



## PHASE 1 HIA REPORT CALVINIA AQUIFER RECHARGE PROJECT NORTHERN CAPE

PHASE 1 HERITAGE IMPACT ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF AN EXPERIMENTAL AQUIFER RECHARGE INFRASTRUCTURE IN THE AKKERENDAM NATURE RESERVE, ON THE FARM CALVINIA 805 PORTION 0, CALVINIA, HANTAM LOCAL MUNICIPALITY, NAMAKWA DISTRICT MUNICIPALITY, NORTHERN CAPE.

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**Declaration of Independence:**

UBIQUE Heritage Consultants hereby, as the appointed independent specialists, declare that:

- We act as independent specialists in this application;
- We perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- We regard the information contained in this report as it relates to our specialist input/study to be accurate and correct, and do not have and will not have any financial interest in the undertaking of the activity other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any specific environmental management Act;
- We declare that there are no circumstances that may compromise my objectivity in performing such work;
- We have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- We will comply with the Act, Regulations and all other applicable legislation;
- We have no, and will not engage in, conflicting interests in the undertaking of the activity;
- We have no vested interest in the proposed activity proceeding;
- We undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- We have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- We have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- All the particulars furnished by me in this specialist input/study are true and correct, and
- We realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signed: 

Date: 2024-01-16

**J.A.C. Engelbrecht, H. Fivaz & S. Fairhurst**  
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## SUMMARY OF SPECIALIST EXPERTISE

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CRM ARCHAEOLOGIST

Jan Engelbrecht is accredited by the Cultural Resources Management section of the Association of Southern African Professional Archaeologists (ASAPA) to undertake Phase 1 AIAs and HIAs in South Africa. He is also a member of the Association for Professional Archaeologists (ASAPA). Mr Engelbrecht holds an honours degree in archaeology (specialising in the history of early farmers in southern Africa (Iron Age) and the Colonial period) from the University of South Africa. He has over 12 years of experience in heritage management. Mr Engelbrecht established Ubiqum Heritage Consultants in 2012. He is currently studying for his MA Degree in Archaeology.

## EXECUTIVE SUMMARY

### Project description

UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA) to conduct a cultural heritage assessment to determine the impact of the proposed experimental aquifer recharge infrastructure in the Akkerendam Nature Reserve, Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape, on any sites, features, or objects of cultural heritage significance.

### Findings and Impact on Heritage Resources

No archaeological, historical, or cultural heritage resources were identified within the development footprint. Even though the site inspection was cursory as part of the proposed Calvinia Bulk Water project (Fivaz & Engelbrecht 2020), the development footprints are small (< 5 ha) and lie within seasonal water courses and drainage lines. The continuous seasonal water flow means that any recorded cultural material within the footprints would have been alluvial deposits with unknown provenance. Therefore, no in-situ heritage resources of any significance are expected to be impacted by the development. Based on the desktop and survey results, the direct impact on heritage resources will be low, and the cumulative impact is expected to be low.

The project Formation is underlain by the Tierberg locality, which overlies the Collingham Formation in the south and the Whitehill Formation in the north and is overlain by the Waterford Formation. The age of this formation is probably the earliest Middle Permian. A maximum thickness of 1 252 m has been recorded. It occurs north of Matjiesfontein northwards to the Calvinia-Brandvlei area, and from there eastwards to the Britstown area and then northeast-wards, passing northwest of Bloemfontein, to Hertzogville (Fourie 2024). Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks of igneous or metamorphic nature. Therefore, if there is the presence of strata the palaeontological sensitivity can generally be **VERY LOW** to **VERY HIGH**, and here locally in the development area **MODERATE** for the Vryheid Formation (SG 2.2 SAHRA APMHOB, 2012).

### Recommendations

Based on the assessment of the potential impact of the development on the identified heritage, the following recommendations are made, taking into consideration any existing or potential sustainable social and economic benefits:

1. No significant heritage sites or features were identified within the surveyed area of the proposed development footprint. Based on the survey results, there will not be any impact on heritage resources. **Therefore, from a heritage point of view, we recommend that the proposed development continue.**
  
2. Regarding the palaeontological resources:
  - The potential impact of the development on fossil heritage is **MODERATE**; therefore, a field survey is not necessary for this development (according to SAHRA protocol). A Phase 1 Palaeontological Impact Assessment Field Study is required if fossils are found during the development. The protocol for Chance Find is attached.
  - Mitigation will be needed if fossils are found during the development.
  - No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formations present and their fossils and follow protocol.
  - The development may go ahead with caution due to the presence of the Tierberg Formation shale.
  - The ECO must survey for fossils before and or after clearing, blasting, drilling or excavating.
  - The EMPr will cover the conservation of heritage and palaeontological material that may be exposed during development activities. For a chance fossil find, the protocol is to cease all activities immediately, construct a 30 m no-go barrier, and contact SAHRA for further investigation.
  
3. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit must be alerted immediately as per section 36(6) of the NHRA. Depending on the nature of the finds, a professional archaeologist or palaeontologist must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources are of archaeological or palaeontological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred due to such oversights.

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## ABBREVIATIONS

AIA:	Archaeological Impact Assessment
ASAPA:	Association of South African Professional Archaeologists
CRM:	Cultural Resource Management
EIA:	Early Iron Age
EMP:	Environmental Management Plan
ESA:	Earlier Stone Age
GPS:	Global Positioning System
HIA:	Heritage Impact Assessment
HWC:	Heritage Western Cape
IA:	Iron Age
IMP:	Integrated Management Plan
LSA:	Later Stone Age
MIA:	Middle Iron Age
MSA:	Middle Stone Age
NBKB:	Ngwao-Boswa Jwa Kapa Bokone (Northern Cape PHRA)
NHRA:	National Heritage Resources Act
PHRA:	Provincial Heritage Resource Agency
SADC:	Southern African Development Community
SAHRA:	South African Heritage Resources Agency
SAHRIS:	South African Heritage Resources Information System

# 1. INTRODUCTION

## 1.1 Scope of study

The project involves the experimental aquifer recharge infrastructure in the Akkerendam Nature Reserve, Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape. EnviroAfrica has appointed UBIQUE Heritage Consultants as independent heritage specialists in compliance with Section 38 of the National Heritage Resources Act 25 of 1999 (NHRA) to conduct a cultural heritage assessment (AIA/HIA) of the development area.

The assessment aims to identify and report any heritage resources that may fall within the development footprint; to determine the impact of the proposed development on any sites, features, or objects of cultural heritage significance; to assess the significance of any identified resources; and to assist the developer in managing the documented heritage resources in an accountable manner, within the framework provided by the National Heritage Resources Act (Act 25 of 1999) (NHRA).

South Africa's heritage resources are rich and widely diverse, encompassing sites from all periods of human history. Resources may be tangible, such as buildings and archaeological artefacts, or intangible, such as landscapes and living heritage. Their significance is based on their aesthetic, architectural, historical, scientific, social, spiritual, linguistic, economic or technological values; their representation of a time or group; their rarity; and their sphere of influence.

Natural (e.g. erosion) and human (e.g. development) activities can jeopardise the integrity and significance of heritage resources. In the case of human activities, a range of legislation exists to ensure the timely and accurate identification and effective management of heritage resources for present and future generations.

The result of this investigation is presented within this heritage impact assessment report. It comprises the recording of present/ absent heritage resources and offers recommendations for managing them within the proposed development context.

Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, considering any proposed mitigation measures.



## 1.2 Assumptions and limitations

It is assumed that the description of the proposed project, as provided by the client, is accurate. Furthermore, it is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is comprehensive and does not have to be repeated as part of the heritage impact assessment.

The significance of the sites, structures and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. The various aspects are not mutually exclusive, and any site is evaluated with reference to any number of these aspects. Cultural significance is site-specific and relates to the content and context of the site.

The comprehensive field survey and intensive desktop study have taken all possible care to identify sites of cultural importance within the development areas. However, it is essential to note that some heritage sites may have been missed due to their subterranean nature or dense vegetation cover. No subsurface investigation (i.e. excavations or sampling) was undertaken since a SAHRA permit is required for such activities. Therefore, should any heritage features and/or objects, such as architectural features, stone tool scatters, artefacts, human remains, or fossils, be uncovered or observed during construction, operations must be stopped, and a qualified archaeologist must be contacted to assess the find. Observed or located heritage features and/or objects may not be disturbed or removed in any way until the heritage specialist has been able to assess the significance of the site (or material) in question.

## 2. TERMS OF REFERENCE

### 2.1 Statutory Requirements

#### 2.1.1 General

The principle is that the environment should be protected for present and future generations by preventing pollution, promoting conservation and practising ecologically sustainable development. With regard to spatial planning and related legislation at national and provincial levels, the following legislation may be relevant:

- Physical Planning Act 125 of 1991
- Municipal Structures Act 117 of 1998
- Municipal Systems Act 32 of 2000
- Development Facilitation Act 67 of 1995 (DFA)

The identification, evaluation and management of heritage resources in South Africa are required and governed by the following legislation:

- National Environmental Management Act 107 of 1998 (NEMA)
- KwaZulu-Natal Heritage Act 4 of 2008 (KZNHA)
- National Heritage Resources Act 25 of 1999 (NHRA)
- Minerals and Petroleum Resources Development Act 28 of 2002 (MPRDA)

#### 2.1.2 National Heritage Resources Act 25 of 1999

The NHRA established the South African Heritage Resources Agency (SAHRA) together with its Council to fulfil the following functions:

- coordinate and promote the management of heritage resources at the national level;
- set norms and maintain essential national standards for the management of heritage resources in the Republic and to protect heritage resources of national significance;
- control the export of nationally significant heritage objects and the import into the Republic of cultural property illegally exported from foreign countries;
- enable the provinces to establish heritage authorities which must adopt powers to protect and manage certain categories of heritage resources; and
- provide for local authorities' protection and management of conservation-worthy places and areas.

#### 2.1.3 Heritage Impact Assessments/Archaeological Impact Assessments

Section 38(1) of the NHRA of 1999 requires **the responsible heritage resources authority to notify the person who intends to undertake a development that fulfils the following criteria to submit an impact assessment report if there is reason to believe that heritage resources will be affected by such event:**

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- the construction of a bridge or similar structure exceeding 50m in length;
- any development or other activity that will change the character of a site—
  - exceeding 5000m<sup>2</sup> in extent; or
  - involving three or more existing erven or subdivisions thereof; or
  - involving three or more erven or divisions thereof which have been consolidated within the past five years; or
  - the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- the rezoning of a site exceeding 10 000m<sup>2</sup> in extent; or
- any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

#### 2.1.4 Management of Graves and Burial Grounds

- **Graves younger than 60 years** are protected in terms of Section 2(1) of the Removal of Graves and Dead Bodies Ordinance 7 of 1925 as well as the Human Tissues Act 65 of 1983.
- **Graves older than 60 years, situated outside a formal cemetery administered by a local Authority** are protected in terms of Section 36 of the NHRA as well as the Human Tissues Act of 1983. Accordingly, such graves are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of NHRA) is applicable to graves older than 60 years that are situated outside a formal cemetery administered by a local authority. Graves in the category located inside a formal cemetery administered by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

The **protocol for the management of graves older than 60 years situated outside a formal cemetery administered by a local authority** is detailed in Section 36 of the NHRA:

(3) (a) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation

and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

(5) SAHRA or a provincial heritage resources authority may not issue a permit for any activity under subsection (3)(b) unless it is satisfied that the applicant has, in accordance with regulations made by the responsible heritage resources authority—

- (a) made a concerted effort to contact and consult communities and individuals who by tradition have an interest in such grave or burial ground; and
- (b) reached agreements with such communities and individuals regarding the future of such grave or burial ground.

(6) Subject to the provision of any other law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in cooperation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority—

- (a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and
- (b) if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-interment of the contents of such grave or, in the absence of such person or community, make any such arrangements as it deems fit.

## 3. STUDY APPROACH AND METHODOLOGY

### 3.1 Desktop study

The first step in the methodology was to conduct a desktop study of the heritage background of the area and the proposed development site. This entailed scoping and scanning historical texts/records, previous heritage studies, and research around the study area.

The study area is contextualised by incorporating data from previous HIA/AIA reports and an archival search. The objective is to extract data and information on the area in question, looking at archaeological sites, historical sites and graves. A concise account of the archaeology and history of the broader study area was compiled (sources listed in the bibliography).

#### 3.1.1 Literature review

A literature survey was undertaken to obtain background information regarding the area. Through researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (<http://www.sahra.org.za/sahris>), it was determined that several other archaeological or historical studies had been performed within the broader vicinity of the study area. Sources consulted in this regard are indicated in the bibliography.

### 3.2 Field study

Phase 1 (AIA/HIA) requires the completion of a field study to establish and ensure the following:

#### 3.2.1 Systematic survey

A systematic survey of the proposed project area was completed to locate, identify, record, photograph, and describe archaeological, historical or cultural interest sites.

UBIQUE Heritage Consultants inspected the proposed development and surrounding areas from the **16<sup>th</sup> to 19<sup>th</sup> of November 2020** and completed a controlled-exclusive, pre-planned pedestrian and vehicular survey. We inspected the ground's surface, wherever the surface was visible. This was done with no substantial attempt to clear brush, sand, deadfall, leaves or other material that may cover the surface and with no effort to look beneath the surface beyond inspecting rodent burrows, cut banks and other exposures fortuitously observed.

The survey was tracked with a handheld Garmin global positioning unit (Garmin eTrex 10) and an Android smartphone with a Locus Map application.

### 3.2.2 Recording significant areas

GPS points of identified significant areas were recorded with a handheld Garmin global positioning unit (Garmin eTrex 10). Photographs were taken with a Canon IXUS 185 20-megapixel camera. Detailed field notes were taken to describe observations. The layout of the area and plotted GPS points, tracks and coordinates were transferred to Google Earth, and QGIS and maps were created.

### 3.2.3 Definitions of heritage resources

The NHRA defines a heritage resource as any place or object of cultural significance, i.e., aesthetic, architectural, historical, scientific, social, spiritual, linguistic, or technological value or significance. These include, but are not limited to, the following wide range of places and objects:

- Living heritage as defined in the National Heritage Council Act No 11 of 1999 (cultural tradition; oral history; performance; ritual; popular memory; skills and techniques; indigenous knowledge systems; and the holistic approach to nature, society and social relationships);
- Ecofacts (non-artefactual organic or environmental remains that may reveal aspects of past human activity; definition used in KwaZulu-Natal Heritage Act 2008);
- places, buildings, structures and equipment;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds;
- public monuments and memorials;
- sites of significance relating to the history of slavery in South Africa;
- movable objects, but excluding any object made by a living person; and
- battlefields.

## 3.3 Determining significance

Heritage resources are considered of value if the following criteria apply:

- a. It is important in the community or pattern of South Africa's history;
- b. It has uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- c. It has the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;
- d. It is vital in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
- e. It exhibits particular aesthetic characteristics valued by a community or cultural group;

f.	It is essential in demonstrating a high degree of creative or technical achievement at a particular period;
g.	It has a strong or unique association with a particular community or cultural group for social, cultural or spiritual reasons;
h.	It has a strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
i.	It is of significance relating to the history of slavery in South Africa.

Levels of significance of the various types of heritage resources observed and recorded are determined by the following criteria:

CULTURAL & HERITAGE SIGNIFICANCE	
<b>LOW</b>	A cultural object found out of context, not part of a site or without any related feature/structure in its surroundings.
<b>MEDIUM</b>	Any site, structure or feature is regarded as less important due to several factors, such as date, frequency and uniqueness. Likewise, any important object found out of context.
<b>HIGH</b>	Any site, structure or feature is regarded as important because of its age or uniqueness. Graves are always categorised as of a high importance. Likewise, any important object found within a specific context.

