 1871 and the renaming as *Griqua Land West* (Legassick, 2010).



Scottish Geographical Magazine. 1885.

Figure 9. Historic Map showing Griqua Land West (Scottish Geographical Magazine, 1885)

After 1800 the Cape Government sent scouting parties out to the area. The Griqua Leader, Willem Visser settled on Blinkklipkop and it became a permanent Griqua outpost. The London Mission Society started a mission station, named Sibling, on Blinkklip in 1833.

The British government took over Griqualand West in 1871 and on 14 April 1892 the name of the town was changed to Postmasburg in honour of Reverend Dirk Postma, one of the founding members of the Dutch Reformed Church. The town was officially founded in 1893.

The Gouws family acquired the farm Kameelhoek (study area) in the Postmasburg region on 21 February 1885 and built the first farmhouse in 1890. The building still remains and is still lived in. (See figure 12: original Farmhouse). The same family remains on the farm to this day, stretching over 5 generations, although they are now named Erasmus (passing from father to daughter).

With the outbreak of war between the British and the Boer Republics on 11 October 1899, this area was annexed by Boer Commandoes and was held for the next eight months. By March 1900 the whole Griqua Land West was under the control of Boer Commander P J de Villiers.



Figure 10. Cmdr. PJ de Villiers

On the 30th of March 1900 E.M. Warden was appointed as the Magistrate of Postmasburg, with G.H.J. van der Walt as his assistant.

The Postmasburg Boer soldiers stationed themselves at Campbell to secure the position against an attack by the British. Sir Alfred Miller anticipated the danger from these soldiers and gave Sir Charles Warren an order to besiege Griqualand-West. On the 30th of May 1900 the Boer soldiers attacked Warren's troops. The attack was unsuccessful and after fifteen British soldiers and 30 Boer soldiers were killed, the Boer troops retreated.

After this battle, Colonel S. Hughes marched up against all the towns in Griqualand West, including Postmasburg and conquered the area. G.H.J. van der Walt handed over the keys to the government offices to J.D. Aucamp and turned himself in. After a failed petition attempt to escape persecution, all Boer soldiers who held a rank were put in prison in Griqualand.

For nearly a year there were no military operations and most of the Boer soldiers were set free with parole and were allowed to return to their farms.

In June 1901 the Boer commandos would rise up again and intercepted a post-cart between Postmasburg and Floradale. Within a few weeks of this incident, General De Villiers invaded the area a second time to serve as a link between General De La Rey in the Western Transvaal and General J.C. Smit in the Northern Cape. Postmasburg was once again under the Boer's control when Commandant Edwin Conroy occupied the Government Offices, Police Station and Post Office on the 10th of August 1901.

During the battle of Rooikoppies, on 24 August 1901, twelve British soldiers were killed.

When the Boer Republics surrendered in May 1902, control of Griqualand West was returned to the British (Strydom 1937).

From 1918 onwards, the area was known for diamond mines focussed on kimberlite pipes. Until its closure in 1930, the West End Diamond Mine near Postmasburg produced more than 180 000 carats of diamonds (Snyman, 1977).

The Beeshoek Mine was originally a manganese mine that started operating in 1935. The scope of the iron-ore deposits in the area was realized in the 1940's. Exploration followed and in the late 1950's the mine switched its operations to produce iron-ore. The mine continued its operations (primitively hand sorting) until when in 1975 a full washing and screening plant was installed. Beeshoek was closed in 1981 but reopened in 1985 and graduated their operations with new extensions in 1999.

Sources:

www.southafrica.org.za/south-africa-travel-postmasburg.html

www.greenkalahari.co.za/index.php/postmasburg

www.sa.venues.com/attractionsnv/postmasburg.php

www.minigweekly.com/article/beeshoek-ironore-mine-2005-08-05

9.5 Archival Research

Three main sources of information regarding the heritage sensitivity of this area could be identified. These were;

- Scientific publications on heritage related research in the area
- Previous heritage studies in the area as per the SAHRIS database

- Historic maps and figures as available in the National Archive

Scientific publications

Several publications on heritage related work in this area could be sourced. These include, but are not limited to;

- Beaumont, P.B. and Boshier A.K. (1974). *Report on Test Excavations in a Prehistoric Pigment Mine near Postmasburg, Northern Cape*. The South African Archaeological Bulletin, Vol.29, No 113/114 (Jun., 1974), pp. 41 – 59.
- Humphreys, A.J.B. *Note on the Southern Limits of Iron Age Settlement in the Northern Cape*. The South African Archaeological Bulletin, Vol 31, No. 121/122 (jun., 1976), pp. 54-57.
- Thackeray, A.I., Thackeray J.F., Beaumont, P.B. *Excavations at the Blinkklikop Specularite Mine near Postmasburg, Northern Cape*. The South African Archaeological Bulletin, Vol. 38, No. 137 (Jun., 1983), pp. 17-25.
- Forssman, T.R., Kuman, K, Leader, G.M., Gibbon, R.J. *A Later Stone Age Assemblage from Canteen Kopje, Northern Cape*. The South African Archaeological Bulletin, Vol. 65, No. 192 (December 2010), pp. 204-214.
- Couzens, R., Sadr, K. *Rippled Ware at Blinklipkop, Northern Cape*. The South African Archaeological Bulletin, Vol. 65, No. 192 (December 2010), pp. 196 – 203.
- Rudner, J., Rudner, I. *Rock-Art in the Thirstland Areas*. The South African Archaeological Bulletin, Vol.23, No. 91 (Dec., 1968), pp. 75-89.
- Humphreys, A.J.B., *Cultural Material from Burials on the Farm St. Cair, Douglas Area, Northern Cape*. The South African Archaeological Bulletin, Vol 37, No. 136 (Dec., 1982), pp. 68-70.

The literature study of the above publications resulted in several findings that guided investigations regarding the site at Kameelhoek 477 & 478; The main points are;

- The identification of five pre-colonial specularite mines in the immediate vicinity of Postmasburg as identified by P.B. Beaumont and A.K. Boshier. These are as follows;
 1. Doornfontein – This is a site with a maximum length of 100m consisting of four chambers from which at least an estimated 45 000 metric tons of specularite was removed (Beaumont & Boshier, 1974). Although the specularite mining is discussed in detail there is however no discussion on the reasons for these large scale excavation. It is clear that the workings were that of Stone Age peoples and since specularite does not deliver good material for stone tool manufacture it begs the question why these extensive excavations exist in the first place.

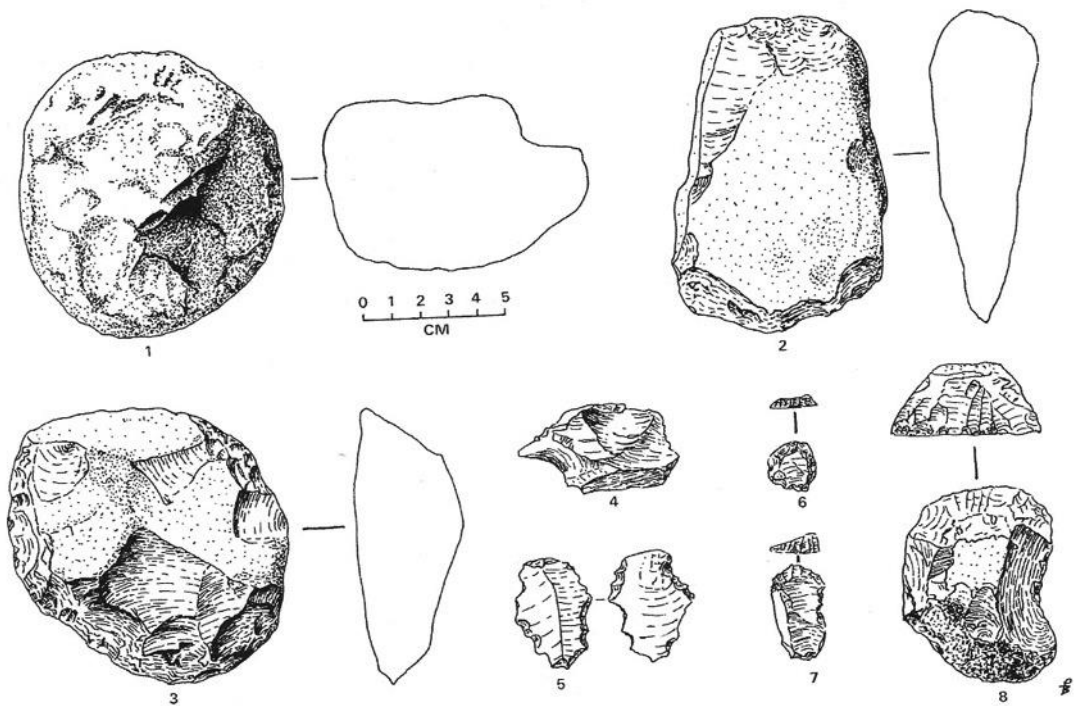


Figure 11. Stone Tools from Doornfontein (Beaumont & Boshier, 1974)