Field Ratings or Gradings are assigned to indicate the level of protection required and who is responsible for national, provincial, or local protection.

FIELD RATINGS & GRADINGS	
<b>National Grade I</b>	Heritage resources with exceptional qualities to the extent that they are of national significance and should, therefore be managed as part of the national estate.
<b>Provincial Grade II</b>	Heritage resources with qualities of provincial or regional importance, although they may form part of the national estate, should be managed as part of the provincial estate.
<b>Local Grade IIIA</b>	Heritage resources are of local importance and worthy of conservation. Therefore, it should be included in the heritage register and not be mitigated (high significance).
<b>Local Grade IIIB</b>	Heritage resources are of local importance and worthy of conservation. Therefore, it should be included in the heritage register and mitigated (high/ medium significance).
<b>General Protection Grade IVA</b>	The site/resource should be mitigated before destruction (high/ medium significance).

FIELD RATINGS & GRADINGS	
General protection Grade IVB	The site/resource should be recorded before destruction (medium significance).
General protection Grade IVC	Phase 1 is considered sufficient recording and may be demolished (low significance).

### 3.4 Determining Impact

A heritage resource impact may be defined broadly as the net change, either beneficial or adverse, between the integrity of a heritage site with and without the proposed development. Beneficial impacts occur wherever a proposed development actively protects, preserves, or enhances a heritage resource by minimising natural site erosion or facilitating non-destructive public use. More commonly, development impacts are of an adverse nature and can include:

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

Beneficial and adverse impacts can be direct or indirect and cumulative, as implied by the examples. Although indirect impacts may be more difficult to foresee, assess and quantify, they must form part of the assessment process.

#### 3.4.1 Impact Rating System

Impact assessment must take account of the nature, scale, and duration of impacts on the environment, whether such impacts are positive or negative. Impact assessment is completed according to the project phases:

- planning
- construction
- operation
- decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact is detailed. A brief discussion of the impact and the rationale behind assessing its significance is included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the impact mitigation. In assessing the significance of each impact, the following criteria are used:



**NATURE**

Loss of Archaeological & Cultural Heritage

**GEOGRAPHICAL EXTENT**

This is defined as the area over which the impact will be experienced.

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	The impact will undoubtedly occur (Greater than a 75% chance of occurrence).

**DURATION**

This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.

1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 - 1 years), or the impact 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 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. However, they will be mitigated by direct human action or by natural processes thereafter (10 - 30 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 period that the impact can be considered indefinite.

**INTENSITY/ MAGNITUDE**

Describes the severity of an impact.

1	Low	The impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
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2	Medium	Impact alters the quality, use and integrity of the system/component, but the system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	The 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	The 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. Rehabilitation and remediation are often impossible. If possible, rehabilitation and remediation are often unfeasible due to extremely high costs.

#### REVERSIBILITY

This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.

1	Completely reversible	The impact is reversible with the 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 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 a marginal loss of resources.
3	Significant loss of resources	The impact will result in a significant loss of resources.
4	Complete loss of resources	The impact results in a complete loss of all resources.

#### CUMULATIVE EFFECT

This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant. However, it may become significant if added to other existing or potential impacts emanating from similar or diverse activities due to 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.

**SIGNIFICANCE**

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. The calculation of the significance of an impact uses the following formula:

$$\text{(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.}$$

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.

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.

**3.5 Report**

The desktop research and field survey results are compiled in this report. The identified heritage resources and anticipated direct, indirect, and cumulative impacts of the proposed project's development on the identified heritage resources will be presented objectively. Alternatives are offered if any significant sites are impacted adversely by the proposed project. All efforts will be made to ensure that all studies, assessments, and results comply with the relevant legislation, code of ethics, and Association of South African Professional Archaeologists (ASAPA) guidelines. The report aims to assist the developer in managing the documented heritage resources in a responsible manner and protecting, preserving, and developing them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999).

## 4. PROJECT OVERVIEW

UBIQUE Heritage Consultants were appointed by EnviroAfrica cc as independent heritage specialists in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA) to conduct a cultural heritage assessment to determine the impact of the proposed experimental aquifer recharge infrastructure in the Akkerendam Nature Reserve, on the Farm Calvinia 805 Portion 0, Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape, on any sites, features, or objects of cultural heritage significance.

The project entails the implementation of several experimental structures by the Department of Water and Sanitation to artificially recharge the underground water resources (existing extraction boreholes). During rainfall events, episodic drainage lines flow and even flood for short periods (weeks). The downhill flow can be fast, so water penetration is restricted. This experiment aims to slow the rundown of the water by installing shallow infiltration ponds or check dams, from where some of the runoff can be diverted *via* boreholes directly back into the underlying aquifer. It could greatly benefit the town of Calvinia (and many other communities in similar circumstances) if successful. It is considered a much better practice to store water underground than above ground in warm, arid regions (where evaporation rates are high).

The proposal is to install gabion walls (to slow down or check the water flow) within the watercourse and to install small intake structures within a small pond behind the gabion walls. Gabion walls are typically tightly packed rocks within a wire basket. These walls are not watertight but will slow down and back up the water behind the gabion wall. The infiltration pond will be excavated and fitted with an intake structure. The intake structure will consist of an excavated sand filter filled with porous stone and coarse sand with a borehole in the middle. In this proposal, the borehole is just a pipe with infiltration holes along its sides located within a sand filter (the intake structure). Water will accumulate behind the gabion wall, draining through the sand and rock filter into the borehole pipe and down to the underground aquifer, which should enhance the aquifers' recharge, resulting in a more sustainable groundwater supply. Pond 3 will be located on a rocky shale layer where a gabion wall will not find any purchase. Instead, a concrete retention wall will be constructed, anchored in the rock with steel dowels.

The terrain will determine the sizes of the four ponds but will be between 0,2-0,4ha in size (Pond 1 =  $\pm 0.26$  ha; Pond 2 =  $\pm 0.2$  ha; Pond 3 =  $\pm 0.33$  ha; Pond 4 =  $\pm 0.4$ ha). The size of the gabions will also vary depending on the terrain but will mostly be between 40-100 m (the concrete retention wall of Pond 3 is expected to be about 130 m long to encircle the flat rocky surface). The excavated sand filter will be 10 m long by 5 m wide and 1 m deep, located behind the gabion wall at the bottom of the pond.

Various location options within the Calvinia area have been investigated. However, due to landowner resistance, it was decided to start with four infiltration ponds within the Akkerendam Nature Reserve, which will link up with existing extraction boreholes. It is also close to the Karee Dam and the Calvinia Water Treatment Works. It is important to note that one of the main reasons for establishing the Akkerendam Nature Reserve was to protect the town's water resources.

## 4.1 Technical information

PROJECT DESCRIPTION		
Project name	Calvinia Aquifer Recharge Project	
Description	Proposed development of experimental aquifer recharge infrastructure in the Akkerendam Nature Reserve, Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape	
DEVELOPER		
Hantam Local Municipality		
Development type	Water Services - Storage	
PROPERTY DETAILS		
Province	Northern Cape	
District municipality	Namakwa District Municipality	
Local municipality	Hantam Local Municipality	
Topo-cadastral map	3119BD 1:50 000	
Farm name	Calvinia 805 Portion 0	
Closest town	Calvinia	
GPS Coordinates	31° 25'53.57S 19° 46'23.67E	
PROPERTY SIZE	15 198 ha	
DEVELOPMENT FOOTPRINT SIZE	2-3 ha	
LAND USE		
Previous	Nature Reserve	
Current	Nature Reserve	
Rezoning required	Yes	
Sub-division of land	Yes	
DEVELOPMENT CRITERIA IN TERMS OF SECTION 38(1) NHRA		YES/NO
Construction of a road, wall, power line, pipeline, canal or other linear forms of development or barrier exceeding 300 m in length.		Yes
Construction of bridge or similar structure exceeding 50 m in length.		No
Construction exceeding 5000m <sup>2</sup> .		No
Development involving three or more existing erven or subdivisions.		No
Development involving three or more erven or divisions that have been consolidated within the past five years.		No
Rezoning of site exceeding 10 000 m <sup>2</sup> .		No
Any other development category, public open space, squares, parks, recreation grounds.		Yes



Figure 1 The Calvinia Aquifer Recharge Development Layout

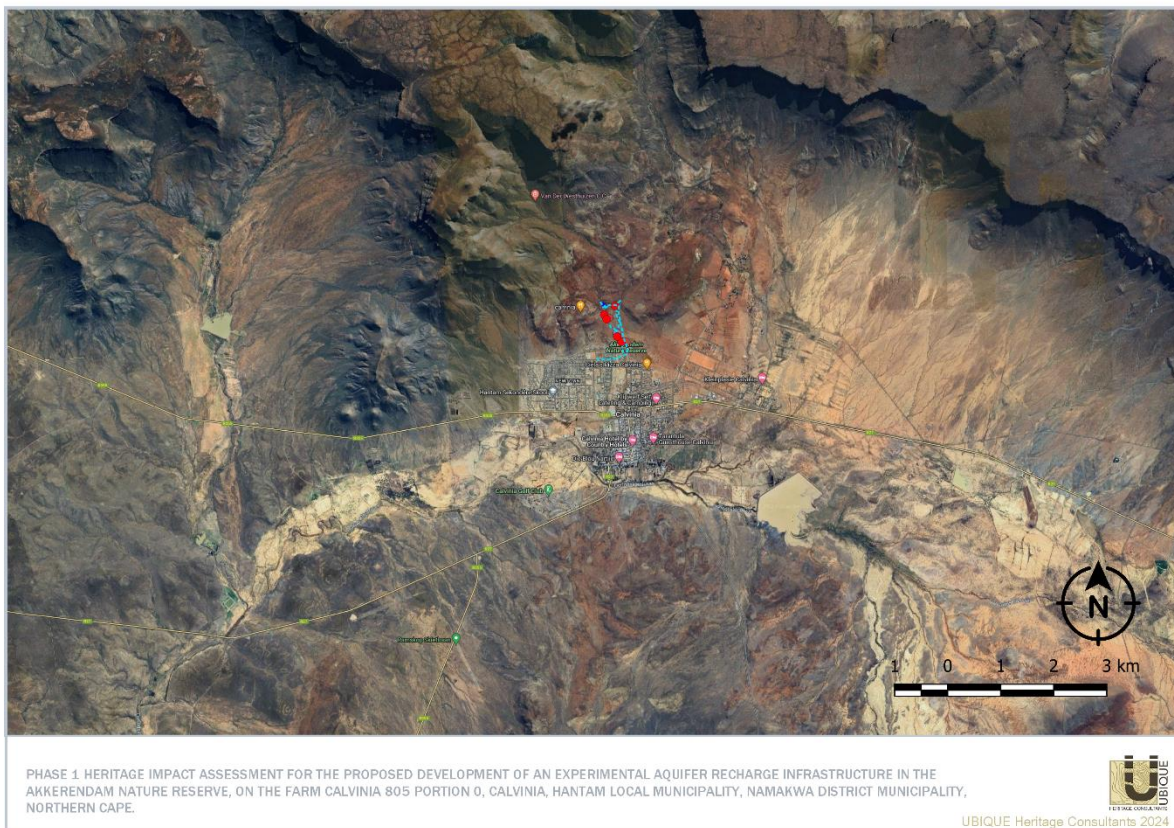


Figure 2 Regional locality of the development footprint, indicated on Google Earth Satellite imagery.

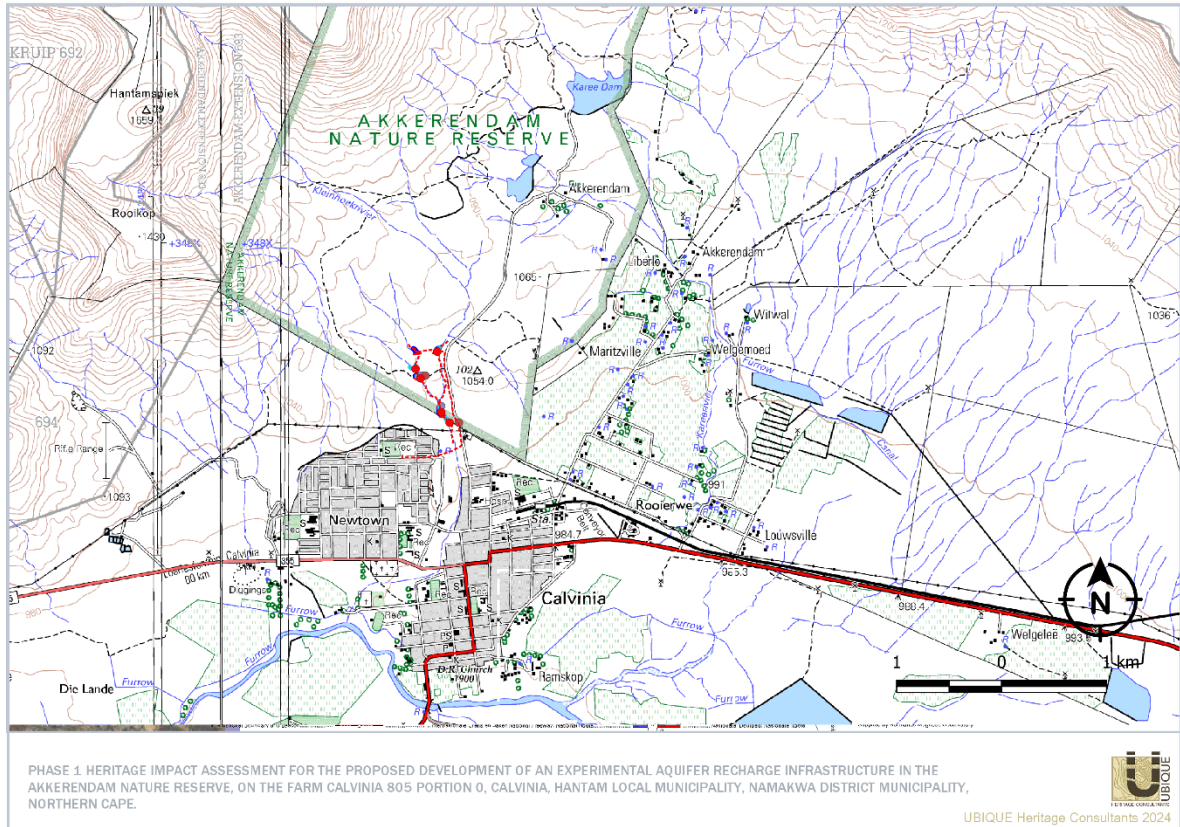


Figure 3 Locality of the development footprint, indicated on 1: 50 000 3119BD map.

## 5. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

### 5.1 Region: Northern Cape

South Africa has a long and varied history of human occupation (Deacon & Deacon 1999). This occupation dates to approximately 2mya (million years ago) (Mitchell 2002). Briefly, the archaeology of South Africa can be divided into three "major" periods: the Stone Age, the Iron Age and the Historical Period. In addition, various archaeological and historical sites have been identified and documented throughout South Africa, including the Northern Cape province.

#### 5.1.1 Stone Age

The history of the North West Province is reflected in a rich archaeological landscape with a wealth of pre-colonial archaeological sites. Numerous sites have been identified and documented across the region, dating to the earlier, middle, and later Stone Ages.