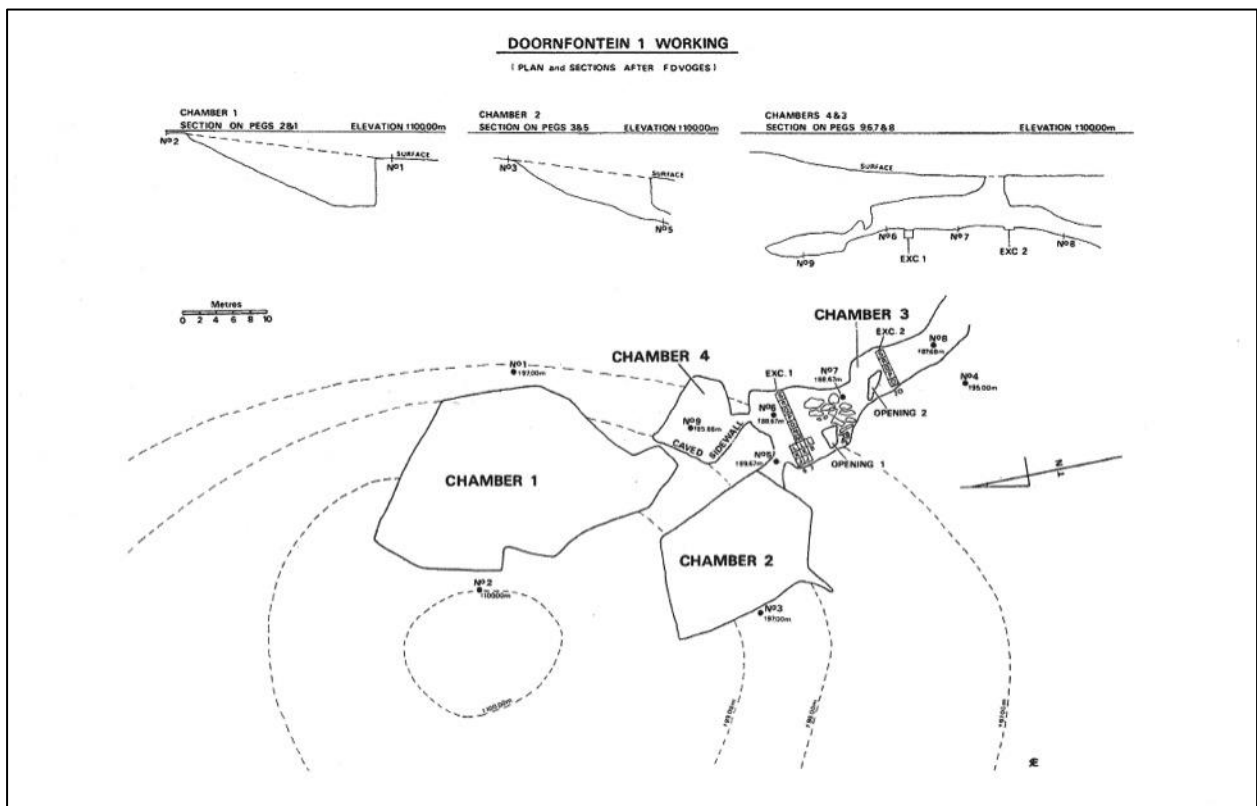


Figure 12. Layout figure for Doornfontein (Beaumont & Boshier, 1974)

2. Blinkklikop – This is another pre-colonial specularite mine on a hill known as Blinkklikop or Gatkoppies, 5km north-east of Postmasburg. In this analysis the authors give a much more detailed description of the use of specularite as a decorative element for body decoration or even pottery decoration. Further examples of specularite use is also described in Burchell

(1822-4), Cumming (1850 I:232), Livingstone (1858), Borchers (1861 : 73-4) and Stow (1905 : 436) (Thackeray, Thackeray & Beaumont, 1983). The size and extent of deposits at Blinkklipkop makes this probably the most important of the five sites.

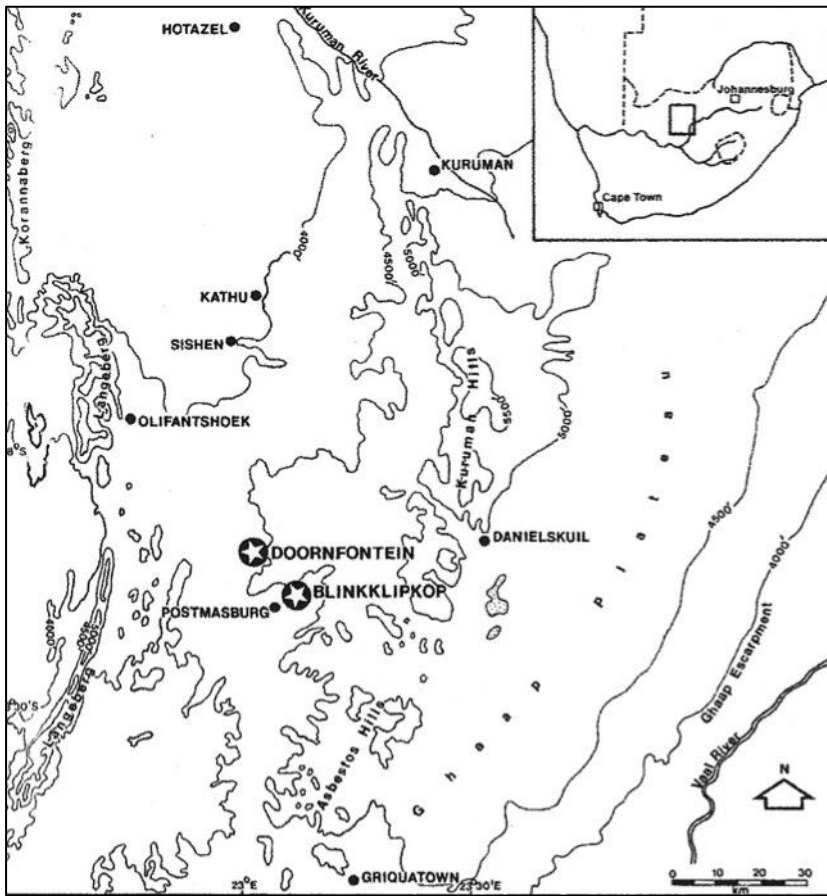


Figure 13. Location of Pre-Colonial Specularite Mines (Thackeray, Thackeray & Beaumont, 1983)

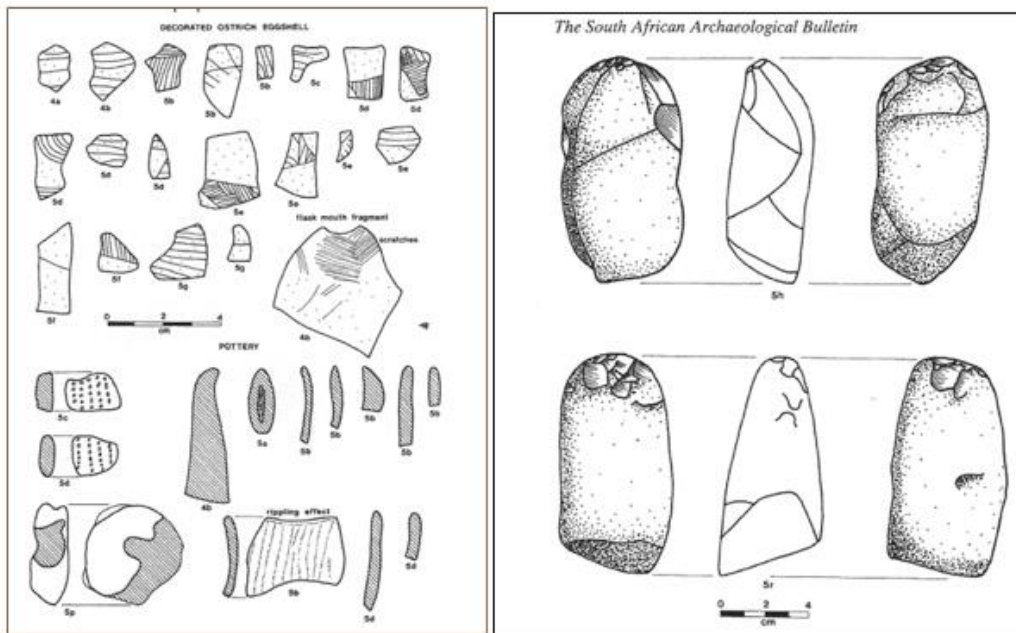


Figure 14. Decorated OEG and Mining Tools from Blinkklipkop (Thackeray, Thackeray & Beaumont, 1983)

3. Paling – Another large concentration of specularite is located on the farm Paling M87, 16km northwest of Postmasburg. The author does not indicate the extent of pre-colonial mining that actually took place here (Thackeray, Thackeray & Beaumont, 1983) .
 4. Gloucester – A pre-colonial specularite mine is found on the farm Gloucester, 13,24km north of Postmasburg. Only mining pits are observed here (Thackeray, Thackeray & Beaumont, 1983).
 5. Huxley – The final documented occurrence of specularite mining is on the farm Huxley, 15,30km north of Postmasburg. Only mining pits located at this site (Thackeray, Thackeray & Beaumont, 1983).
- The identification of petroglyphs of elephant, kudu, ostrich, etc. on the farm Beeshoek. Some geometric symbols similar to *Late Red Art* is also identified here by Judner in 1968 (Judner & Judner, 1969).
 - Petroglyphs are also identified at Koegrabie on the farm Eindgoed (Rudner & Rudner, 1968).

9.6 SAHRIS Database Studies

An extensive research into the SAHRIS database resulted in the identification of the following heritage related studies that have been performed over the last decade in the study area. Only studies within a radius of 50km from the study area were considered.