In South Africa, the Stone Age can be divided into three periods. It is, however, important to note that dates are relative and only provide a broad framework for interpretation. The division of the Stone Age, according to Lombard et al. (2012), is as follows:

Earlier Stone Age:	>2 000 000 - >200 000 years ago
Middle Stone Age:	<300 000 - >20 000 years ago
Later Stone Age:	<40 000 - until the historical period.

In short, the Stone Age refers to humans that mainly utilised stone as their technological marker. Each of the sub-divisions represents a group of industries where the assemblages share attributes or common traditions (Lombard et al. 2012). The ESA is characterised by flakes produced from pebbles, cobbles, percussive tools, and objects created later during this period, such as large hand axes, cleavers and other bifacial tools (Klein 2000). The MSA is associated with small flakes, blades and points. The aforementioned are commonly inferred to have been made and utilised for hunting activities and had numerous functions (Wurz 2013). Lastly, the LSA is characterised by microlithic stone tools, scrapers and flakes (Binneman 1995; Lombard et al. 2012). The LSA is also associated with rock art. Numerous LSA rock art sites, mainly in rock engravings and paintings, have been identified in the Northern Cape (Beaumont 2008; Kruger 2018; Morris 1988). These sites are commonly found on slopes, hilltops, rocky outcrops and occasionally in river beds (Kruger 2018). Banded ironstone occurs on several sites throughout the Northern Cape and appears to have been a favoured raw material for making stone tools due to its superior flaking qualities (Morris 2012). Prominent sites that exemplify these periods in the Nama-Karoo Biome are Rooidam and Bundu Farm (Earlier Stone Age and Middle Stone Age), and Biesje Poort 2, Bokvasmaak 3, Melkboom 1, Vlermuisgat, and Jagtpan 7 (Later Stone Age) (Lombard et al. 2012).



### 5.1.2 Iron Age

Archaeologically, the arrival of African farming communities from West Africa about 1700 years ago and their subsequent settlement, first in the northeastern parts and later in much of southern Africa, is known as the Iron Age (Huffman 2007). These farmers encountered Khoisan communities (Mitchell 2002). The archaeology of farming communities of southern Africa encompasses three phases. The Early Iron Age, dated 200 – 900 CE, represents the arrival of farmers in southern Africa. The Middle Iron Age (900 – 1300 CE) is best associated with the onset of state formation in the Limpopo Valley of South Africa. Finally, the Late Iron Age (1300 – 1840 CE) marked the arrival and spread of ancestral Nguni- and Sotho-Tswana communities into southern Africa and the development of state-level societies, such as Great Zimbabwe and Mutapa (Huffman 2007; Badenhorst 2010).

There is some controversy about the periods within the IA. Van der Ryst & Meyer (1999) have suggested that there are two phases within the IA, namely:

- Early Iron Age (EIA) 200 – 1000 A.D
- Late Iron Age (LIA) 1000 – 1850 A.D

However, Huffman (2007) suggests instead that there are three periods within the Iron Age, these periods are:

- Early Iron Age (EIA) 250 – 900 A.D
- Middle Iron Age (MIA) 900 – 1300 A.D
- Late Iron Age (LIA) 1300 – 1840 A.D

Thomas Huffman believes that the Middle Iron Age should be included within this period; his dates have been widely accepted in the IA field of archaeology.

The South African Iron Age is generally characterised by farming communities with domesticated animals, cultivated plants, manufactured and used ceramics and beads, and smelted iron for weapons and manufactured tools (Hall 1987). Iron Age people were often mixed farmers/agropastoralists. These agropastoralists generally lived in areas with sufficient water for domestic use and arable soil that could be cultivated with an iron hoe. Most Iron Age (IA) settlements built by agropastoralists were permanent settlements (with a few exceptions). They comprised houses, raised grain bins, storage pits and animal kraals/byres, contrasting with pastoralists' and hunter-gatherers' temporary camps (Huffman 2007). It is evident in the archaeological record that IA groups had migrated with their material culture (Huffman 2002).

Most IA groups in southern Africa preferred to occupy southern Africa's central and eastern parts from about 200 AD. The San and Khoi remained in the western and southern parts (Huffman 2007; Van Vollenhofen 2014); it is, thus, very rare, but not uncommon, to find IA sites in the Northern Cape. Nonetheless, IA sites have been recorded in the northeastern province. However, according to Kruger (2018), environmental factors ensured that the spread of IA farming westwards from the 17<sup>th</sup> century was constrained mainly to the areas east of the Langeberg Mountains.

### 5.1.3 Historical period

The Historical/Colonial period coincides with the incursion of white traders, hunters, explorers, and missionaries into the interior of South Africa over the last 500+ years. Buildings and structures associated with the early missionaries, travellers, and traders such as PJ Truter's and William Somerville (arriving in 1801), Donovan, Burchell and Campbell, James Read (arriving around 1870) William Sanderson, John Ryan and John Ludwig's (De Jong 2010; Snyman 2000) arrival during the 19<sup>th</sup> century, and the settlement of the first white farmers and towns, are still evident in the Northern Cape. During the colonial frontier period, place names started becoming fixed on maps and farm names, specifically in a cadastral sense.

The region has been the backdrop to various incidents of conflict. Numerous factors such as population growth, increasing pressure on natural resources, the emergence of power blocs' attempts to control trade, the emergence of the Griquas, and penetration of the Koranna and early white communities from the southwest resulted in instability in the Northern Cape. With the introduction of loan farms in the second half of the 18<sup>th</sup> century, an influx of newcomers such as trekboers, European game hunters and livestock thieves contributed to the region's volatility and sociocultural stress and transformation (Mlilo 2019). Furthermore, the Northern Cape was critical in the Anglo-Boer War (1899-1902), and significant battles took place within 120 km of Kimberley, including the battle of Magersfontein. Boer guerrilla forces roamed the entire Northern Cape region, and skirmishes between Boer and Brits were regular occurrences. Furthermore, many graves in the region tell the story of battles fought during the 1914 Rebellion (Hopkins 1978).

## 5.2 Local: Calvinia

The Calvinia district is part of the Great Karoo region of South Africa. Calvinia is the principal town of the Hantam Karoo. It lies at the crossroads of several towns scattered across the wide-open spaces of Bushmanland and the Tankwa, Roggeveld and Hantam Karoo. The town is south of the Hantam Mountains on the banks of the Oorlogskloof River. According to Webley (2014), the Hantam Mountains have not been subjected to archaeological research programs or surveys. Thus, there is little information on this area.

In short, Calvinia was established in the 1840s on the farm Hoogekraal. However, the town initially had a different name: Hantam. The name Hantam has its roots in the distant past with the Khoi/Khoekhoen people. It derives from the word "*hanami*", which means: "the mountain where the red bulbs grow" or "the hill where the red nutsedge grows" (Calvinia Information Pamphlet 1. 2020; K-SA 2019). The Khoi/Khoekhoen called this place Hantam/Heyntama due to the abundance of the plant *Pelargonium biflorum* (Amschwand 2019). With the arrival of Reverend N. J. Hofmeyr in 1851, the town's name was changed to Calvinia in honour of the Protestant theologian and reformer John Calvin.

The first colonists arrived in the area during the 1740s and 1750s. They consisted of hunters, traders and sheep farmers. The sheep farmers applied for grazing rights and later on loan farms.

The quitrent system (a tax or land tax imposed on occupants) was introduced in 1813 and eventually led to conflicts with the Khoi and the San since they could no longer roam around the countryside with their herds in search of the best grazing spots. They, in turn, became part of the system. In other words, many of them went to live and work on the farms as labourers, some of whom were allowed to keep their livestock (Calvinia Information Pamphlet 9. 2020).

On the 19<sup>th</sup> of January 1847, on the Farm Tygerhoek (approximately 5 km west of the present town of Calvinia), a meeting was held where it was decided to establish a parish of the Dutch Reformed Church (DRC). Later, in 1848, a portion of the farm Hoogekraal (Ramskop) was bought for 60,000 Gulden. Thus, the town of Hantam. Rev. Hofmeyr, the minister of the DRC, later requested permission from the church council to have the town (Hantam) renamed after John Calvin. His request was granted, and the new town's name was declared in the Government Gazette of the 30<sup>th</sup> of October 1851. The church council governed the town until 1892, after which an independent town management board eventually took over. Countless towns, such as Calvinia, were often established to build churches. Soon after the establishment of the churches, various traders, agriculturalists, artisans (e.g. carpenters and joiners) followed, and lawyers to sort out disputes and draw up contracts (Amschwand 2019). Calvinia was one of the leading centres for collecting and shipping feathers to Europe during the two ostrich-feather booms in 1865-1870 and 1900-1914. However, this industry collapsed at the start of the First World War (Amschwand 2019).

Abraham Esau's life and death significantly influenced the development of Calvinia's political and cultural identities and social relations. He was a patriotic coloured blacksmith loyal to the British. Esau, having gained some prosperity as a blacksmith in Calvinia, rose to become a leader of the coloured population in Calvinia (Van Der Walt 2013). The Anglo-Boer War (1899-1902) played a significant role in shaping South Africa's history. This war affected the lives of white, coloured and black South African populations (Van Der Walt 2013). During the Anglo-Boer War, Calvinia was attacked by raiding Boer Commandos. Abraham Esau had gathered a force of 70 locals to defend the town against the raiding Boer Commando. Through displaying an active devotion to Britain and defiantly asserting the restricted civic rights enjoyed by coloureds in the Cape Colony at the time, Esau earned the contempt of the Boers. Esau was captured and eventually executed by Stephanus Strydom, one of the Boer Commandos. It would appear that this was all in vain because a few days later, the British arrived and recaptured the town (Amschwand 2019; K-SA 2019).

The town gained municipal status in 1904. The town commonage was also bought from the DRC for £ 3,000 in 1914 (Calvinia Information Pamphlet 9. 2020). The railway linking Calvinia and Hutchinson arrived in 1917. This railway was the outlet for the district's agricultural products for many years and aided in the economic development of the town and district. However, it closed in 2001 (Amschwand 2019; K-SA 2019).

Additionally, a sizeable Jewish community made its home in Calvinia in the early twentieth century. This community made significant contributions to Calvinia's commercial development. In 1920, a Jewish Synagogue was constructed and opened in the town. However, the Jewish community

started to diminish over the years. The synagogue was closed and converted into the Museum of Calvinia (K-SA 2019).

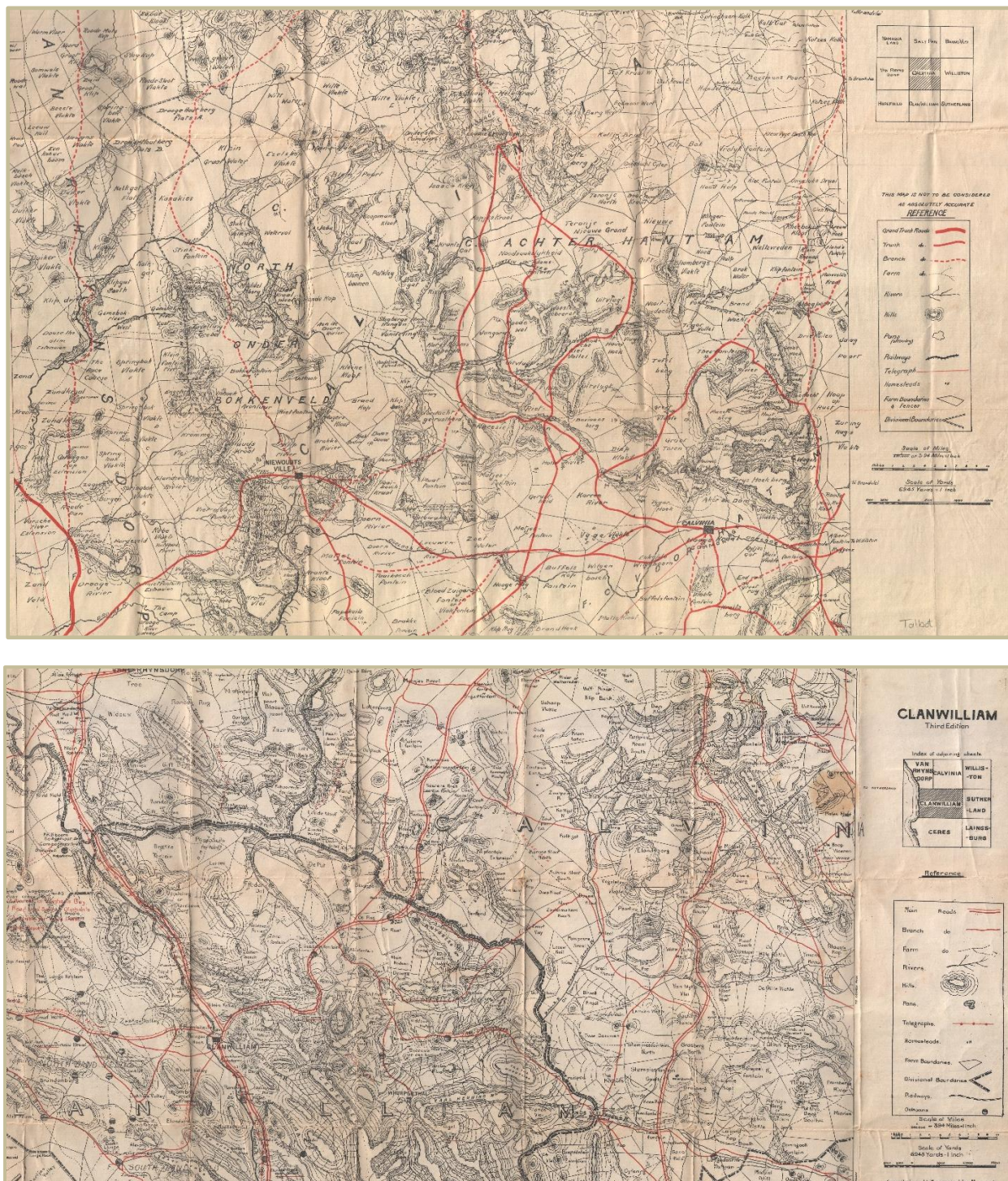


Figure 4 1899-1902 Imperial Map of Calvinia and surrounds, with the wagon routes indicated. Image from UCT digital collections, <https://digitalcollections.lib.uct.ac.za/islandora/object/islandora%3A24815/datastream/OBJ/view>

## 6. HERITAGE SENSITIVITY

### 6.1 Summary of Local Heritage Resources

The desktop study revealed that only a handful of HIA and AIA reports (e.g. Dreyer 2003; Fivaz & Engelbrecht 2020; Halkett & Hart 2011; Webley 2014; Webley & Halkett 2009a & b; Rossouw 2007) had been done in and around (within a 50 km radius) the town of Calvinia and the current development. To obtain the most comprehensive archaeology/heritage review of the landscape surrounding Calvinia, the scope for the desktop study was extended to include several reports near Nieuwoudtville, Loeriesfontein, and Williston (e.g. ACRM 2016; Dreyer 2007; Kaplan 2014; Morris 2007; 2013; Orton 2014a & b, 2017a & b; Rossouw 2017; Van Der Walt 2013; Van Schalkwyk 2011; Webley & Halkett 2012; Webley & Orton 2012). Additionally, since there have been reasonably few reports conducted in the area, the Heritage Screening tool (<https://screening.environment.gov.za/>) was used to complement the assessment of the study area's heritage sensitivity.

#### 6.1.1 Stone Age

Very few scatters of stone implements have been recorded in and around Calvinia. The lithics that have been recorded have been attributed to the MSA and LSA. Most of the reports, in general, revealed that the scatters of stone implements are very widely distributed and do not generally appear to be concentrated in any specific locations. These scatters of stone implements are of low significance.

During the survey for the AIA for the proposed expansion of Borrow Pit BR R27.8 M 32.6 RHS 6.2, on Portion 1 of the Farm Bloedzeuigerfontein Noord 782 (Merino), Calvinia, Webley (2014) recorded several stone artefacts such as flakes and cores of quartzite and silcrete flake as well as a single Upper Grindstone. Webley (2014) notes that the artefacts are very widely distributed across the old lands at the base of the hill, and thus, theorises that they may have been uncovered by ploughing or by the shallow ditch which runs at right angles across the property and is probably related to farming activities. A single dolerite core was recorded at Quarry #6 during the Phase 1 AIA and PIA of 30 gravel quarries on the R354 between Sutherland and Calvinia by Rossouw (2007). Rossouw (2007) believes that this core was most likely out of context, as it was uncapped and isolated. Webley and Orton (2012) found very few stone tools (e.g. quartz flakes between Shepherd's Rock and Nathan's site) during their survey in the Oorlogskloof Nature Reserve (the nature reserve is situated  $\pm 40$ km southwest - as the crow flies - from the current study).

No archaeological resources were recorded or encountered during the field assessment for the construction of sports and field irrigation and facilities infrastructure in Calvinia (ACRM 2020). Webley and Halkett (2009a & b) found no significant archaeological material during the two small surveys that were conducted in the Calvinia District. Dreyer (2003) found no indication of archaeological material during his survey for the proposed development at Calvinia. Halkett and

Hart (2011) did not find any significant archaeological remains/material during their survey for the proposed strengthening of National Route 27 sections 7 & 8 between the Western/Northern Cape border and Calvinia.

However, archaeological material and occurrences have been recorded around Nieuwoudtville, Loeriesfontein, and Williston. For example, several ostrich eggshell (OES) fragments were recorded by Van Der Walt (2013) during his survey on the Farm Dikpens 182 situated in the District of Calvinia ( $\pm 145$ km north/northwest of the town of Calvinia). Orton (2017a & b) found several MSA/LSA scatters, an isolated lower grindstone as well as OES fragments and a potsherd during his surveys for the proposed Kokerboom 1 and 2 wind energy facility on the Farms 215/REM, 1164/REM, 227/REM and 1163/REM. Several LSA artefacts and OES beads have been reported near Nieuwoudtville (Orton 2014b). According to Orton (2014b), the vicinity of the Doring River and Cederberg Mountains has an abundance of archaeological sites. Two light scatters of artefacts (one was a mixed occurrence with occasional ESA and MSA artefacts amongst a scattering of LSA material) were recorded along the R27 between Nieuwoudtville and Calvinia by Halkett and Hart (Orton 2014b). One broken LSA silcrete flake of low significance was recorded during a study undertaken by ACRM (2016) for the proposed cultivation of Rooibos Tea on Farm 951 Zonderwaterkraal, near Nieuwoudtville. Orton (2014b) recorded several scatters of MSA stone artefacts on the surface while surveying the site for the proposed new structure at Hantam National Botanical Garden, Nieuwoudtville. They were low in density and were considered to be background scattered with no significance (Orton 2014b).

Rossouw (2017) did a pedestrian survey for a Phase 1 AIA of a proposed new 10-ha residential development in Williston and found two highly weathered hornfel stone flakes. They were recorded as isolated surface scatters. Additionally, sparsely-scattered, highly-patinated MSA/LSA flakes were found at BP6 during the first phase of archaeological and cultural heritage assessment of the proposed borrow pit sites along the R63 road between Carnarvon & Williston approximately 193km northeast of Calvinia (as the crow flies) (Dreyer 2007).

Interestingly, in the Loeriesfontein Museum, a collection of OES water containers, bored stones and soapstone pipes are on display (Kaplan 2014). Kaplan (2010) encountered several scatters of MSA and LSA artefacts in Loeriesfontein, approximately 66km (as the crow flies) northwest of Calvinia, during an AIA for a proposed low-cost housing project on the southwestern edge of the town (Kaplan 2014). He recorded several MSA and LSA implements during Kaplan's (2014) surveys for the proposed pipeline route on the farms Rheebofsfontein, De Brak and Hoek van Berg. These include MSA flakes in indurated shale, a weathered ironstone MSA flake, one snapped LSA indurated shale flake, several large, flat, utilised/retouched pieces and a sizeable flat-convex scraper in indurated shale. He also recorded a worked-out disc core in indurated shale, a large, flat, edge-nicked banded ironstone chunk and a large, weathered, indurated shale core (Kaplan 2014).

He also found one weathered indurated shale MSA flake alongside an eroded donga at the base of a steep hill near the Loeriesfontein reservoir. He encountered several weathered indurated shale MSA flakes, including two broken/snapped LSA flakes/blades alongside the R355 in the open veld

(Kaplan 2014). According to Kaplan (2014), traces of MSA material were recorded during an HIA for a proposed solar energy plant at the Naronsies farm north of Loeriesfontein by Van der Walt (2010).

Moreover, random scatters of weathered MSA artefacts were recorded across the landscape in the western part of Bushmanland for the HIA of the proposed solar energy farm north of Loeriesfontein (Webley & Halkett 2012). Webley and Halkett (2012) also identified several LSA sites on low koppies and near the river. These sites exhibit a pattern of formal stone artefacts and raw material, as well as pottery and OES, which have not been recorded in combination in Western Bushmanland before (Webley & Halkett 2012). Webley and Halkett (2012) posit that these sites have the potential to inform us about a regional pattern of LSA settlements, and the sites are, therefore, considered to be of medium to high significance. During this study, they also found LSA lithics and portable grooved stones on the banks of a small stream (Webley & Halkett 2012). During an HIA for a proposed power line for the Loeriesfontein 2 Wind Energy Facility about 50kms north of the town, ephemeral scatters of highly weathered MSA objects and scatters of LSA material were encountered (Orton 2014a). Van Schalkwyk (2011) also encountered open sites with surface scatters of MSA and LSA material on hilltops during an HIA for a proposed wind energy farm north of Loeriesfontein. Morris (2007) recorded several small MSA artefacts near a rocky knoll (hill) during his survey for the upgrading of the railway infrastructure on the Sishen-Saldanha Ore line in the vicinity of the new Loop 7a near Loeriesfontein. In the same study, he encountered sparse MSA artefacts on a hill feature near km 318 and by an existing borrow pit at km 322 (adjacent to the Brakfontein road bridge) (Morris 2007). During an assessment of powerline options, access roads and substation sites for the Khobab wind energy facility farm, Morris (2013) encountered very sparse scatters of Stone Age artefacts.

Fivaz & Engelbrecht (2020) reported only one isolated small MSA quartzite core found adjacent to the R355 on Farm No. 114, south of Calvinia. The lithic material shows various degrees of weathering and is without substantial archaeological context or matrix; therefore, it is deemed of minor scientific importance and not conservation-worthy (NCW).

### 6.1.2 Rock Art

Research and surveys undertaken in and around the Oorlogskloof Nature Reserve have revealed that rock art (specifically San and Khoehoen art) is quite common (ACRM 2016; Orton 2013; Webley & Orton 2012). However, the associated archaeological remains appear to be more ephemeral (Orton 2014b). Several rock art sites have been recorded around Calvinia (Nightjar Travel 2017). These include, but are not limited to, Papkuilsfontein ( $\pm 57$ km as the crow flies from Calvinia); Traveller's Rest ( $\pm 94$ km as the crow flies from Calvinia); Bushman's Kloof Wilderness Reserve (approx. 95km as the crow flies from Calvinia); Gifberg ( $\pm 101$ km as the crow flies from Calvinia). There are also reports of numerous rock shelters containing rock art in the Koebee River valley, about 40km south of Oorlogskloof (ACRM 2016).

### 6.1.3 Iron Age

No HIA/AIA reports recorded IA artefacts/structures near the study area.

### 6.1.4 Historical/Colonial period

Very few AIA/HIAs reported archaeological/cultural material or buildings relating to the colonial period in and around Calvinia. For example, during the survey for the proposed construction of a new cemetery at Calvinia, Webley and Halkett (2009) found few scatters of very recent 20<sup>th</sup>-century glass, tin and ceramics. They note that the material they found confirms that the area they surveyed was an informal rubbish dump. They found no structures or evidence of previous burials (Webley & Halkett 2009). As mentioned earlier, Halkett and Hart (2011) found no significant archaeological remains/material during their survey for the proposed strengthening of National Route 27 sections 7 & 8. They did, however, note the Oorlogskloof River Bridge, which is more than 60 years of age and is thus protected by the NHRA.

During an HIA for a proposed power line for the Loeriesfontein 2 Wind Energy Facility, Orton (2014a) recorded two farmsteads (one with a graveyard) and noted they are significant resources. He also found a stone kraal, some reservoirs and wind pumps. During Orton's (2014b) survey for the proposed new structure at Hantam National Botanical Garden, Nieuwoudtville, Orton (2014b) noted four structures on the site that are older than 60 years of age and protected under the NHRA. Three of these structures, he states, have heritage significance due to their construction style and materials that are strongly associated with the Nieuwoudtville area and are uncommon. The fourth structure is a corrugated shed (Orton 2014b). During Kaplan's (2014) survey for an HIA for the proposed Loeriesfontein bulk water supply pipeline and reservoir, he found the ruins of a small stone structure (either a shepherd's hut or stock pen) alongside the proposed pipeline route overlooking the gravel road on the Farm Rheebofsfontein and a few pieces of late 19<sup>th</sup>-/early 20<sup>th</sup> - century English transferware (Kaplan 2014). Kaplan (2014) also noted several old, dry-packed stone stock enclosures/kraals, farm buildings, and farm labourers' cottages in the general area of the proposed pipeline route (Kaplan 2014). Orton (2017a) recorded a few historical finds (e.g. earthenware plate fragments on a hilltop, two small medicine bottles, rusted end of a metal fuel canister, a .577/45 Martini-Henry cartridge case inscribed with 'GK', and an incomplete 'B' on its headstamp) during his survey.

Webley and Halkett (2012) surveyed the proposed solar energy farm on the Farm Klein Rooiberg and recorded some historical archaeological material (material associated with European contact) such as fragments of ceramics with spongeware decoration, several metal lids, wire, tins (some with wire handles), fencing posts and white bottle glass. The majority of the material they encountered was found on river banks. Webley and Hallett (2012) thus suggested that it is possible that during the early 20<sup>th</sup> century, the river may have formed a focus for seasonal settlement by agricultural workers. During the same study, they encountered an old enamel bowl, a tin, a wire hook and two rusted sardine cans associated with a single semi-circular structure (a stock pen/post) in the area north of Loeriesfontein (Webley & Halkett 2012).



Webley and Orton (2012) encountered an old rusted plough at Doltuin and found circular lower grindstones on three different instances during the survey for the proposed construction of chalets and associated infrastructure on existing campsites in the Oorlogskloof Nature Reserve. They also recorded rectangular and circular structures of varying sizes. There was no associated historical material, and thus, these structures could not be dated accurately; however, according to the Reserve Manager, these settlements date to the 1930s (Webley & Orton 2012).

Fivaz & Engelbrecht (2020) recorded twelve historical features and material occurrences on the Farm Aurets Kloof No. 854, south of Calvinia. The recorded finds consist of features associated with a historical farm and probable outspan area. These include homestead structural remains, outbuildings, and livestock kraals constructed from stone and clay. Three substantial middens were documented, but there are smaller middens and concentrated ashy deposits and surface scatters throughout the area. The documented surface material included post-1880s European porcelain, Refined Industrial Ware, historic thick-walled black glass sherds, and embossed bottle fragments. Metal artefacts included remnants of farm implements, such as wheels, blades and foodstuff tins. An interview with the current fourth-generation landowner, Mr Viviers, confirmed the area as the earliest settlement location of his forebears. A perennial spring and the old wagon branch road between the main Calvinia-Ceres and Calvinia-Sutherland roads run through the site, making it the ideal location for settlement and outspan. Areas of the wagon route have been packed with stones and compacted with soil. The road is currently still in use. Fivaz & Engelbrecht determined that the sites are part of a larger site with local significance. The historical farmscape identified is considered a typical 19<sup>th</sup>-century colonial farm-type site with medium to high significance.

Four old National Monuments, now Provincial Heritage sites, are associated with Calvinia and have been documented on the SAHRA database.

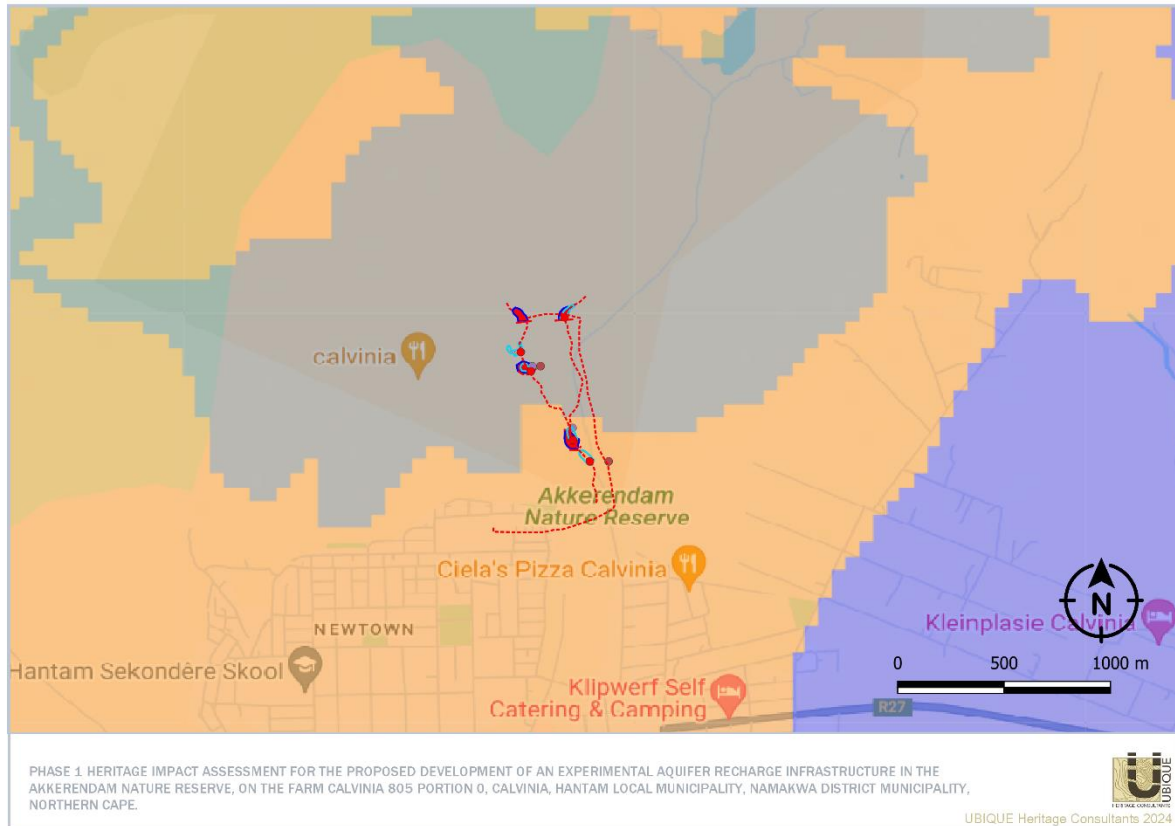
### 6.1.5 Graves/Burials

Three known cemeteries have been recorded in the Calvinia district. Very few HIA and AIAs reported Graves/Burials. During his study, Orton (2014a) encountered a small graveyard (also reported by Van Schalkwyk 2011). The landowner reported that the named grave belonged to his grandfather's brother (Orton 2014a). Additionally, Orton (2014a) encountered a small cairn; although its function is unknown, he does not believe it is a grave.