- Dreyer, C. 2007. (Private). Archaeological and Historical Investigation of the Proposed Mining Activities at the Farm Rosslyn, Lime Acres, Northern Cape.
- Beaumont, P.B. 2007a. (McGregor Museum). Phase 1 Heritage Impact Assessment Report on Five Borrow Pits adjacent to the R383 and R386 Roads South of Postmasburg, Siyanda District Municipality, Northern Cape Province.
- Beaumont, P.B. 2007b. (McGregor Museum). Phase 1 Heritage Impact Assessment Report on the Farm Makganyene 667, between Postmasbug and Olifantshoek, Siyanda District Municipality, Northern Cape Province.
- Henderson, Z.L. 2005. (National Museum Bloemfontein). Cultural Heritage Assessment for Finsch Mine.
- Morris, D. 2001. (McGregor Museum). Report on Assessment of Archaeological Resources in the Vicinity of Proposed Mining at Morokwa.
- Morris, D. 2005a. (McGregor Museum). Report on a Phase 1 Archaeological Assessment of Proposed Mining Areas of the Farms Bruce, King, Makoning and Parson, between Postmasburg and Kathu, Northern Cape. Phase 1 Archaeological & Cultural Heritage Impact Assessment
- Metsimatala 150MW CSP Solar Energy Facility – Power Lines, (near Postmasburg), Siyanda District Municipality, Northern Cape ArchaeoMaps
- Morris, D. 2005b. (McGrgeor Museum). Report on a Phase 1 Archaeological Assessment of Proposed Mining Areas on the Farms Ploegfontein, Klipbankfontein, Welgevonden, Leeufontein, Wolhaarkop and Kapstewel, West of Postmasburg, Northern Cape.
- Morris, D. 2008a. (McGregor Museum, KBY). Archaeological and Heritage Impact Assessment on Remainder of Carter Block 458, near Lime Acres, Northern Cape.
- Morris, D. 2008b. (McGregor Museum). Archaeological and Heritage Phase 1 Predictive Impact Assessment for Prospecting on Magoloring Portions 4 and 5 (Japies Rust), near Glosam, Northern Cape.
- Morris, D. & Beaumont, P.B. 1994. (McGregor Museum, KBY). Ouplaas 2 Rock Engravings, Danielskuil.
- Van Ryneveld, K. 2005. (McGregor Museum, KBY). Cultural Heritage Site Inspection Report for the purpose of a Prospecting Right EMP – (Portion of) Skeyfontein 536, Postmasburg District, Northern Cape, South Africa.
- Becker, E. 2012. (Hatch). Transnet Capital Projects: Ngqura 16Mtpa Manganese Rail. Phase 1 Heritage Impact Assessment Kimberley to De Aar.
- Gaigher, S. 2014. (G&A Heritage). Heritage Impact Assessment Report. Heritage Impact Scoping Report for the Mining Rights Application for the Remaining Portions 2, 3, 4 and 5 of the Farm Kapstewel 436 near the Town of Postmasburg in the Northern Cape Province.
- Hutton, L. & Hutton, M. 2013. (Private). Heritage Impact Assessment Report for the Farms Plaas 438 Portion 1 and Plaas 588 RE.
- Hutton, M. 2014. (PGS). Solar Reserve SA (Pty) Ltd – Proposed Construction of Two 132kV Power Lines and Switchyards to Connect the Redstone Solar Thermal Energy Plant to the Olien Substation in the Z.F. Ngcawu District Municipality in the Northern Cape Province – Option 1: Redstone Solar Thermal Energy Plant to Olien Substation.

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- Van Vollenhoven, A.C. 2014b. (Archaetnos). A Report on a Heritage Impact Assessment for the Proposed Eskom Kimberley Strengthening Phase 4 Project between the Manganore and Ferrum Substations in the Northern Cape Province Phase 1 Archaeological & Cultural Heritage Impact Assessment
- Metsimatata 150MW CSP Solar Energy Facility – Power Lines, (near Postmasburg), Siyanda District Municipality, Northern Cape ArchaeoMaps
- Webley, L.E. 2010. (ACO). Heritage Impact Assessment of proposed Groenwater Solar Array, Northern Cape Province.

Relevance of Listed Heritage Studies for the Study Area

Of specific value for this project is the 2009 report by Van Vollenhoven and Pelsler;

- Pelsler, A. & Van Vollenhoven, A.C. 2009. (Archaetnos). A report on a Heritage Impact Assessment Study for Proposed Mining Development on the Remaining Extent and Portions 2, 3, 4 and 5 of Kapstewel 436, Kuruman Registration District, Siyanda District Municipality, Northern Cape Province.

And the 2014 report by Gaigher;

- Gaigher, S. 2014. (G&A Heritage). Heritage Impact Assessment Report. Heritage Impact Scoping Report for the Mining Rights Application for the Remaining Portions 2, 3, 4 and 5 of the Farm Kapstewel 436 near the Town of Postmasburg in the Northern Cape Province.

Both these studies were performed on the same footprint as the current study, with the exception of Portion 4 of Kapstewel. These studies identified the following sites of heritage significance on these properties:

Site 1 (S 28.13266 E 23.11854)

This site contains the remains of an old mining complex. There are various prospecting trenches, mine buildings and an ore crushing facility. Scrap metals, building rubble and old vehicle parts scatter the area. The site is probably less than 60 years of age and is deemed of low significance. The documentation (recording and photographs taken) done during the survey is seen as sufficient mitigation measures.

Probability of Impact: Possible

Extent of Impact: Local (up to 5km from the project site)

Duration of Impact: Long-term

Intensity of Impact: Medium

Significance of Impact: Moderate



Figure 15. Ore crushing plant



Figure 16. Ore dump

Site 2 (S 28.14171 E 23.11661)

This is a site with some low stone walled features, possibly dating to either the Iron Age or to earlier Later Stone Age hunter-gatherers. There are at least 3 circular and semi-circular features that might represent either windbreaks for shelters or dwellings. No artifacts were identified. The exact function or age of these features is unknown at this stage, and more investigation is needed. **The site is deemed to be of medium to high significance, and some mitigation measures need to be implemented should mining operations take place in this area. This will include mapping and drawing.**

Probability of Impact: Probable

Extent of Impact: Local (up to 5km from the project site)

Duration of Impact: Long-term

Intensity of Impact: Medium

Significance of Impact: Moderate¹⁴



Figure 17. Stone walled features on Site 2

Site 3 (S 28.14229 E 23.11664)

This is a possible grave. It is a stone packed, rectangular-shaped feature with no visible headstone. Some pieces of undecorated porcelain were found near to it. **If this is indeed an unknown grave it is of high significance. If the mining operations are to impact directly on this area, this will have to be taken into consideration and the mining plans will have to be altered in order to avoid disturbing the grave. If not possible, the grave will have to be exhumed and relocated after all necessary processes related to graves have been undertaken.**

Probability of Impact: Possible

Extent of Impact: Local (up to 5km from the project site)

Duration of Impact: Long-term

Intensity of Impact: Medium

Significance of Impact: Moderate¹⁵



Figure 18. Possible Grave

Site 4 (S 28.14735 E 23.11530)

The site contains at least 9 circular (stone-lined) depressions, stretched in a row along an old mine prospecting road. The function or exact age of these features is unknown, but it is possible that it is related to the recent historic mining activities in the area and that it represents a mine camp where tents were pitched. The linear layout of the site does not conform to the Iron Age and its

location next to the road does seem to favor the mine camp conclusion. Bottles and other cultural material found in the vicinity also seems to date the site to the 1960's/70's. The site has low significance, as it most probably is less than 60 years of age. The documentation done during the survey is deemed sufficient enough mitigation.

Probability of Impact: Possible

Extent of Impact: Local (up to 5km from the project site)

Duration of Impact: Long-term

Intensity of Impact: Medium

Significance of Impact: Moderate¹⁶



Figure 19. Circular Depressions

Site 5 (S28.11267 E23.11928)

This is an old farm stead, with a number of buildings and features on it. It is less than 60 years of age and not very significant. It will be revamped and used as part of the new mining infrastructure. The documentation (recording and photographs taken) done during the survey deemed sufficient.

Probability of Impact: Definite

Extent of Impact: Site

Duration of Impact: Long-term

Intensity of Impact: Medium

Significance of Impact: Moderate¹⁷



Figure 20. Old Farmstead

Site 6 (S 28.15434 E 23.10222; S 28.15394 E 23.10295; S 28.15448 E 23.10101; S 28.15612 E 23.10101)

This site represents the old mine offices and complex of the old SAMANCOR Manganore mining operations. It contains various buildings and features. This could be re-used for the new mining operations. It is less than 60 years of age (dating to around the 1970's to 1990's). It has low cultural heritage significance and the documentation done during the survey is sufficient enough to be regarded as mitigation.

Probability of Impact: Definite

Extent of Impact: Site

Duration of Impact: Long-term

Intensity of Impact: Medium

Significance of Impact: Moderate

Site 7 (S 28.15708 E 23.09991)

This site is related to Site 6 and contains the remains of the SAMACOR mining operations, including conveyor belts and the old railway line. The railway line will be revamped and used during the new mining operations. The documentation (recording and photographs taken) done during the survey is deemed sufficient.

Probability of Impact: Definite

Extent of Impact: Site

Duration of Impact: Long-term

Intensity of Impact: Medium

Significance of Impact: Moderate

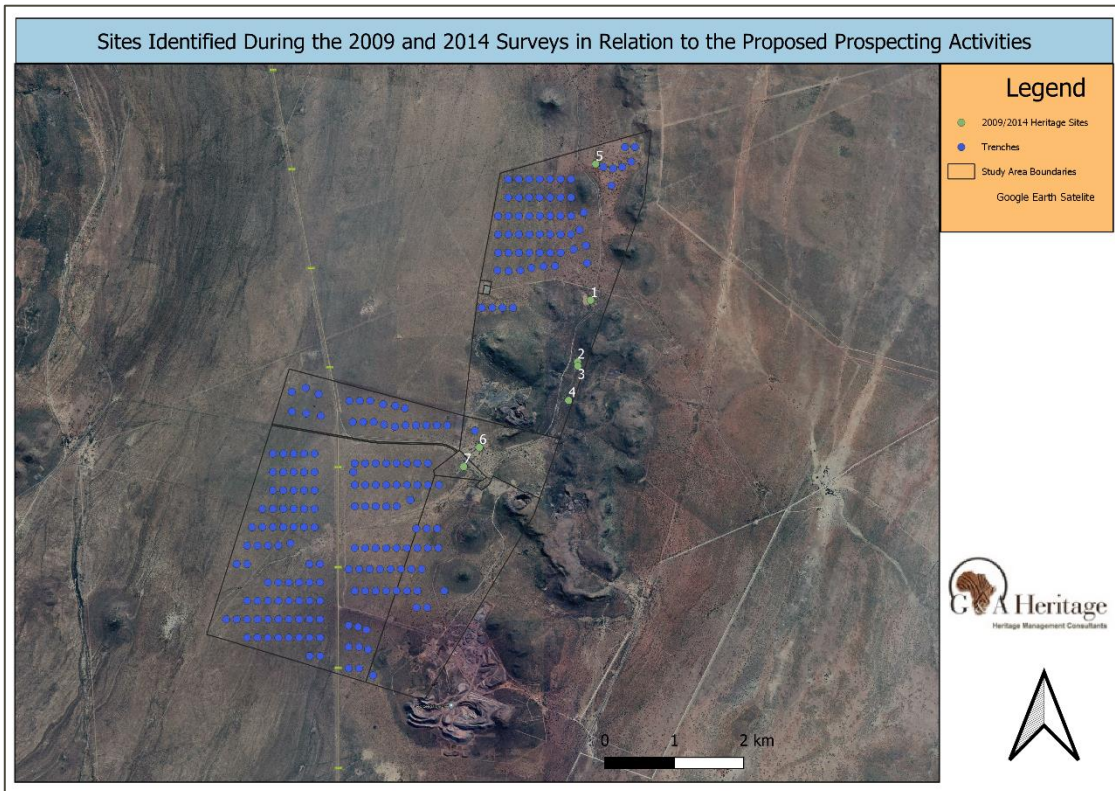


Figure 21. Sites identified during the 2009 and 2014 surveys in relation to the proposed prospecting sites

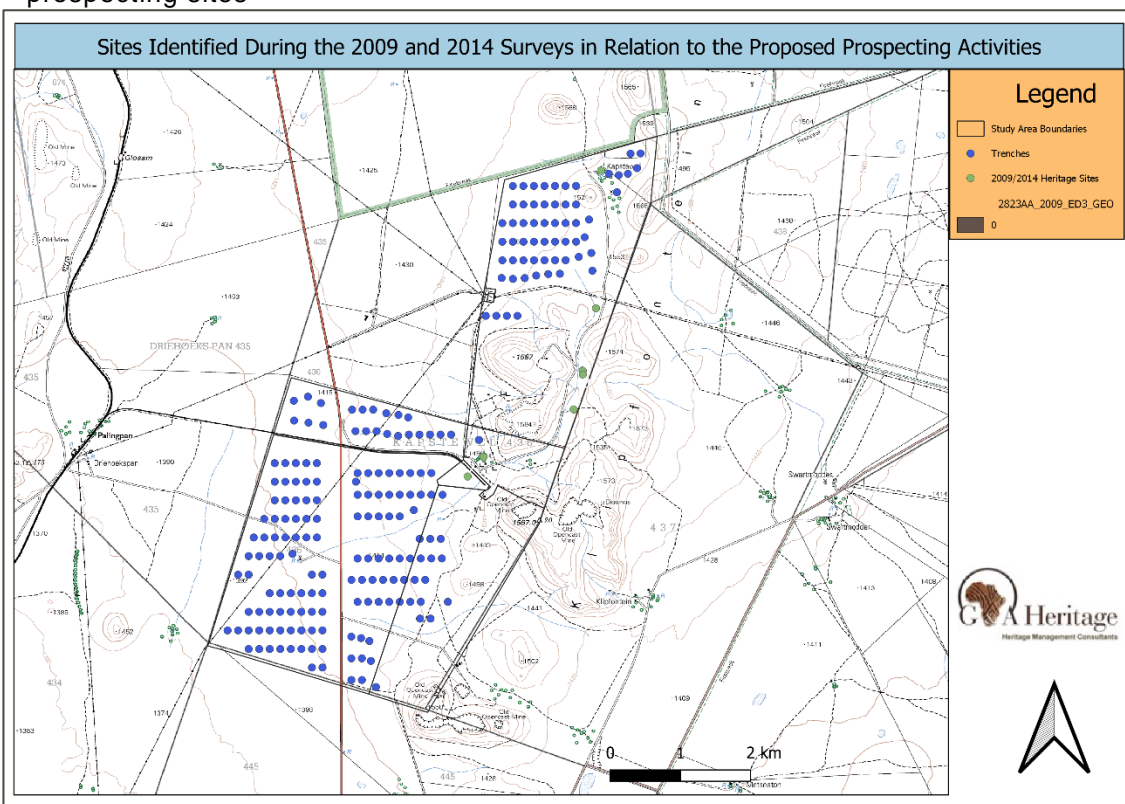


Figure 22. Sites identified during 2009 and 2014
None of these sites are endangered by the proposed prospecting trenches and boreholes. The closest any trench comes to a site is at the Kapstewel Homestead and, as can be seen below, this is still well removed from the site and will not cause any damage.



Figure 23. Trench closest to known heritage feature

9.7 Historical Typographical Maps

Especially during the evaluation of historic structures, the use of archived historic maps is very handy. They give a direct chronological reference for such sites and also lead the investigation on the ground.

The following historic map sets are relevant for this study (in chronological order);

- 2823 AA 1970
- 2823 AA 1989
- 2823 AA 2009

Unfortunately these maps can only inform up to 1970, and while some of the mining structures are indicated on them, this only gives them a relative age of 50 years or more which puts them outside of the mandate of the NHRA 25 of 1999.