Similarly, a stone cairn made of round dolerite cobbles (no such cobbles naturally occur in the immediate area) was recorded during the assessment for the proposed Kokerboom 2 wind energy facility (Orton 2017). Orton (2017) comments that its location would suggest that it is unlikely to be a grave. Webley and Halkett (2012) noted a few cairns on the top of low koppies during their study of the proposed Loeriesfontein PV solar power plant on portion 5 of the farm Klein Rooiberg 227; they, however, believe that these may be elevation markers. Two graves were encountered during Webley and Orton's (2012) assessment for constructing chalets in the Oorlogskloof Nature Reserve. Most of the graveyards in the Reserve have been recorded by the Reserve Manager.

Three graves were found on the Farm Aurets Kloof No. 854, south of Calvinia (Fivaz & Engelbrecht 2020). The graves are marked with stone cairns and uninscribed headstones. A rectangular stone enclosure demarcates the extent of the graves.

### 6.1.6 Palaeontological sensitivity



**Figure 5** The Heritage Paleo screening tool and SAHRIS PalaeoSensitivity Map, indicating Low (blue), and High (orange), palaeontological significance in the study area (<https://screening.environment.gov.za/>; <https://sahris.sahra.org.za/map/palaeo>).

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas. The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and northeast, with coal seams also being present in the northeast (Fourie 2024).

Ecca rocks are stable and lend themselves well to development. It is only unstable in or directly above mining activities (Snyman 1996). Dolerite dykes occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on groundwater flow and mass transport. The Vryheid Formation sediments may attain a thickness of 120 – 140 m. A typical profile includes soil and clay, sandstone and siltstone, shale, two upper seams, shale, two seams, sandstone, one seam, shale and dolomite at the bottom. The typical

colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The grey shale's thickness can vary, interlayered with the variable yellow sandstone and coal seams (Fourie 2024).

The Tierberg Formation conformably overlies the Collingham Formation in the south and the Whitehill Formation in the north and is overlain by the Waterford Formation. The age of this formation is probably the earliest Middle Permian. A maximum thickness of 1 252 m has been recorded. It occurs north of Matjiesfontein northwards to the Calvinia-Brandvlei area, and from there eastwards to the Britstown area and then northeast-wards, passing northwest of Bloemfontein, to Hertzogville (Fourie 2024).

## 6.2 Site Verification

The site sensitivity verification was completed through a desktop analysis, satellite imagery and literature research, and cursory on-site inspection. The project footprint falls within a South African Protected Area, the Akkerendam Nature Reserve, the second oldest proclaimed municipal nature reserve in the Northern Cape (1967).

The DFFE Screening Tool (<https://screening.environment.gov.za/>) shows a Low Archaeological and Cultural Theme Sensitivity surrounding the proposed development with high sensitivity directly toward the south of the proposed project area (Figure 6). Even though few HIAs/AIAs have been conducted in the area, desktop research confirms the Low and High sensitivity locations shown on the DFFE Screening Tool. Most heritage sites recorded by HIA/AIA reports lie south of the development footprint, around the Calvinia townscape and specifically in the proximity of the Oorlogskloof River. Furthermore, the development footprints are small (<5 ha) and lie within watercourses and drainage lines (Botes 2023). Therefore, a new, intensive HIA site survey was deemed unnecessary.

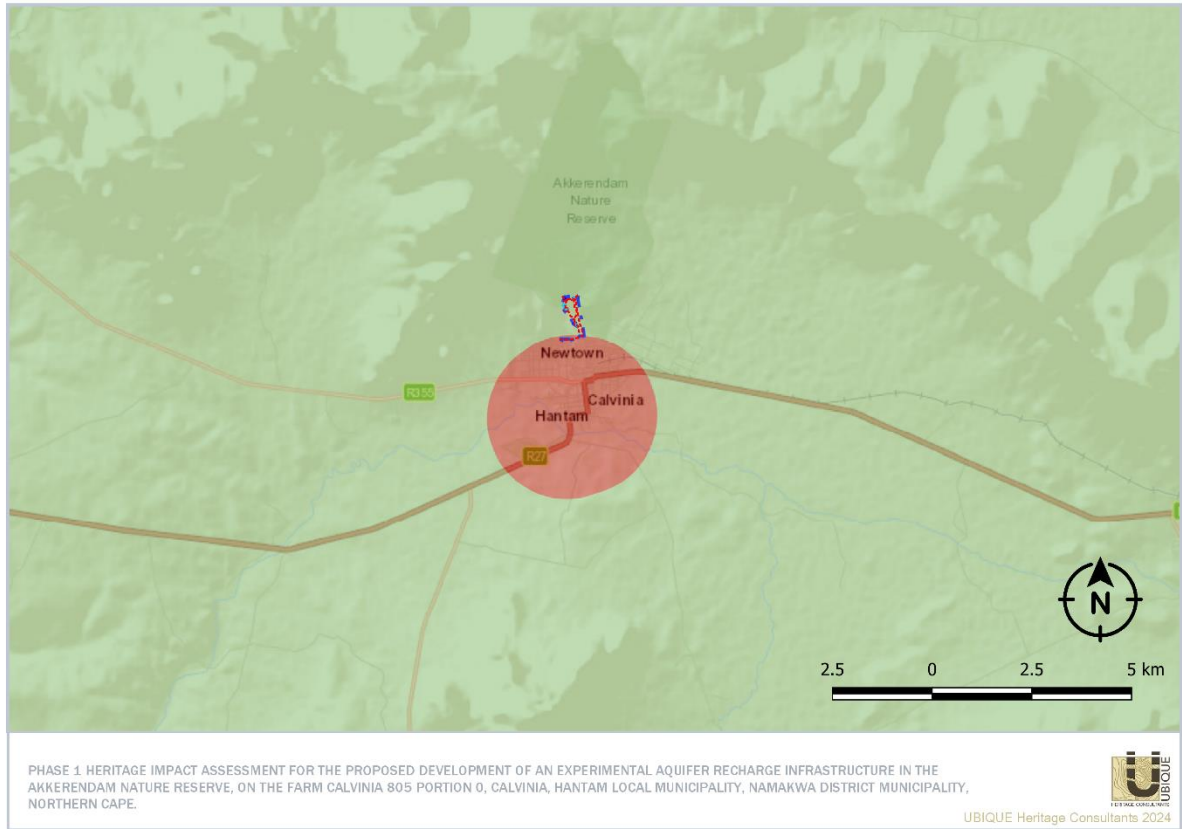
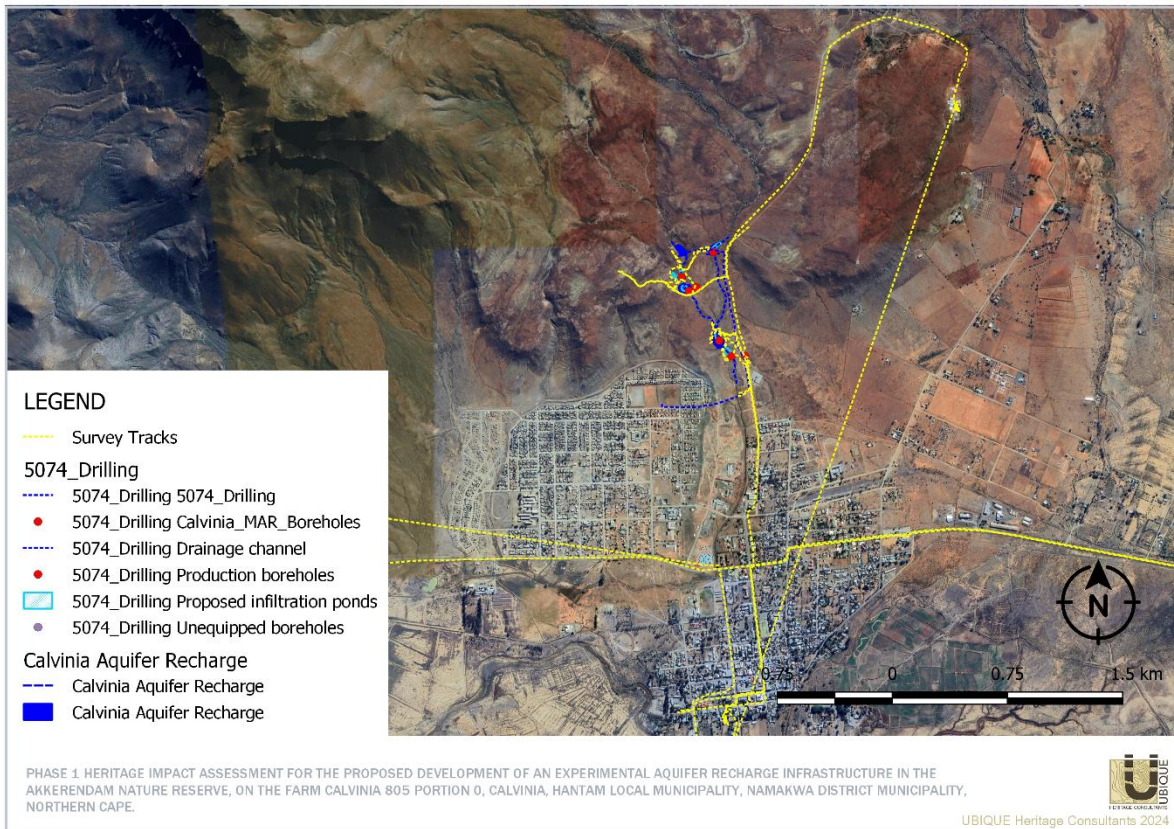


Figure 6 The Project area indicated on the Heritage Screening tool (<https://screening.environment.gov.za/>)

## 7. IDENTIFIED RESOURCES AND HERITAGE ASSESSMENT

### 7.1 Surveyed area

The areas surveyed for the impact assessment were dictated by the Google Earth map of the development footprints provided by the client. The proposed development areas were surveyed by vehicle and on foot. The areas were preliminary inspected as part of the Calvinia Bulk Water project.



**Figure 7** Survey tracks across the development footprint.

### 7.2 Description of the affected environment

The development area mainly falls within the Bokkeveld Sandstone Fynbos area, with intermittent crossover into Hantam Plateau Dolerite Renosterveld and Hantam Karoo vegetation areas (SANBI 2020). The landscape is characterised by typical Fynbos shrubland, whose diversity depends on soil depth and moisture differences. Large areas of weathered rock and rocky pavements support dwarf succulents, shrubs, lichens and mosses. At the same time, annuals and bulbs are particularly common in more open areas where Graminoids (and grasses), proteoids and shrubby Asteraceae are often dominant (Mucina & Rutherford 2006).

The terrain in the study areas consists of flat stone pavements combined with sandy plains, surrounded by slopes and the Hantam Mountains. There are predominantly shale, hornfels and granite visible on the surface, with dolomite outcrops in certain areas.



**Figure 8** Views of the affected development area

## 7.3 Identified heritage resources

### 7.3.1 Stone Age Identified

**No cultural material, features or structures attributed to the Stone Age period were recorded within the development footprint.**

### 7.3.2 Iron Age Identified

**No cultural material, features or structures attributed to the Iron Age period were recorded within the development footprint.**

### 7.3.3 Historical/Colonial Period Identified

**No cultural material, features or structures attributed to the Historical/Colonial period were recorded within the development footprint.**

### 7.3.4 Graves/Burials

**No graves or burials were recorded within the development footprint.**

## 7.4 Discussion

### 7.4.1 Archaeological features

A cursory survey of the area as part of the proposed Calvinia Bulk Water project found no archaeological features of historical or cultural significance. Even though the site inspection was superficial, the development footprints lie within seasonal water courses and drainage lines (Botes 2023). The continuous seasonal water flow means that any recorded cultural material within the footprints would have been alluvial deposits with unknown provenance. Therefore, no in-situ heritage resources of any significance are expected to be impacted by the development.

### 7.4.2 Palaeontological resources

Palaeontologist, Dr Heidi Fourie, conducted a palaeontological desktop assessment for the Calvinia Aquifer Recharge project. She determined that the project locality is underlain by the Tierberg Formation, which conformably overlies the Collingham Formation in the south and the Whitehill Formation in the north and is overlain by the Waterford Formation. The age of this formation is probably the earliest Middle Permian. A maximum thickness of 1 252 m has been recorded. It occurs north of Matjiesfontein northwards to the Calvinia-Brandvlei area, and from

there eastwards to the Britstown area and then northeast-wards, passing northwest of Bloemfontein, to Hertzogville (Fourie 2024).

*Palaeontology* – Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of strata the palaeontological sensitivity can generally be **VERY LOW** to **VERY HIGH**, and here locally in the development area **MODERATE** for the Vryheid Formation (SG 2.2 SAHRA APMHOB, 2012).

Disarticulated microvertebrate remains, sponge spicules, vascular plants and trace fossils are present in the Tierberg Formation (Groenewald and Groenewald 2014). Rare bone fragments and disarticulated fish, wood, arthropod tracks and fish trails can also be present (Fourie 2024).



# 8. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

## 8.1 Impact Assessment Tables

### ARCHAEOLOGICAL, HISTORICAL, & CULTURAL

SITE(S): No archaeological, historical, or cultural sites were identified

DEVELOPMENT PHASE	DEVELOPMENT IMPACT		IMPACT RATING		RECOMMENDED MITIGATION	IS IMPACT ACCEPTABLE?
			BEFORE MITIGATION	AFTER MITIGATION		
PLANNING PHASE	Nature	Positive	Positive low impact	Positive low impact	NONE	YES
	Extent	1				
	Probability	1				
	Reversibility	1				
	Irreplaceability	1				
	Duration	1				
	Cumulative Effect	1				
	Magnitude	1				
	Impact Significance	6				
CONSTRUCTION PHASE	Nature	Negative	Negative low impact	Positive low impact	If the development uncovers archaeological material, mitigation through assessment and collection is possible.	YES
	Extent	1				
	Probability	1				
	Reversibility	1				
	Irreplaceability	1				
	Duration	2				
	Cumulative Effect	1				
	Magnitude	1				
	Impact Significance	7				
OPERATIONAL PHASE	Nature	Positive	Positive low impact	Positive low impact	NONE	YES
	Extent	1				
	Probability	1				
	Reversibility	1				
	Irreplaceability	1				
	Duration	1				
	Cumulative Effect	1				
	Magnitude	1				
	Impact Significance	6				
DECOMMISSIONING PHASE	Nature	Positive	Positive low impact	Positive low impact	NONE	YES
	Extent	1				
	Probability	1				
	Reversibility	1				
	Irreplaceability	1				
	Duration	1				
	Cumulative Effect	1				
	Magnitude	1				
	Impact Significance	6				

No cultural/archaeological resources were identified. Based on the survey results, the direct impact on heritage resources will be Positive Low. However unlikely, subsurface archaeological material may be discovered during the construction phase. In the improbable instance that archaeological material is discovered during the project's construction phase, it will negatively impact heritage resources. In this case, mitigation is recommended to negate the impact.