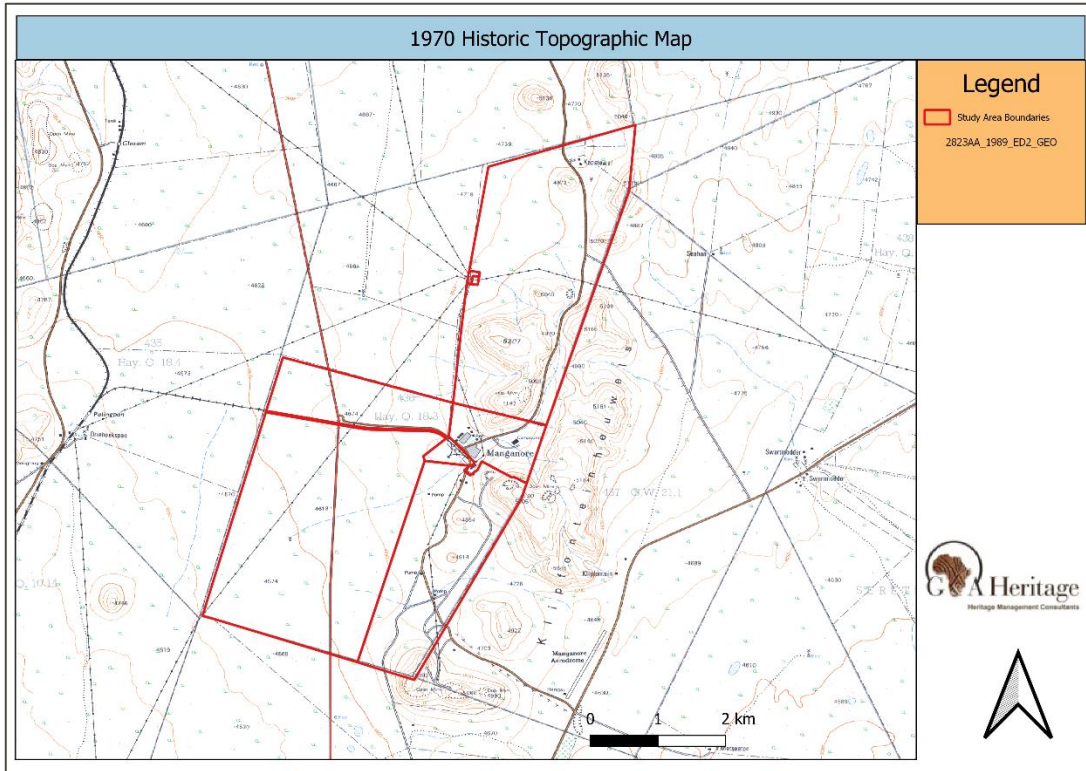


Figure 24. 1970 Topographic Map

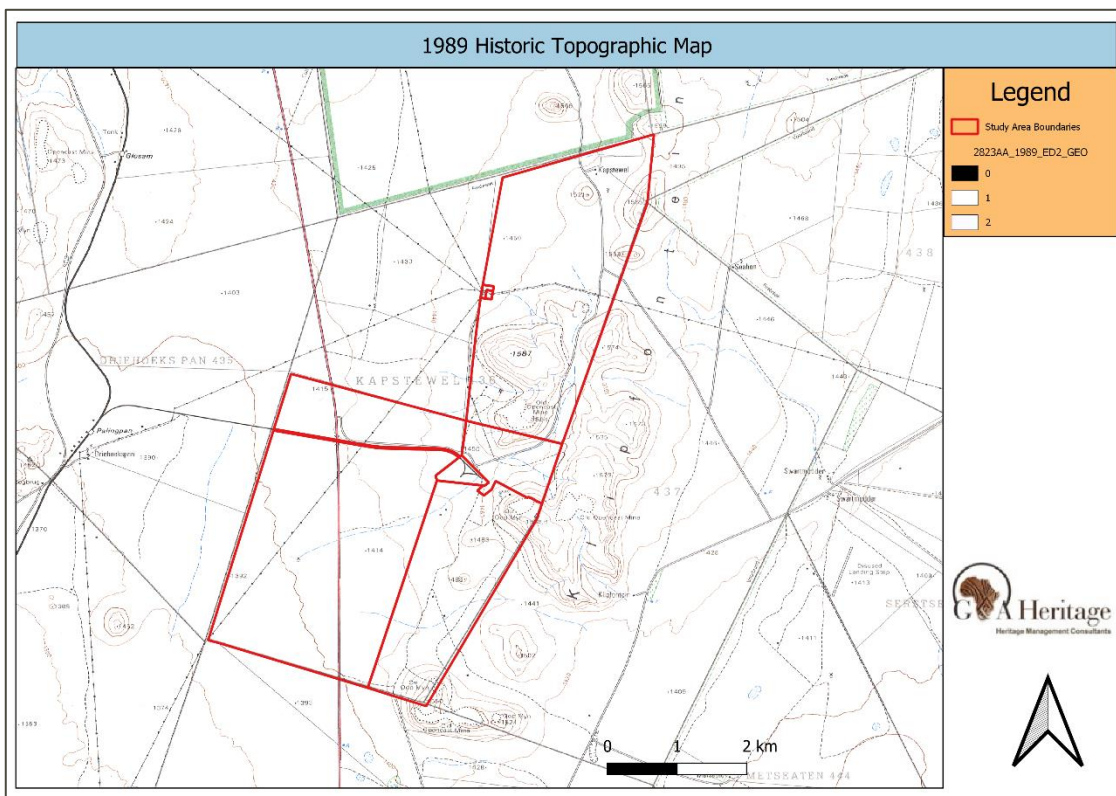


Figure 25. 1989 Topographic Map

10. Photos



Figure 26. View towards current mining activities



Figure 27. View towards Portion 3 (Remaining Extent) indicating current mining activities



Figure 28. Predominant rock formations



Figure 29. Eskom sub-station



Figure 30. Current Mining Activities



Figure 31. Communications tower



Figure 32. Old Samancor village



Figure 33. Crusher dumps and abandoned infrastructure



Figure 34. Current mining activities

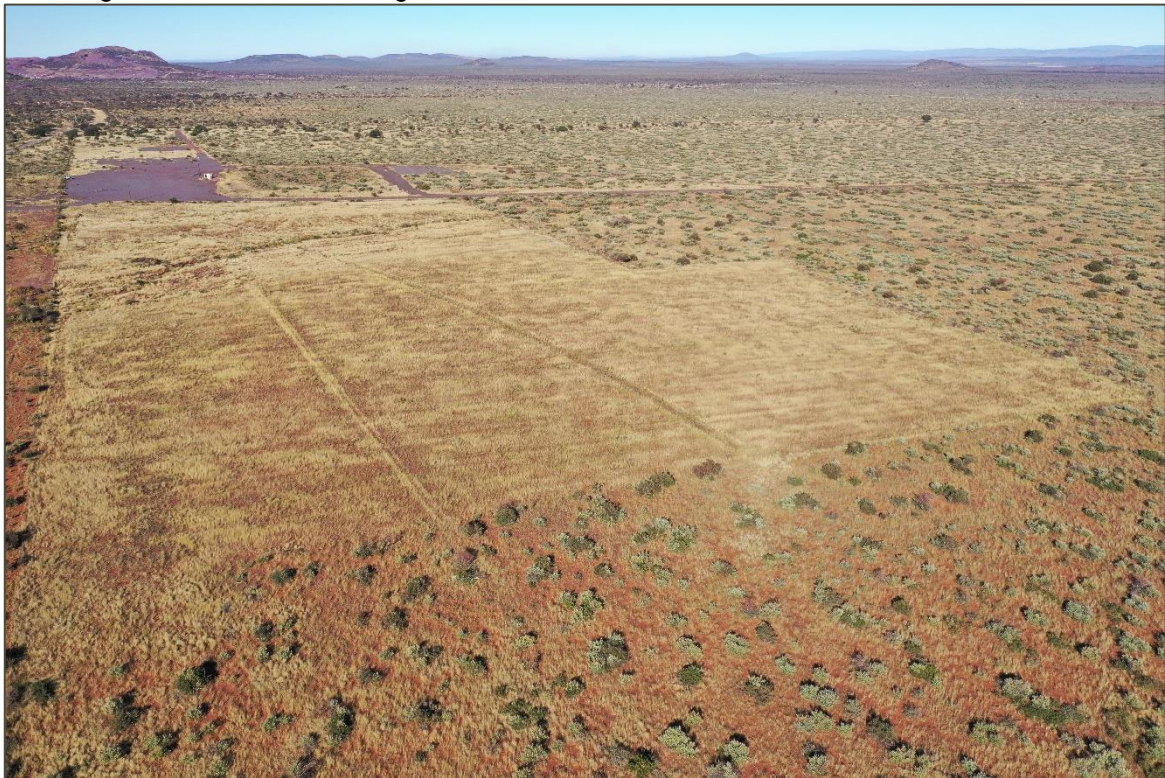


Figure 35. Old agricultural fields

11. Potential Heritage Impacts and Proposed Mitigation

Heritage Impact Assessment

11.1 Introduction and scope

This component will evaluate the potential impact that the proposed development could have on heritage sites and objects of community, cultural or scientific value. This includes archaeological, cultural heritage, built heritage and basic paleontological assessments to determine the impacts on heritage resources within the study area.

The scope of work includes:

- Identification and assessment of archaeological, cultural, historic, built and paleontological sites within the study area
- Interrogation of project specific Drone data and aerial imagery
- Archival study of existing data and information for the study area
- Site inspection and fieldwork: 12 June 2019. This site work includes communicating with local inhabitants to confirm possible locations of heritage and cultural sites.
- Compilation of a Heritage Impact Assessment (HIA) Report.

11.2 Impact Assessment and Proposed Mitigation

The site was readily accessible, and the confidence level of the provided impact evaluation is as a result high.

Damage to Graves and Burial Sites

None

Damage to Ceremonial Sites and Places-of-Power

None

Excavation of Palaeontological Materials

Addressed in standalone report.

Damage to Unidentified or Buried Archaeological Sites

Unlikely

Ref:		4	
Project phase	Construction		
Impact	Unidentified/Sub-surface Archaeological Remains		
Description of impact	Archaeological deposits not identified during the fieldwork or which are buried under the predominant and shifting alluvial sands could be uncovered during the prospecting activities.		
Mitigability	High	Mitigation exists and will considerably reduce the significance of impacts	
Potential mitigation	Chance Finds Protocol		
Assessment	Without mitigation		With mitigation
Nature	Negative		Positive
Duration	Short term	Impact will last between 1 and 5 years	Long term Impact will last between 10 and 15 years
Extent	Local	Impacts felt mostly throughout the study area	Regional Impacts felt outside the study area, at a regional / provincial level
Magnitude	High	Natural and/ or social functions and/ or processes are notably altered	Moderate Natural and/ or social functions and/ or processes are moderately altered
Probability	Unlikely	Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur	Likely The impact may occur
Confidence	Medium	Determination is based on common sense and general knowledge	High Substantive supportive data exists to verify the assessment
Reversibility	Low	The affected environment will not be able to recover from the impact - permanently modified	High The affected environmental will be able to recover from the impact
Resource irreplaceability	Medium	The resource is damaged irreparably but is represented elsewhere	Medium The resource is damaged irreparably but is represented elsewhere
Significance	Negligible - negative		Minor - positive
Comment on significance	Although information on archaeological sites are scant, there is a possibility of encountering Stone Age sites. Documentation of archaeological sites as a result of access to previously inaccessible areas will be beneficial in regards to heritage research and archaeological knowledge within this area.		
Cumulative impacts	The growth of the iron and manganese mining industry could negatively affect sites (if they occur - none were identified during fieldwork) and the impact of further mining activities could compound this effect.		

11.3 No-Go Alternative

The no-go option will have the least impact on the heritage components discussed in this report

11.4 Conclusions and Recommendations

The area proposed for the placement of prospecting boreholes and trenches was previously inspected for the occurrence of heritage sites in 2009 and 2014. During these studies identified several possible sites of heritage significance. After investigating their location in relation to the proposed prospecting boreholes and trenches it was concluded that the proposed prospecting will not pose any threat to these sites.

Although some Stone Age tool scatters were noted in some areas, none of these constituted a site and they are indicative of numerous such scatters that occur across the whole of the Northern Cape Province. No other sites of heritage significance could be identified.

The area designated as Portion 3 (Remaining Extent) of Kapstewel 436 could not be accessed since permission could not be obtained from the landowner at the time. This section was however part of both the 2009 and 2014 surveys and these both failed to identify any heritage sites. It is unlikely that heritage features will be endangered on this property as a result of the planned prospecting, however it is still recommended that the 14 sites that could not be verified be cleared by a qualified heritage practitioner once access to this portion has been secured and before any prospecting activities begin.

11.5 Chance Finds Protocol

It is important to note that, although unlikely, sub-surface remains of heritage sites could still be encountered during construction of the project. Such sites would offer no surface indication of their presence due to the


high state of alterations in some areas as well as heavy vegetation cover in other areas. The following indicators of unmarked sub-surface sites could be encountered:

- Ash deposits (unnaturally grey appearance of soil compared to the surrounding substrate);
- Bone concentrations, either animal or human;
- Ceramic fragments such as pottery shards either historic or pre-contact;
- Stone concentrations of any formal nature.

The following recommendations are given should any sub-surface remains of heritage sites be identified as indicated above:

- All operators of excavation equipment should be made aware of the possibility of the occurrence of sub-surface heritage features and the following procedures should they be encountered.
- All construction in the immediate vicinity (50m radius of the site) should cease.
- The heritage practitioner should be informed as soon as possible.
- In the event of obvious human remains the Namibian Police Services should be notified.
- Mitigation measures (such as refilling etc.) should not be attempted.
- The area in a 50m radius of the find should be cordoned off with hazard tape.
- Public access should be limited.
- The area should be placed under guard.
- No media statements should be released until such time as the heritage practitioner has had enough time to analyze the finds.