PALAEOLOGICAL						
SITE(S): No archaeological, historical, or cultural sites were identified						
DEVELOPMENT PHASE	DEVELOPMENT IMPACT		IMPACT RATING		RECOMMENDED MITIGATION	IS IMPACT ACCEPTABLE?
			BEFORE MITIGATION	AFTER MITIGATION		
CONSTRUCTION PHASE	Nature	Negative	Negative medium impact	Negative low impact	If the development uncovers archaeological material, mitigation through assessment and collection is possible.	YES
	Extent	2				
	Probability	3				
	Duration	5				
	Magnitude	8				
Impact Significance	45					

Regarding the impact on palaeontological resources, The development footprint is situated on a geological layer with a **MODERATE** palaeontological sensitivity. The nature of the impact is the destruction of Fossil Heritage. Loss of fossil heritage will have a negative impact. The extent of the impact only extends to the region of the development activity footprint and may include transport routes (2). The impact's expected duration (5) is assessed as potentially permanent. The impact's intensity/magnitude (8) is moderate, as it may continue in a modified way. The probability (3) of the impact occurring is probable.

Mitigation procedures (should fossil material be present within the affected area) may be necessary if fossils are found. The loss of resources occurs, but natural cultural and social processes continue, albeit in a modified manner. The cumulative impact is low. Impacts on palaeontological heritage during the construction and preconstruction phase may potentially occur.

## 8.2 Cumulative Impact

The NEMA EIA Regulations of 2014 (GNR 326, 2017) determines under Appendix 3 (section 3(j)(i)) that the Environmental Impact Report to be prepared by the EAP must include an assessment of each identified potentially significant impact and risks, including cumulative impacts. The NEMA EIA Regulations interprets cumulative impacts as *'determine the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities*

*associated with that activity, that in itself may not be significant, but may become significant when added to the existing and reasonably foreseeable impacts eventuating from similar or diverse activities.'*

The term "Cumulative Effect" has, for the purpose of this report, been defined as the summation of effects over time which can be attributed to the operation of the project itself and the overall effects on the heritage significance of the site and within a 30 km radius, that can be attributed to the project and other existing and planned future projects.

The desktop research shows heritage resources are sparsely distributed in the broader landscape, with highly significant (Grade 1) sites being rare. The historical and cultural significance of the area is centred around the town of Calvinia. The Calvinia aquifer recharge project is experimental, and its impact cannot be compared to similar projects within the broader landscape. However, even if similar projects are launched within the broader landscape, the small footprint and nature of the project (located within watercourses and drainage lines) mean the cumulative impact of the development on heritage is localised and should be low.

## 9. RECOMMENDATIONS

Based on the assessment of the potential impact of the development on the identified heritage, the following recommendations are made, taking into consideration any existing or potential sustainable social and economic benefits:

1. No significant heritage sites or features were identified within the surveyed area of the proposed development footprint. Based on the survey results, there will not be any impact on heritage resources. **Therefore, from a heritage point of view, we recommend that the proposed development continue.**
  
2. Regarding the palaeontological resources:
  - The potential impact of the development on fossil heritage is **MODERATE**; therefore, a field survey is not necessary for this development (according to SAHRA protocol). A Phase 1 Palaeontological Impact Assessment Field Study is required if fossils are found during the development. The protocol for Chance Find is attached.
  - Mitigation will be needed if fossils are found during the development.
  - No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formations present and their fossils and follow protocol.
  - The development may go ahead with caution due to the presence of the Tierberg Formation shale.
  - The ECO must survey for fossils before and or after clearing, blasting, drilling or excavating.
  - The EMPr will cover the conservation of heritage and palaeontological material that may be exposed during development activities. For a chance fossil find, the protocol is to cease all activities immediately, construct a 30 m no-go barrier, and contact SAHRA for further investigation.
  
3. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit must be alerted immediately as per section 36(6) of the NHRA. Depending on the nature of the finds, a professional archaeologist or palaeontologist must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources are of archaeological or palaeontological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred due to such oversights.

## 10. CONCLUSION

This HIA has identified no significant archaeological heritage resources that development will negatively impact. Therefore, the proposed experimental aquifer recharge infrastructure in the Akkerendam Nature Reserve, Calvinia, Hantam Local Municipality, Namakwa District Municipality, Northern Cape, may continue from a heritage point of view, provided the subsequent decision by SARHA agrees.

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## INFORMATION PAMPHLETS

Calvinia Information Pamphlet 1. (Obtained November 2020).

Calvinia Information Pamphlet 9. (Obtained November 2020).

# APPENDIX A

PALAEONTOLOGICAL DESKTOP IMPACT ASSESSMENT: CALVINIA AQUIFER RECHARGE PROJECT HANTAM LOCAL MUNICIPALITY, NAMA-KWA DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE.

Calvinia Aquifer Recharge Project

Hantam Local Municipality, Namakwa District Municipality, Northern Cape Province.

Farm: Akkerendam Nature Reserve, Portion 0 Calvinia 805

Fourie, H. Dr

***Palaeontological Impact Assessment: Desktop Study***

UBIQUE Heritage Consultants

8814 Ashkam,

Noord Kaap

Tel: 082 845 6276

2024/01/15

Ref: Pending

***Plant fossil - Example***



## B. Executive summary

Outline of the development project: UBIQUE Heritage Consultants appointed Dr H. Fourie, a palaeontologist, to undertake a Palaeontological Impact Assessment (PIA), Desktop Study of the suitability of the proposed Calvinia Aquifer Recharge Project in the Hantam Local Municipality, Namakwa District Municipality, Northern Cape Province on Farm: Akkerendam Nature Reserve, Portion 0 Calvinia 805.

The applicant, Department of Water and Sanitation, wishes to implement several experimental structures to recharge the underground water resources artificially.

The Project includes one locality Option (see Figure 1):

Option 1: Polygonal areas indicated in red and shades of blue north of the R27 Road between Nieuwoudtville and Brandvlei in the Akkerendam Nature Reserve. The town of The approximate size of the site is 3 hectares.

### Legal requirements:-

The **National Heritage Resources Act (Act No. 25 of 1999) (NHRA)** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological 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.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

“palaeontological” 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 traces.

For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of **LOW** to **VERY 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 area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999):

(i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.

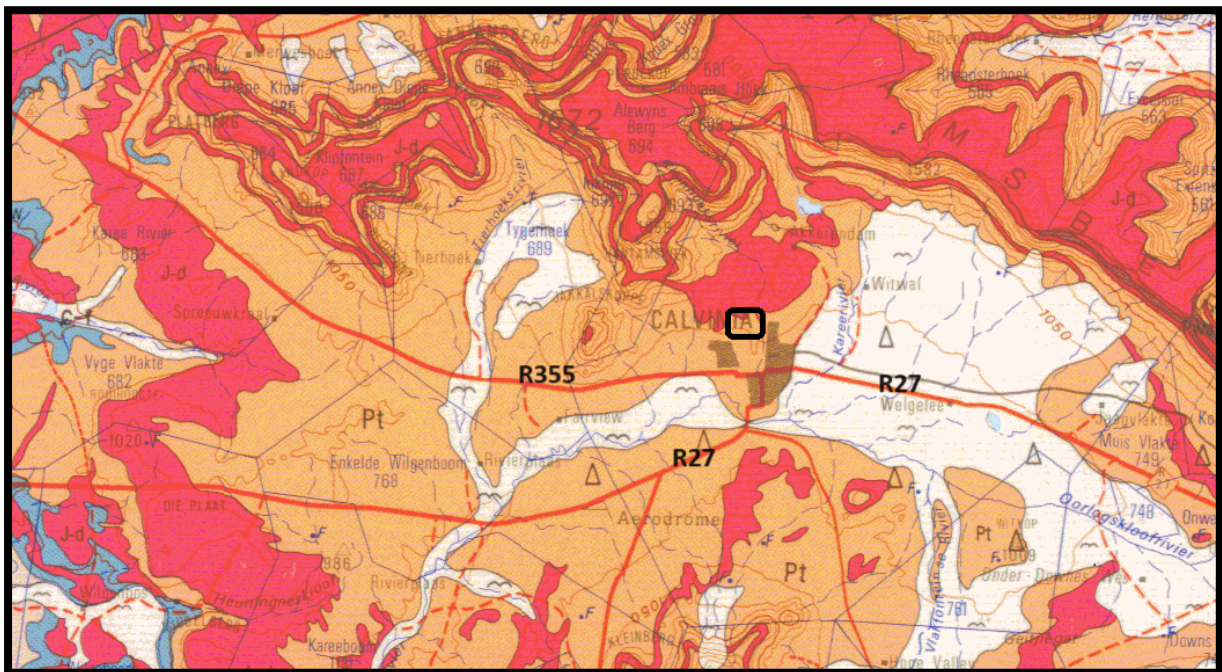
This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999).

Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site (see Section 38); (d) the re-zoning of a site exceeding 10 000 m<sup>2</sup> (1 ha) in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.

This report (Appendix 6, 1c) aims to provide comment and recommendations on the potential impacts that the proposed development could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary.

Outline of the geology and the palaeontology:

The geology was obtained from map 1:100 000, Geology of the Republic of South Africa (Visser 1984) and 3118 Calvinia (De Beer 2001) 1:250 000 geological map.



**Figure:** The geology of the development area.

*Legend to Figure and short explanation.*

J-d – Dolerite (pink). Jurassic.

Pt – Brown to grey shale, siltstone, sandstone (brown). Tierberg Formation, Ecca Group, Karoo Supergroup. Permian.

..... – (black) Lineament (Possible dyke).

--f-- Fault.

---- - Concealed geological boundary.

⊥15° - Strike and dip.

□ – Approximate position of development (blocked in black).

The Tierberg Formation conformably overlies the Collingham Formation in the south and the Whitehill Formation in the north and is overlain by the Waterford Formation. The age of this formation is probably earliest Middle Permian. A maximum thickness of 1 252 m has been recorded. It occurs north of Matjiesfontein northwards to the

Calvinia-Brandvlei area, and from there eastwards to the Britstown area and then northeast-wards, passing northwest of Bloemfontein, to Hertzogville (Viljoen 2005).

*Palaeontology* – Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of strata the palaeontological sensitivity can generally be **VERY LOW** to **VERY HIGH**, and here locally in the development area **MODERATE** for the Vryheid Formation (SG 2.2 SAHRA APMHOB, 2012).

Disarticulated microvertebrate remains, sponge spicules, vascular plants and trace fossils are present in the Tierberg Formation (Groenewald and Groenewald 2014). Rare bone fragments and disarticulated fish, wood, arthropod tracks and fish trails can also be present. Some localities include Brandvlei, Bloemfontein, Kimberley and Hopetown as well as Hertzogville (Viljoen 2005).

Summary of findings (1d): The Desktop Study was undertaken in January 2024 in summer in dry and cool conditions. As this is a desktop study, the season (vegetation) and time (shadows) have no influence on the outcome, and the following is reported:

Recommendation:

Concerns/threats **(1k,l,m)** to be added to EMPr:

1. Threats are earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in, disturbance, damage or destruction of the fossils by development, vehicle traffic, and human disturbance.
2. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden not to intrude fossiliferous layers (shale).

The recommendations are **(1g)**:

1. The potential impact of the development on fossil heritage is **MODERATE** and therefore a field survey is not necessary for this development (according to SAHRA protocol). A Phase 1 Palaeontological Impact Assessment: Field Study is required if fossils are found during the development. Protocol for Chance Find is attached.
2. Mitigation will be needed if fossils are found during the development.
3. No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formations present and their fossils and follow protocol.
4. The development may go ahead with caution due to the presence of the Tierberg Formation shale.
5. The ECO must survey for fossils before and or after clearing, blasting, drilling or excavating.
6. The EMPr will cover the conservation of heritage and palaeontological material that may be exposed during development activities. For a chance fossil find, the protocol is to immediately cease all activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation.

Stakeholders: Developer – Hantam Local Municipality. Private Bag X14, Calvinia, 8190. Tel: 027 341 8500.

Environmental – UBIQUE Heritage Consultants. 8814 Ashkam, Noord Kaap. Tel: 082 845 6267.

Landowners – Hantam Local Municipality.

## **C. Table of Contents**

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## **D. Background information on the project**

### Report

This report is part of the environmental impact assessment process under the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (GN R326 of 7 April 2017) of the Environmental Impact Assessment Regulations (see Appendix 2). It also is in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports, SAHRA, APMHOB, Guidelines 2012, Pg 1-15 (2).

### Outline of development

This report discusses and aims to provide the developer with information regarding the location of palaeontological material that will be impacted by the development. In the pre-mining phase it may be necessary for the developer to apply for the relevant permit from the South African Heritage Resources Agency depending on the presence of fossils (SAHRA / PHRA).

The applicant, Department of Water and Sanitation, wishes to implement several experimental structures to artificially recharge the underground water resources.

The town of Calvinia augments its water supply with groundwater, but this is not sufficient for the growing town. The aim of this experiment is to slow the rundown of rainwater by installing shallow infiltration ponds or check dams, from where some of the run-off can be diverted, via boreholes, directly back into the underlying aquifer.

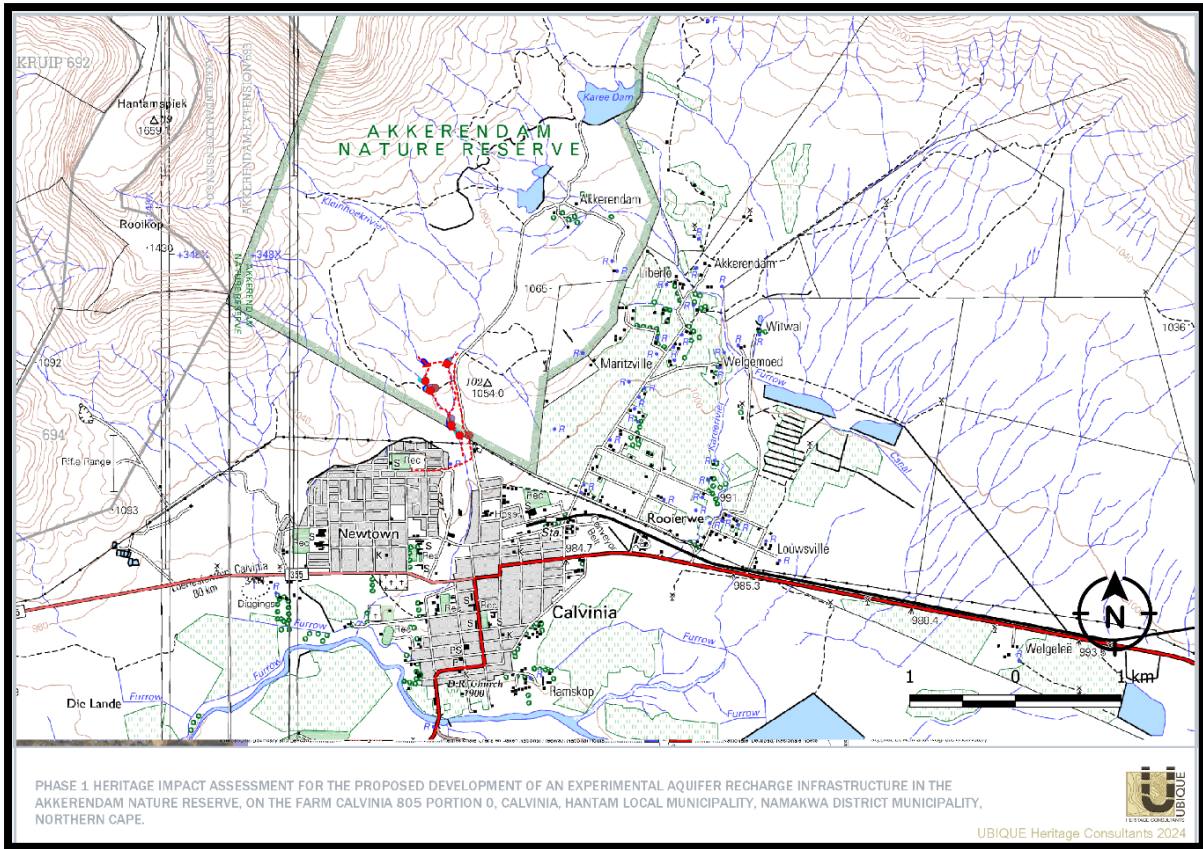


Figure 1: Figure showing topography (UBIQUE).