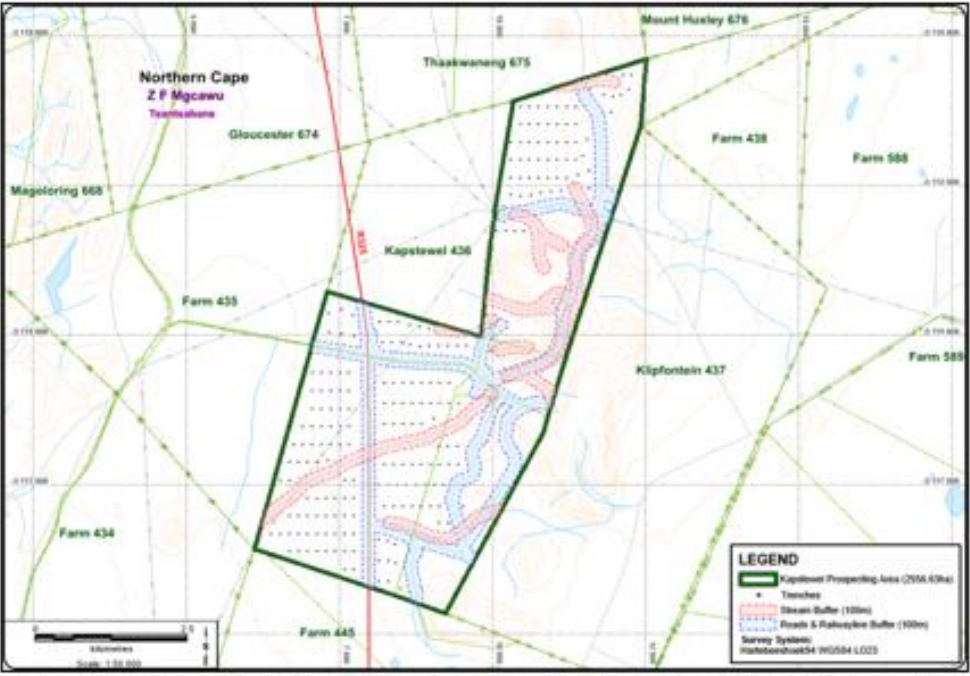
12. Public Participation



G&A Heritage

Heritage Management Consultants

NOTICE OF PHASE 1 HERITAGE IMPACT ASSESSMENT (HIA) APPLICATION



Notice is hereby given that an application for a Phase 1 Heritage Impact Assessment (HIA) in terms of Section 38 of the National Heritage Resources Act (Act 25 of 1999) will be lodged with the South African Heritage Resources Agency (SAHRA) and the Northern Cape Provincial Heritage Authority (NBKB).

PROJECT NAME: Heritage Impact Assessment for the prospecting boreholes and trenches on the farm Kapstewel 436 near Postmasburg in the Northern Cape Province.

NAME OF THE PROPONENT: Jaco-K Consulting

LOCATION: The study area is located near Postmasburg, in the Tsantsabane Municipality, ZF Mgcawu District of the Northern Cape Province.

ANY ENQUIRIES SHOULD BE REFERED TO:
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MAREMANE
Communal Property Association

ATTENDANCE REGISTER

DATE : 28 May 2020
MEETING : WITH G & A HERITAGE
VENUE : KAAPSTEWEL

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13. References

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Appendix A
Palaeontological Impact Assessment

Portion 2 (Remaining Extent),
Portion 3 (Remaining Extent),
Portion 5 and Remaining Extent of
the Farm Kapstewel 436,
Northern Cape Province

PALAEONTOLOGICAL IMPACT ASSESSMENT

Compiled by: Dr JF Durand (Sci.Nat.) For:

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6 June 2020

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1. Executive Summary

The site that will be impacted by this development is primarily underlain by dolomitic limestone of the Lime Acres Formation of the Ghaap Plato Formation of the Campbell Rand Subgroup of the Transvaal Supergroup that is potentially Very Highly Palaeontologically Sensitive.

A layer of sandy soils of the Gordonia Formation that has Moderate Palaeontological Sensitivity covers the dolomitic limestone partially. The largest part of the geology is covered in shallow sandy soils and vegetation.

An overview of the literature on the palaeontology and associated geology of the area is given. Although no publications exist that mention fossils from the study site, several palaeontological studies have been done elsewhere on the same geological formations that occur at the study site where stromatolites (fossilised bacterial mats) have been discovered.

The ECO should take responsibility for supervising the development and should follow the Chance Find Procedure (p.19-20) if a significant fossil discovery, especially extensive and well-preserved stromatolite formations, is made.

2. Introduction

The Heritage Act of South Africa stipulates that fossils and fossil sites may not be altered or destroyed. The purpose of this document is to detail the probability of finding fossils in the study area that may be impacted by the proposed development.

The palaeontological heritage of South Africa is unsurpassed and can only be described in superlatives. The South African palaeontological record gives us insight in inter alia the origin of dinosaurs, mammals and humans. Fossils are also used to identify rock strata and determine the geological context of the subregion with other continents and played a crucial role in the discovery of Gondwanaland and the formulation of the theory of plate tectonics. Fossils are also used to study evolutionary relationships, sedimentary processes and palaeoenvironments.

South Africa has the longest record of palaeontological endeavour in Africa. South Africa was even one of the first countries in the world in which museums displayed fossils and palaeontologists studied earth history. South African palaeontological institutions and their vast fossil collections are world-renowned and befittingly the South African Heritage Act is one of the most sophisticated and best considered in the world.

Fossils and palaeontological sites are protected by law in South Africa. Construction and mining in fossiliferous areas may be mitigated in exceptional cases but there is a protocol to be followed.

This is a Palaeontological Impact Assessment which was prepared in line with Regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involved a site visit where the palaeontologist evaluated the nature of the geology and potential palaeontology of the study site and an overview of the literature on the palaeontology and associated geology of the area.

3. Terms of reference for the report

According to the South African Heritage Resources Act (Act 25 of 1999) (Republic of South Africa, 1999), certain clauses are relevant to palaeontological aspects for a terrain suitability assessment.

- **Subsection 35(4)** No person may, without a permit issued by the responsible heritage resources authority-
 - (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
 - (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
 - (c) trade in, sell for private gain, export or attempt to export from the republic any category of archaeological or palaeontological material or object, or any meteorite; or
 - (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist with the detection or recovery of metals or archaeological material or objects, or use such equipment for the recovery of meteorites.
- **Subsection 35(5)** When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedures in terms of section 38 has been followed, it may-
 - (a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
 - (b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
 - (c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
 - (d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

South Africa's unique and non-renewable palaeontological heritage is protected in terms of the NHRA. According to this act, heritage resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

As areas are developed and landscapes are modified, heritage resources, including palaeontological resources, are threatened. As such, both the environmental and heritage legislation require that development activities must be preceded by an assessment of the impact undertaken by qualified professionals. Palaeontological

Impact Assessments (PIAs) are specialist reports that form part of the wider heritage component of:

- Heritage Impact Assessments (HIAs) called for in terms of Section 38 of the National Heritage Resources Act, Act No. 25, 1999 by a heritage resources authority.
- Environmental Impact Assessment process as required in terms of other legislation listed in s. 38(8) of NHRA;
- Environmental Management Plans (EMPs) required by the Department of Mineral Resources.

HIAs are intended to ensure that all heritage resources are protected, and where it is not possible to preserve them in situ, appropriate mitigation measures are applied.

An HIA is a comprehensive study that comprises a palaeontological, archaeological, built environment, living heritage, etc specialist studies. Palaeontologists must acknowledge this and ensure that they collaborate with other heritage practitioners. Where palaeontologists are engaged for the entire HIA, they must refer heritage components for which they do not have expertise on to appropriate specialists.

Where they are engaged specifically for the palaeontology, they must draw the attention of environmental consultants and developers to the need for assessment of other aspects of heritage. In this sense, Palaeontological Impact Assessments that are part of Heritage Impact Assessments are similar to specialist reports that form part of the EIA reports.

The standards and procedures discussed here are therefore meant to guide the conduct of PIAs and specialists undertaking such studies must adhere to them. The process of assessment for the palaeontological (PIA) specialist components of heritage impact assessments, involves:

Scoping stage in line with regulation 28 of the National Environmental Management Act (No. 107 of 1998) Regulations on Environmental Impact Assessment. This involves an **initial assessment** where the specialist evaluates the scope of the project (based, for example, on NID/BIDs) and advises on the form and extent of the assessment process. At this stage the palaeontologist may also decide to compile a **Letter of Recommendation for Exemption from further Palaeontological Studies**. This letter will state that there is little or no likelihood that any significant fossil resources will be impacted by the development. This letter should present a reasoned case for exemption, supported by consultation of the relevant geological maps and key literature.

A **Palaeontological Desktop Study** – the palaeontologist will investigate available resources (geological maps, scientific literature, previous impact assessment reports, institutional fossil collections, satellite images or aerial photos , etc) to inform an assessment of fossil heritage and/or exposure of potentially fossiliferous rocks within the study area. A Desktop studies will conclude whether a further field assessment is warranted or not. Where further studies are required, the desktop study would normally be an integral part of a field assessment of relevant palaeontological resources.

A **Phase 1 Palaeontological Impact Assessment** is generally warranted where rock units of high palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large-scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed project area is unknown. In the recommendations of Phase 1, the specialist will inform whether further monitoring and mitigation are necessary. The Phase 1 should identify the rock units and significant fossil heritage resources present, or by inference likely to be present, within the study area, assess the palaeontological significance of these rock units, fossil sites or other fossil heritage, comment on the impact of the development on palaeontological heritage resources and make recommendations for their mitigation or conservation, or for any further specialist studies that are required in order to adequately assess the nature, distribution and conservation value of palaeontological resources within the study area.

A **Phase 2 Palaeontological Mitigation** involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or the recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and /or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before Phase 2 may be implemented.

A **'Phase 3' Palaeontological Site Conservation and Management Plan** may be required in cases where the site is so important that development will not be allowed, or where development is to co-exist with the resource. Developers may be required to enhance the value of the sites retained on their properties with appropriate interpretive material or displays as a way of promoting access of such resources to the public.

The assessment reports will be assessed by the relevant heritage resources authority, and depending on which piece of legislation triggered the study, a response will be given in the form of a Review Comment or Record of Decision (ROD). In the case of PIAs that are part of EIAs or EMPs, the heritage resources authority will issue a comment or a record of decision that may be forwarded to the consultant or developer, relevant government department or heritage practitioner and where feasible to all three.

4. Details of study area and the type of assessment:



Figure 1: Google Earth photo indicating study site (white polygon)

The study site is in the mining area between Postmasburg and Kathu. The central and southeastern part of the study site east of the road have been extensively transformed by mining. The southwestern part of the study site west of the road serves as a residential area.

The mining area is characterized by iron-rich formations that occur as hills in an otherwise flat landscape covered with red to pinkish aeolian sand. The area is covered with grass in relatively undisturbed areas.

The relevant literature and geological maps have been studied and the site was visited for a Palaeontological Impact Study.

5. Geological setting

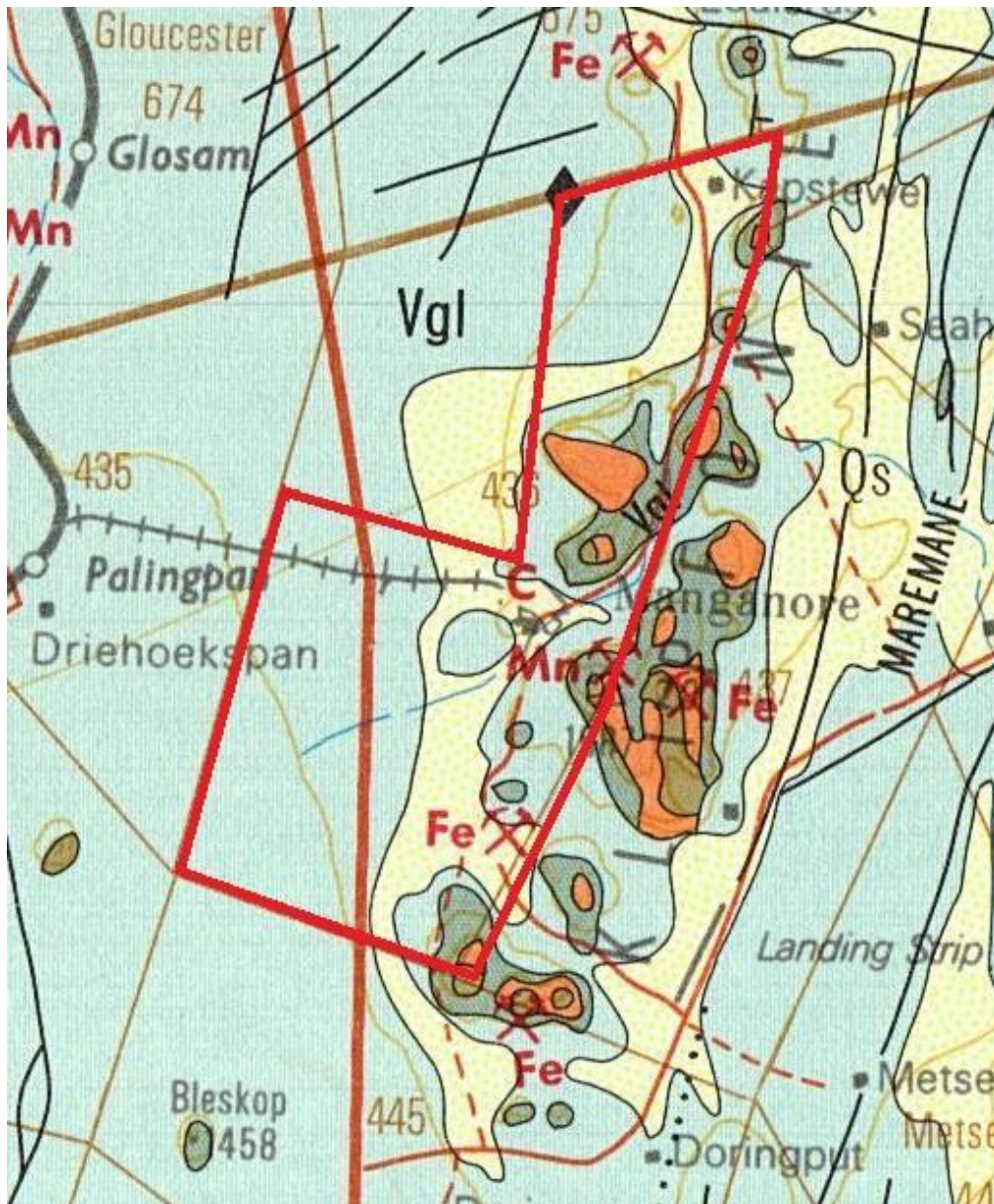


Figure 2: Geology map of the study site (red polygon) and surroundings. Adapted from the 2822 Postmasburg 1: 250 000 Geology Map (Geological Survey, 1977).

LEGEND

	Lithology	Geological unit		Age
Qs	Red to pinkish wind-blown sand	Gordonia Formation	Kalahari Group	Quaternary
Vg	Conglomerate and shale	Gamagara Member of the Postmasburg Formation	Griekwatown Group	Vaalian
	Banded ironstone	Kuruman Member of the Asbesberge Formation		
Vgl	Chert and chert breccia	Lime Acres Member, Ghaap Plato Formation	Campbell Rand Subgroup, Transvaal Supergroup	
Vgl	Dolomitic limestone (puckered limestone)			

The study site is dominated by Vaalian aged dolomitic limestone and chert and fragmented chert of the Lime Acres Formation of the Ghaap Plato Formation of the Campbell Rand Subgroup of the Transvaal Supergroup. The Campbell Rand Subgroup underlies the Banded Ironstone Formation units of the Asbestos Hills Subgroup and constitutes the oldest geological unit in the study area (Eriksson *et al.*, 2009).

The Quaternary aged aeolian sand of the Gordonina Formation of the Kalahari Group covers the dolomitic rocks in the central area of the study site. The Kalahari sands which occur in large palaeo-valley systems that run in a north-south direction are part of the most extensive body of terrestrial sediments of Cenozoic age in southern Africa (Partridge *et al.*, 2009).

6. Site visit

The study site was visited on 30 May 2020.

The geology is covered in places by a thin layer of red sandy soil and drought-resistant vegetation. Weathered Dolomite was observed in barren areas (see Figs. 4-7, 9).

None of these rocks in the study area contained significant palaeontological features.



Figure 3: Study area showing sites where photos were taken



Figure 4: Dolomite at Site 1 28°10'54.79"S 23°04'40.25" E



Figure 5: Dolomite and red ironstone at Site 2 28°09'12.8"S 23°04'39.15"E



Figure 6: Dolomite at Site 3 $28^{\circ}08'56.16''\text{S}$ $23^{\circ}05'46.31''\text{E}$



Figure 7: Dolomite at Site 4 $28^{\circ}10'38.87''\text{S}$ $23^{\circ}05'13.26''\text{E}$



Figure 8: Iron ore mine at $28^{\circ}11.905' S$ $23^{\circ}10.755' E$



Figure 9: Weathered dolomite at Site 5 $28^{\circ}07'42.64'' S$ $23^{\circ}06'22.93'' E$

7. Palaeontological assessment

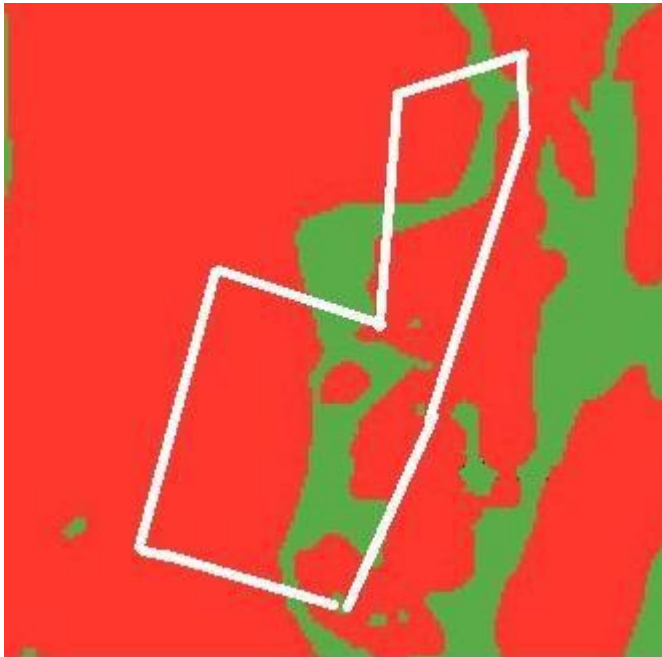


Figure 10: Palaeontological sensitivity of the region (SAHRA, 2020)

Colour	Palaeontological Significance	Action
RED	VERY HIGH	Field assessment and protocol for finds are required.
GREEN	MODERATE	Desktop study is required.

The study area is covered in natural vegetation with grass and shrubs and trees and was originally used for farming but now are mainly used for residential purposes on the west of the road and for mining on the east of the road.

The soil cover in the study area is relatively thin and the underlying eroded bedrock is exposed in places. No fossils were found during the field assessment. This however does not imply that stromatolites would not be discovered once the grass and soil are cleared and it is highly probable that they will be discovered in the study region as soon as mining commences.