Related Infrastructure:

1. Existing boreholes
2. Dams
3. Gabion walls
4. Infiltration pond
5. Intake structure
6. A concrete retention wall, and
7. Four ponds.

The Project includes one locality Option (see Figure 1):

Option 1: Polygonal areas indicated in red and shades of blue north of the R27 Road between Nieuwoudtville and Brandvlei in the Akkerendam Nature Reserve. The town of Calvinia is south. The approximate size of the site is 3 hectares.

Rezoning/ and or subdivision of land: No.

Name of Developer and Consultant: Hantam Local Municipality and UBIQUE Heritage Consultants.

Terms of reference: Dr H. Fourie is a palaeontologist commissioned to do a palaeontological impact assessment: field study to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.

Short Curriculum vitae (tai,aii): Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. At present she

is curator of a large fossil invertebrate collection, Therapsids, dinosaurs, amphibia, fish, reptiles, and plants at Ditsong: National Museum of Natural History. For the past 17 years she carried out field work in the North West, Western Cape, Northern Cape, Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga, Gauteng and Free State Provinces. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 29 years.

Legislative requirements: South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act (Act No. 25 of 1999). An electronic copy of this report must be supplied to SAHRA.

## E. Description of property or affected environment

### Location and depth:

The proposed Calvinia Aquifer Recharge Project will be situated in the Hantam Local Municipality, Namakwa District Municipality, Northern Cape Province on Farm: Akkerendam Nature Reserve, Portion 0 Calvinia 805.

Depth is determined by the related infrastructure to be developed and the thickness of the formation in the development area as well as depth of the foundations, footings and channels to be developed. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops. The depth can be verified with test pit results or drill cores.



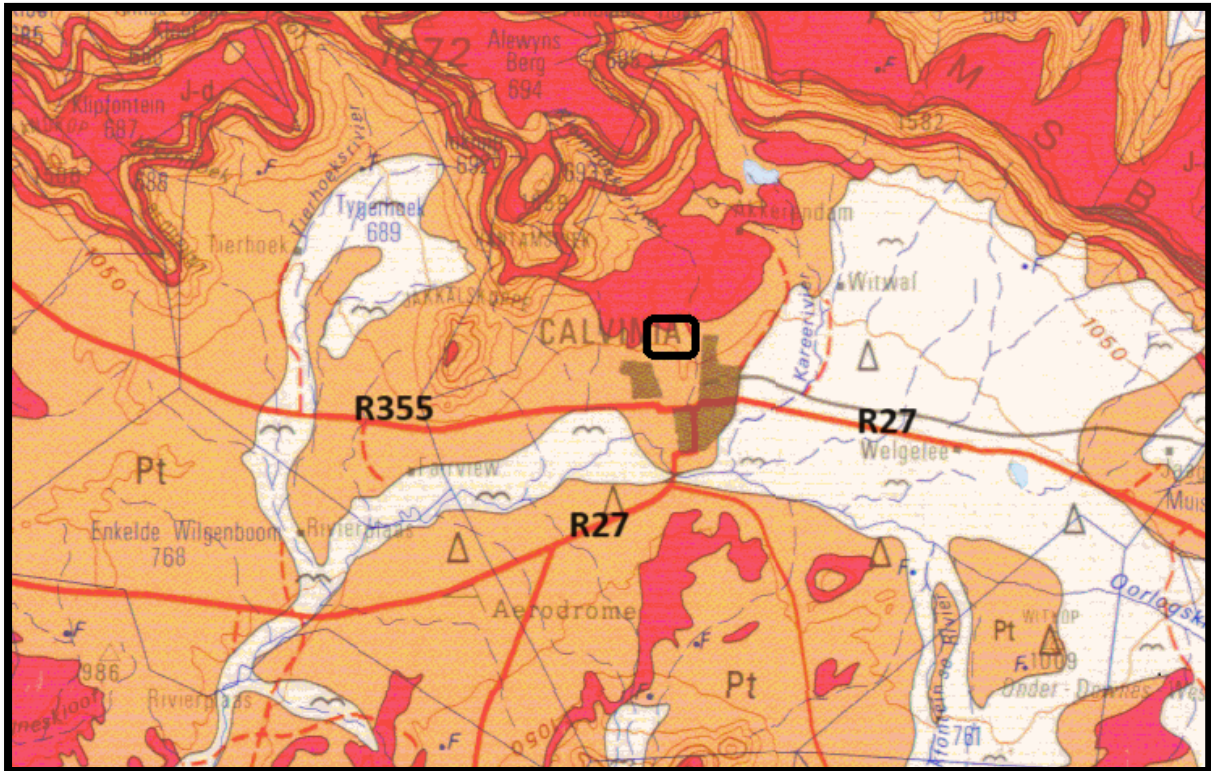
**Figure 2:** Google Earth image showing development area (UBIQUE).

The site is underlain by the Karoo Supergroup Formations.

## F. Description of the Geological Setting

### Description of the rock units:

Large areas of the southern African continent are covered by the Karoo Supergroup (Figure 3). It covers older geological formations with an almost horizontal blanket. Several basins are present with the main basin in the central part of south Africa and several smaller basins towards Lebombo, Springbok Flats and Soutpansberg. An estimated age is 150 – 180 Ma (million years). And a maximum thickness of 7000 m is reached in the south. Three formations overlie the Beaufort Group, they are the Molteno, Elliot and Clarens Formations. The Elliot Formation is also known as the Red Beds and the old Cave Sandstone is known as the Clarens Formation. At the top is the Drakensberg Basalt Formation with its pillow lavas, pyroclasts, etc. (Kent 1980, Snyman 1996). The Beaufort Group is underlain by the Ecca Group which lies on the Dwyka Group.



**Figure 3: Geology of the development area (1h).**

*Legend to Figure and short explanation.*

J-d – Dolerite (pink). Jurassic.

Pt – Brown to grey shale, siltstone, sandstone (brown). Tierberg Formation, Ecca Group, Karoo Supergroup. Permian.

..... – (black) Lineament (Possible dyke).

----- - Concealed geological boundary.

--f-- Fault.

⊥15° - Strike and dip.

□ – Approximate position of development (blocked in black).

Mining Activities on Figure:

None.

Mining past and present has no influence on the project.

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas (see Appendix 1). The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by

the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and north-east, with coal seams also being present in the north-east (Kent 1980, Johnson 2009).

Ecce rocks are stable and lend themselves well to developments. It is only unstable in or directly above mining activities (Snyman 1996). Dolerite dykes occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. The Vryheid Formation sediments may attain a thickness of 120 – 140 m. A typical profile includes soil and clay, sandstone and siltstone, shale, 2 upper seam, shale, 2 seam, sandstone, no 1 seam, shale and dolomite at the bottom. The typical colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The thickness of the grey shale can vary and this is interlayered with the also variable yellow sandstone and coal seams.

The Tierberg Formation conformably overlies the Collingham Formation in the south and the Whitehill Formation in the north and is overlain by the Waterford Formation. The age of this formation is probably earliest Middle Permian. A maximum thickness of 1 252 m has been recorded. It occurs north of Matjiesfontein northwards to the Calvinia-Brandvlei area, and from there eastwards to the Britstown area and then northeast-wards, passing northwest of Bloemfontein, to Hertzogville (Viljoen 2005).

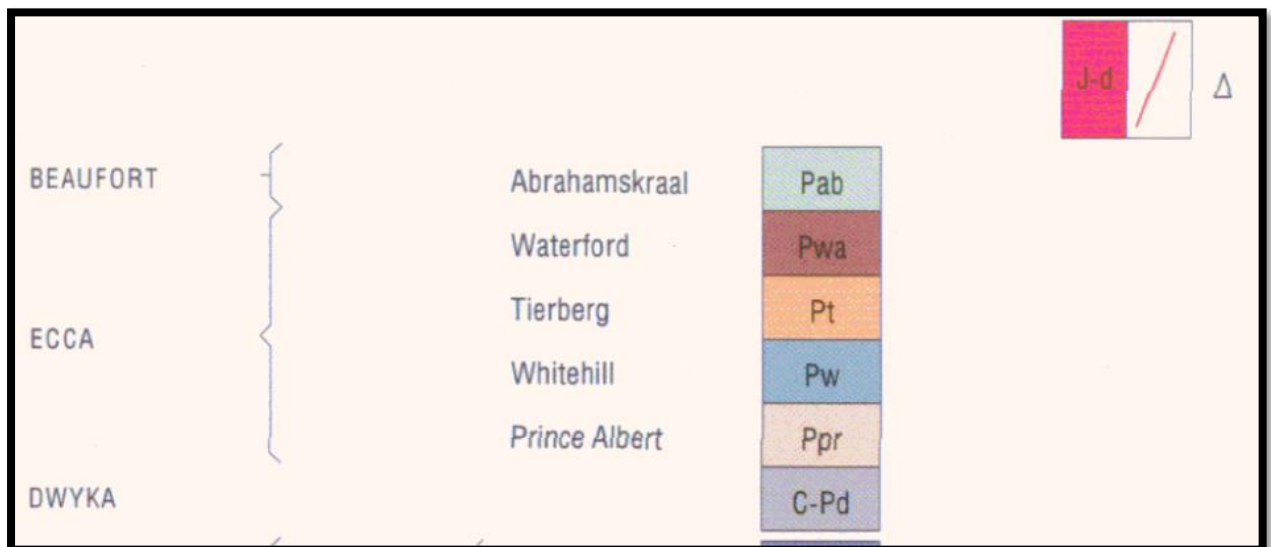


Figure 4: Lithostratigraphic column of the development area (Calvinia 3118).

It is recommended to wait for the response from SAHRA on the Desktop Study (this report). SAHRA protocol must be followed.

### G. Background to Palaeontology of the area

Summary: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012).

Rocks of Permian age (Ecce Group, Figure 5) in South Africa are particularly rich in fossil plants (Rayner and Coventry 1985). The fossils are present in the grey shale interlayered with the coal seams. The fossils are not very rare and occur also in other parts of the Karoo stratigraphy. It is often difficult to spot the greyish fossils as they are the same colour as the grey shale in which they are present as these coalified compressions have been

weathered to leave surface replicas on the enclosing shale matrix. The pollen of the Greenside Colliery near Witbank also on the Vryheid Formation was the focus of a Ph.D study. A locality close to Ermelo, also Vryheid Formation, has yielded *Scutum*, *Glossopteris* leaves, *Neoggerathiopsis* leaves, the lycopod *Cyclodendron leslii*, and various seeds and scale leaves (Prevec 2011).

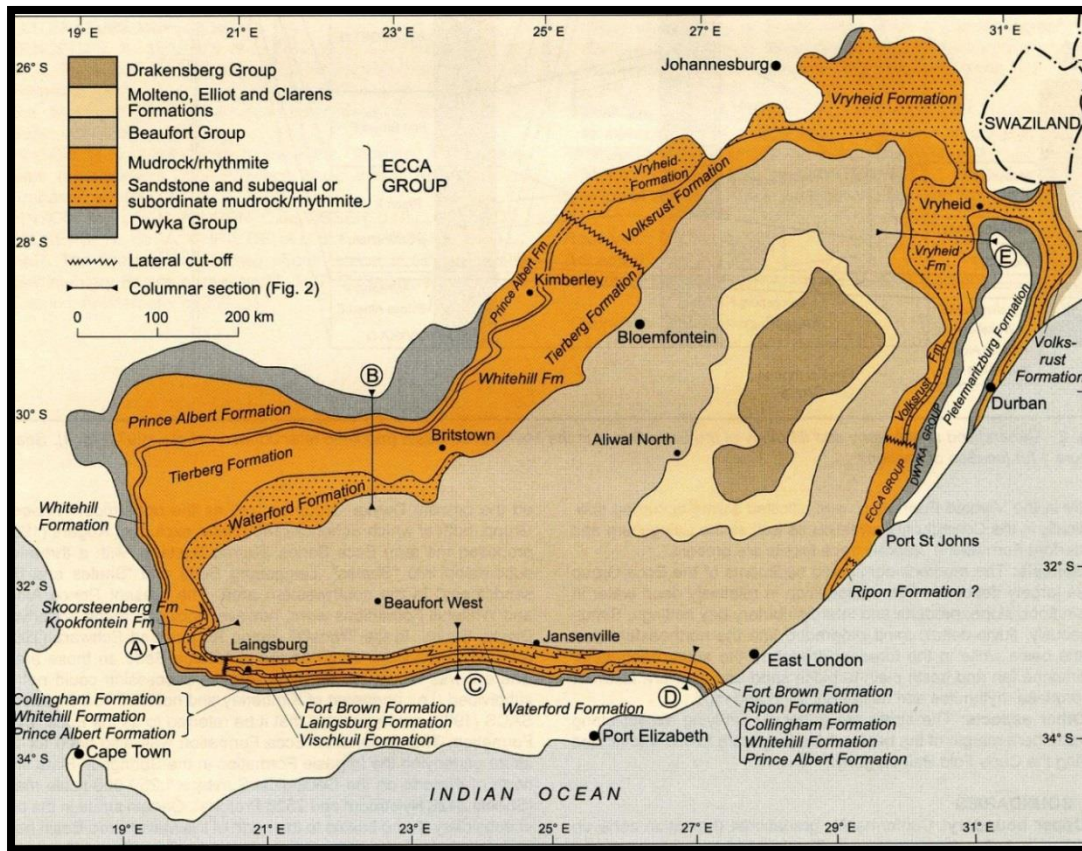


Figure 5: Extent of the Karoo Supergroup (Johnson 2009).

Disarticulated microvertebrate remains, sponge spicules, vascular plants and trace fossils are present in the Tierberg Formation (Groenewald and Groenewald 2014). Rare bone fragments and disarticulated fish, wood, arthropod tracks and fish trails can also be present. Some localities include Brandvlei, Bloemfontein, Kimberley and Hopetown as well as Hertzogville (Viljoen 2005).

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally **VERY LOW** to **VERY HIGH**.

Table 1: Taken from Palaeotechnical Report (Groenewald 2012) (1cA).

<p><b>9b. Ecca Group:</b> non-marine trace fossils, vascular plants (including petrified wood) and palynomorphs of <i>Glossopteris</i> flora, mesosaurid reptiles, fish (including microvertebrate remains, coprolites), crustaceans, sparse marine shelly invertebrates (molluscs, brachiopods), microfossils (radiolarians <i>etc</i>), insects</p>	<ul style="list-style-type: none"> <li>• Diverse non-marine trace fossil assemblages from Gondwana</li> <li>• Exceptionally preserved biota of Whitehill Sea (mesosaurid reptiles, fish, crustaceans)</li> </ul>
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Table 2:	Criteria used	(Fossil Heritage Layer Browser/SAHRIS) (1cB)
Rock Unit	Significance/vulnerability	Recommended Action
Tierberg Formation	Moderate	Desktop Study is required
Ecca Group	Moderate	Desktop Study is required

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).

Impact: **MODERATE** for the Tierberg Formation, Karoo Supergroup. There are significant fossil resources that may be impacted by the development (mudstone, shale) and if destroyed are no longer available for scientific research or other public good (Almond, *et al.* 2009).

The Project includes one locality Option (see Figure 1) (1f,j) The palaeontological sensitivity is as stated above. Option 1: Polygonal areas indicated in red and shades of blue north of the R27 Road between Nieuwoudtville and Brandvlei in the Akkerendam Nature Reserve. The town of Calvinia is south. The approximate size of the site is 3 hectares.

All the land involved in the development was assessed (ni,nii) and none of the property is unsuitable for development (see Recommendation B).

#### H. Description of the Methodology (1e)

The palaeontological impact assessment study was undertaken in January 2024. A Phase 1: Field Survey of the affected portion includes photographs (in 7.1 mega pixels) taken of the site with a digital camera (Canon PowerShot A470). Additionally, Google Maps will be accessed on a cellular phone/tablet for navigation. A Global Positioning System (GPS) (Garmin eTrex 10) is used to record fossiliferous finds and outcrops (bedrock) when the area is not covered with topsoil, subsoil, overburden, vegetation, grassland, trees or waste. The survey did identify the Karoo Supergroup. A literature survey is included and the study relied heavily on geological maps.

SAHRA document 7/6/9/2/1 (SAHRA 2012) requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded with a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what type of fossil and zone will be found in any particular region. Archaeozoologists concentrate on more recent fossils in the quaternary and tertiary deposits.

### Assumptions and Limitations (1i):-

The accuracy and reliability of the report **may be** limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.
5. Lack of rocky outcrops.
6. Inaccessibility of site – site visit not necessary.
7. Insufficient data from developer and exact lay-out plan for all structures - sufficient.

### **A Phase 2 Palaeontological Impact Assessment: Mitigation will include:**

1. Recommendations for the future of the site.
2. Description of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan.
6. Possible declaration as a heritage site or Site Management Plan.

The National Heritage Resources Act No. 25 of 1999 further prescribes.

#### Act No. 25 of 1999. National Heritage Resources Act, 1999.

National Estate: 3 (2) (f) archaeological and palaeontological sites,

(i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens,

Heritage assessment criteria and grading: (a) Grade 1: Heritage resources with qualities so exceptional that they are of special national significance;

(b) Grade 2: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and (c) Grade 3: Other heritage resources worthy of conservation.

SAHRA is responsible for the identification and management of Grade 1 heritage resources.

Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources.

Local authorities identify and manage Grade 3 heritage resources.

No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection.

Archaeology, palaeontology and meteorites: Section 35.

(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, 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 a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (e. g. during bedrock excavations), this must be safeguarded, where feasible *in situ*, and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (e. g. Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

### **I. Description of significant fossil occurrences**

All Karoo Supergroup geological formations are ranked as **VERY LOW** to **VERY HIGH**, and here the impact is potentially **MODERATE** for the Tierberg Formation.

Disarticulated microvertebrate remains, sponge spicules, vascular plants and trace fossils are present in the Tierberg Formation (Groenewald and Groenewald 2014). Rare bone fragments and disarticulated fish, wood, arthropod tracks and fish trails can also be present. Some localities include Brandvlei, Bloemfontein, Kimberley and Hopetown as well as Hertzogville (Viljoen 2005).

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot.

The threats are:-

- Earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction,
- The sealing-in or destruction of fossils by development, vehicle traffic, and human disturbance. See Description of the Geological Setting (F) above.

### **J. Recommendation**

- a. There is no objection (see Recommendation B) to the development, it was not necessary to request a Phase 1 Palaeontological Impact Assessment: Field Study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity of the site is **MODERATE**. A Phase 1

Palaeontological Assessment is necessary if fossils are found during construction. Protocol for chance find is attached (Appendix 2).

- b. Preferred choice: The Project includes one locality Option (Figure 1) near Calvinia present mostly on the Tierberg Formation with a **MODERATE** heritage impact.
- c. The ECO must undertake periodic audits to monitor and record heritage impacts and non-compliance, preferable weekly or bi-weekly.
- d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed and a palaeontologist should be called in to determine proper mitigation measures.
- e. This report must be submitted to SAHRA/PHRA together with the Heritage Impact Assessment Report.

#### Sampling and collecting:

Wherefore a permit is needed from the South African Heritage Resources Agency (SAHRA / PHRA).

- a. Objections: Cautious. See heritage value and recommendation.
- b. Conditions of development: See Recommendation.
- c. Areas that may need a permit: No.
- d. Permits for mitigation: Only needed from SAHRA/PHRA prior to Mitigation.

#### **K. Conclusions**

- a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).
- b. All information needed for the Palaeontological Impact Assessment was provided by the Consultant. All technical information was provided by UBIQUE Heritage Consultants.
- c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
- d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped, a 30 m barrier constructed, and a palaeontologist should be called in to determine proper mitigation measures.
- e. This project may benefit the community, will create short- and long-term employment, the life expectancy of the community, the growth of the community, and social development in general.
- f. Consultation with parties was not necessary **(1o,p,q)**.
- g. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils) and adjacent areas as well as for safety and security reasons.

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**Declaration (1b)**

I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological assessment. There are no circumstances that compromise the objectivity of me performing such work.

I accept no liability, and the client, by receiving this document, indemnifies me against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the use of the information contained in this document.

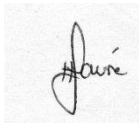
It may be possible that the Phase 1: Field Study may have missed palaeontological resources in the project area as outcrops are not always present or visible while others may lie below the overburden of earth and may only be present once development commences.

This report may not be altered in any way and any parts drawn from this report must make reference to this report.

**POPI Act 2013 Statement**

It provides that everyone has the right to privacy and includes a right to protection against the unlawful collection, retention dissemination and use of personal information contained in this document and pertains to the phone and contact details, signature and contents.

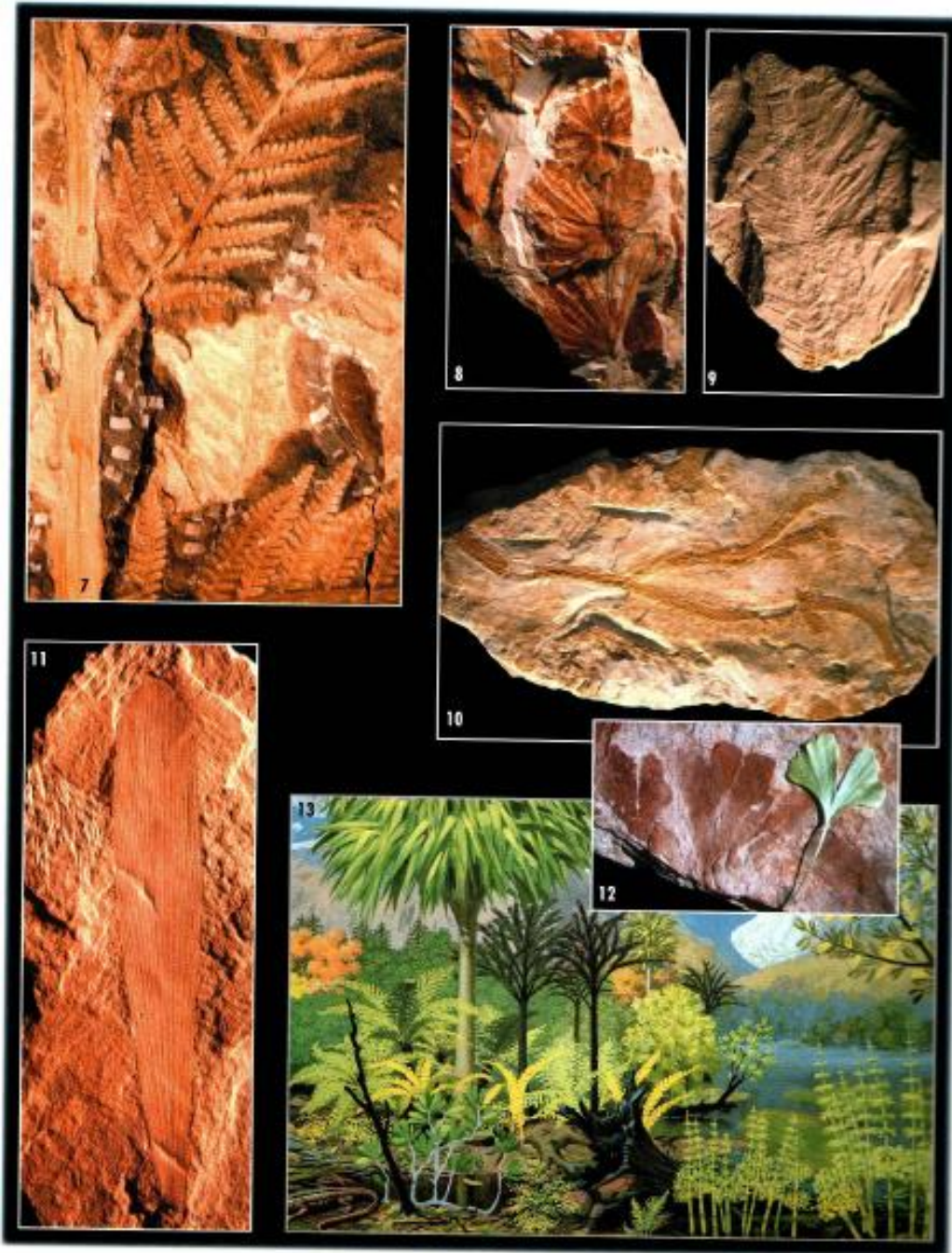
As per the Declaration Section none of the information may be shared without the permission of the author.



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Heidi Fourie  
2024/01/15

**Appendix 1:** Example of Plant Fossils (MacRae 1999)



**Appendix 2:** Protocol for Chance Finds and Management Plan (1k,l,m)

This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is **LOW**; this process guides the palaeontologist / palaeobotanist on site and should not be attempted by the layman / developer. As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to oversee the construction activities in line with the legally binding Environmental Management Programme (EMPr).

- The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities.

- For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. Construction workers must be informed that this is a no-go area.
- It is recommended that the EMP be updated to include the involvement of a palaeontologist for pre-construction training of the ECO or during the digging and excavation phase of the development.
- The ECO must visit the site after clearing, drilling, excavations and blasting and keep a photographic record.
- The developer may be required to survey the areas affected by the development and indicate on plan where the construction / development / mining will take place. Trenches may have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden.

Mitigation will involve recording, rescue and judicious sampling of the fossil material present in the layers sandwiched between the geological / coal layers. It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during mining or excavations. In order for this to happen, in case of coal mining operations, the process will have to be closely scrutinised by a professional palaeontologist / palaeobotanist to ensure that only the coal layers are mined and the interlayers (siltstone and mudstone) are surveyed for fossils or representative sampling of fossils are taking place.

The palaeontological impact assessment process presents an opportunity for identification, access and possibly salvage of fossils and add to the few good plant localities. Mitigation can provide valuable onsite research that can benefit both the community and the palaeontological fraternity.

A Phase 2 study is very often the last opportunity we will ever have to record the fossil heritage.

#### **A Phase 2 Palaeontological Impact Assessment: Mitigation will include (SAHRA) -**

1. Recommendations for the future of the site.
2. Description and purpose of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan and map.
6. Possible declaration as a heritage site or Site Management Plan.
7. Stakeholders.
8. Detailed report including the Desktop and Phase 1 study information.
9. Annual interim or progress Phase 2 permit reports as well as the final report.
10. Methodology used.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, 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 a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (e. g. during bedrock excavations), this must be safeguarded, where feasible *in situ*, and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (e. g. Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

The Palaeontological Society of South Africa (PSSA) does not have guidelines on excavating or collecting, but the following is suggested:

The developer needs to clearly stake or peg-out (survey) the areas affected by the mining/ construction/ development operations and dig representative trenches and if possible supply geological borehole data. When the route is better defined, it is recommended that a specialist undertake a 'walk through' of the entire road as well as construction areas, including camps and access roads, prior to the start of any construction activities, this may be done in sections.

1. When clearing vegetation, topsoil, subsoil or overburden, hard rock (outcrop) is found, the contractor needs to stop all work.
2. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
3. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.
4. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.
5. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once every week).
6. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

#### **Fossil excavation if necessary, during Phase 2:**

1. Photography of fossil / fossil layer and surrounding strata.
2. Once a fossil has been identified as such, the task of extraction begins.
3. It usually entails the taking of a GPS reading and recording lithostratigraphic, biostratigraphic, date, collector and locality information.

4. Using Paraloid (B-72) as an adhesive and protective glue, parts of the fossil can be kept together (not necessarily applicable to plant fossils).
5. Slowly chipping away of matrix surrounding the fossil using a geological pick, brushes and chisels.
6. Once the full extent of the fossil / fossils is visible, it can be covered with a plaster jacket (not necessarily applicable to plant fossils).
7. Chipping away sides to loosen underside.
8. Splitting of the rock containing palaeobotanical material should reveal any fossils sandwiched between the layers.

**This document forms part of the Environmental Monitoring Programme.** For practical reasons a palaeontologist/palaeobotanist may be required to be on site as predetermined. If any fossil material is discovered then a Phase 2 rescue operation may be necessary, and a permit will be required.

**The South African Heritage Resources Agency has the following documents in place:**

Guidelines to Palaeontological Permitting policy.

Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.

Guidelines for Field Reports.

Palaeotechnical Reports (Eastern Cape, North West, Northern Cape, Mpumalanga, Gauteng, Western Cape, Free State, KwaZulu-Natal, and Limpopo)

**Appendix 3: Table 3:** Listing points in Appendix 6 of the Act and position in Report (bold in text).

<b>Section in Report</b>	<b>Point in Act</b>	<b>Requirement</b>
B	1(c)	Scope and purpose of report
B	1(d)	Duration, date and season
B	1(g)	Areas to be avoided
D	1(ai)	Specialist who prepared report
D	1(aii)	Expertise of the specialist
F Figure 3	1(h)	Map
F, B	1(ni)(iA)	Authorisation
F, B	1(nii)	Avoidance, management, mitigation and closure plan
G Table 1	1(cA)	Quality and age of base data
G Table 2	1(cB)	Existing and cumulative impacts
G, D	1(f)	Details or activities of assessment
G	1(j)	Description of findings
H	1(e)	Description of methodology
H	1(i)	Assumptions
J	1(o)	Consultation
J	1(p)	Copies of comments during consultation
J	1(q)	Information requested by authority
Declaration	1(b)	Independent declaration
Appendix 2	1(k)	Mitigation included in EMPr
Appendix 2	1(l)	Conditions included in EMPr
Appendix 2	1(m)	Monitoring included in EMPr
D	2	Protocol or minimum standard



**Appendix 4:** Impact Statement.

The development footprint is situated on a geological layer with a **MODERATE** palaeontological sensitivity. The nature of the impact is the destruction of Fossil Heritage. Loss of fossil heritage will have a negative impact. The extent of the impact only extends in the region of the development activity footprint and may include transport routes (2). The expected duration (5) of the impact is assessed as potentially permanent. The intensity/magnitude (8) of the impact is moderate as it may continue in a modified way. The probability (3) of the impact occurring is probable.

Mitigation procedures (should fossil material be present within the affected area) may be necessary if fossils are found. The loss of resources occurs but natural cultural and social processes continue, albeit in a modified manner. The cumulative impact is low. Impacts on palaeontological heritage during the construction and preconstruction phase may potentially occur.

The significance of the impact occurring will be:  $S = (E+D+M) P$

$$S = (2+5+8)3$$

$$S = 45 \text{ Medium (30-60).}$$