The central part of the study area is covered with the red to pinkish aeolian sand and sandy soil of the Quaternary-aged Gordonia Formation, overlying the dolomitic limestone of the Lime Acres Member of the Ghaap Plato Formation which is exposed in the study area.



Figure 11: Example of stromatolites at Sterkfontein Caves

Stromatolites are very important from an evolutionary, environmental, ecological and geological perspective. Stromatolites were formed approximately 2.2 Ga ago when mats of cyanobacteria covered the sea floor up to a certain depth which allowed them to photosynthesize. The slimy surface caused fine grained mud and precipitates to adhere to them after which cyanobacterial strands consisting of chains of bacterial cells would continue to extend by means through the sediment in order to get enough light to photosynthesize. Very thin layers of sediments were set down during this process. In time these sedimentary layers were petrified and turned into columns of rock. Some of these columns which are stacked closely together are as thin as pencils, while others are formed mushroom-like scallops (see Figs. 26 & 27) and others formed bigger domes (see Fig. 28) and even megadomes which are meters across (Keyser and Du Plessis, 1993).

Cyanobacteria were the first photosynthesizing organisms and it is thought that the chloroplast found in plants has evolved from a cyanobacterial ancestor.

Cyanobacteria released oxygen as a by-product of photosynthesis in such quantities that it irrevocably changed the atmosphere from a reducing to an oxidizing atmosphere which had a devastating effect to most bacteria which were and still are anoxic. This event was also responsible for the oxidization and precipitation of huge amounts of iron from solution that formed the Banded Ironstone Formations for which this region is known. Higher organisms such as fungi, plants and animals would not have been able to exist without the oxygen in the atmosphere and would therefore not have evolved if it were not for cyanobacteria.

When the soil and underlying eroded rock stratum are removed, it is possible that stromatolite formations could be exposed in places in the study site. When significant stromatolite formations are uncovered during excavations a palaeontologist must be appointed to assist in the evaluation of the importance of the

conservation of these structures before mining continues, following the Chance Find Procedures.

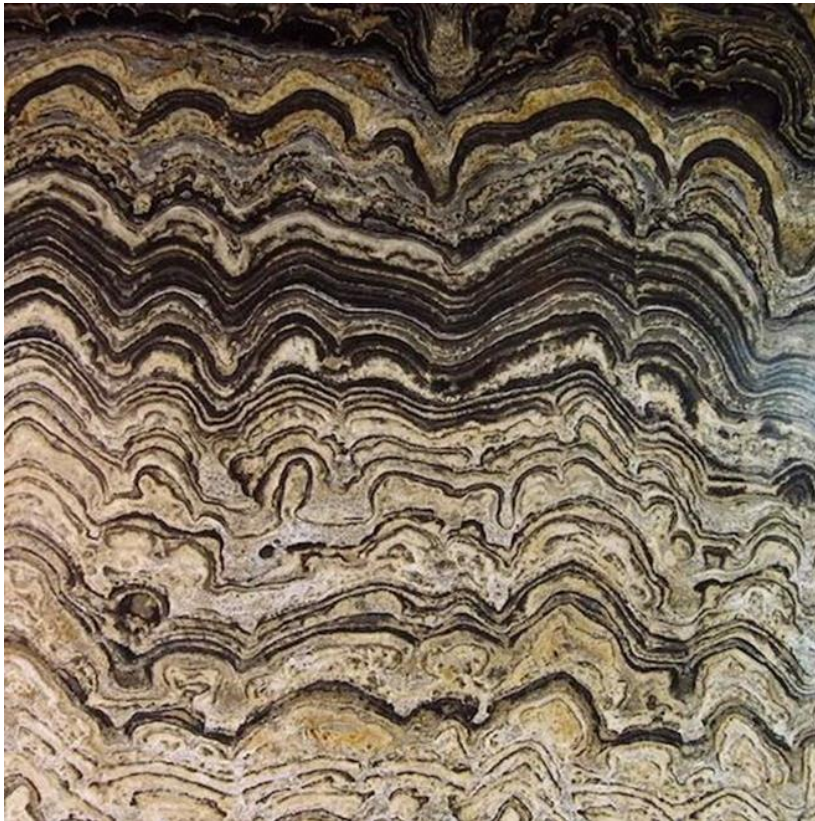


Figure 12: Polished vertical section through stromatolites

(from: <https://www.google.co.za/imgres?imgurl=http%3A%2F%2Fwww.therockgallery.co.uk%2Fekmps%2Fshops%2Ftherockgallery%2Fimages%2Fstromatolite-large-polished-slice-100-million-years-old-andes-mountains-bolivia-%5B4%5D-1997-p.jpg&imgrefurl=http%3A%2F%2Fwww.therockgallery.co.uk%2Fstromatolite-large-polished-slice----100-million-years-old----andes-mountains-bolivia-1997p>

[asp&docid=2vFkg_vqTH0I5M&tbnid=FQcixxQGdtBUFM%3A&vet=10ahUKEwinl8rfwjAhUGsKQKHf8wBy0QMwgsKAYwBg..i&w=500&h=500&bih=918&biw=1280&q=stromatolites&ved=0ahUKEwinl8rfwjAhUGsKQKHf8wBy0QMwgsKAYwBg&iact=mr&uact=8](http://www.google.co.za/imgres?imgurl=http%3A%2F%2Fwww.kidsdiscover.com%2Fwp-content%2Fuploads%2F2015%2F04%2FBacteria_2.jpg&imgrefurl=http%3A%2F%2Fwww.kidsdiscover.com%2Fspotlight%2FBacteria%2F%3Fmc_cid%3D97b6810d71%26mc_eid%3Df31cca173c&docid=jpZALMrhml6d1M&tbnid=6zCWRFeJARwpQM%3A&vet=10ahUKEwioIMq6z6jAhWisqQKHTkzCSQMwhCKAMwAw..i&w=1000&h=683&bih=344&biw=553&q=Bacteria_2%20stromatolites&ved=0ahUKEwioIMq6z6jAhWisqQKHTkzCSQMwhCKAMwAw&iact=mr&uact=8))



Figure 13: Domal structures of stromatolites seen from above

(from: https://www.google.co.za/imgres?imgurl=http%3A%2F%2Fwww.kidsdiscover.com%2Fwp-content%2Fuploads%2F2015%2F04%2FBacteria_2.jpg&imgrefurl=http%3A%2F%2Fwww.kidsdiscover.com%2Fspotlight%2FBacteria%2F%3Fmc_cid%3D97b6810d71%26mc_eid%3Df31cca173c&docid=jpZALMrhml6d1M&tbnid=6zCWRFeJARwpQM%3A&vet=10ahUKEwioIMq6z6jAhWisqQKHTkzCSQMwhCKAMwAw..i&w=1000&h=683&bih=344&biw=553&q=Bacteria_2%20stromatolites&ved=0ahUKEwioIMq6z6jAhWisqQKHTkzCSQMwhCKAMwAw&iact=mr&uact=8)

The aeolian deposits of the study site have a low to moderate potential to yield fossils and the possibility of finding fossil material cannot be ignored. The fossil record of the overlying Kalahari Group is sparse, occurs sporadically and is low in diversity. Although no fossils have been reported for the study area, fossils such as root casts, burrows, termitaria, ostrich eggshells, mollusc shells and isolated bones have been discovered in the Kalahari Group elsewhere (Almond & Pether 2008).

References:

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8. Conclusion and recommendations:

There is a low likelihood that the Quaternary aeolian sand at the study site may contain fossils. Elsewhere rare fossils of root casts, burrows, ostrich egg shells, mollusc shells, isolated bones, root casts, burrows and termitaria have been found and the possibility of finding similar fossils at the study area cannot be excluded.

The overall palaeontological sensitivity of the study areas is considered to be very high based on the probability of finding stromatolites when mining commences.

Although stromatolites are considered to be fossils, there are hundreds of square kilometres of stromatolites in South Africa and it is not considered to be so scarce that every stromatolite formation has to be preserved. In the event of the discovery of an exceptional stromatolite formation it is advised that it should on principle not be destroyed if it could be preserved.

In the event of fossils being discovered in the sands, soils or dolomitic limestone in the study area, the ECO should follow the Chance Find Procedure.

PROCEDURE FOR CHANCE PALAEOLOGICAL FINDS

Extracted and adapted from the National Heritage Resources Act, 1999 Regulations Reg No. 6820, GN: 548.

The following procedure must be considered in the event that previously unknown fossils or fossil sites are exposed or found during the life of the project:

1. Surface excavations should continuously be monitored by the ECO and any fossil material be unearthed the excavation must be halted.
2. If fossiliferous material has been disturbed during the excavation process it should be put aside to prevent it from being destroyed.
3. The ECO then has to take a GPS reading of the site and take digital pictures of the fossil material and the site from which it came.
4. The ECO then should contact a palaeontologist and supply the palaeontologist with the information (locality and pictures) so that the palaeontologist can assess the importance of the find and make recommendations.
5. If the palaeontologist is convinced that this is a major find an inspection of the site must be scheduled as soon as possible in order to minimise delays to the development.

From the photographs and/or the site visit the palaeontologist will make one of the following recommendations:

- a. The material is of no value so development can proceed, or:
 - b. fossil repository after a permit was obtained from SAHRA for the removal of the fossils, after which the development may proceed, or:
 - c. The fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and take them to a recognised fossil repository, after which the development may proceed.
7. If any fossils are found then a schedule of monitoring will be set up between the developer and palaeontologist in case of further discoveries.

14. 9. Declaration of Independence:

I, Jacobus Francois Durand declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



Palaeontological specialist:

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BSc Botany & Zoology (RAU), BSc Zoology (WITS), Museology Dipl. (UP), Higher Education Diploma (RAU), PhD Palaeontology (WITS)