CES: PROPOSED STURDEE ENERGY PPC SLURRY SOLAR PROJECT ON PORTIONS OF THE FARM SLURRY 96 JO, NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITY NORTH WEST PROVINCE

Integrated Heritage Impact Assessment Report

Submitted subject to Section 38(3) and Section 38(8) of the NHRA

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INTEGRATED HERITAGE IMPACT ASSESSMENT (HIA) ON PORTIONS OF THE FARM SLURRY 96 JO FOR THE PROPOSED STURDEE ENERGY PPC SLURRY SOLAR PROJECT, NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITY, NORTH WEST PROVINCE

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DECLARATION

I, Nelius Le Roux Kruger, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed Sturdee Energy PPC Slurry Solar Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, including the relevant Heritage Legislation (National Heritage Resources Act no. 25 of 1999, Human Tissue Act 65 of 1983 as amended, Removal of Graves and Dead Bodies Ordinance no. 7 of 1925, Excavations Ordinance no. 12 of 1980), the Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment (SAHRA, AMAFA and the CRM section of ASAPA), regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I 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;
- All the particulars furnished by me in this declaration are true and correct.

Signature of Specialist
Company: Exigo Sustainability
Date: 4 September 2021

EXECUTIVE SUMMARY

This report details the results of a Heritage Impact Assessment (HIA) and findings from a Palaeontological Desktop Assessment in support ofan Environmental Impact Assessment (EIA) process for the proposed Sturdee Energy PPC Slurry Solar Project on Portions of the farm Slurry 96 JO in the Ngaka Modiri Molema District Municipality of the North West Province. The proposed project entails the establishment of a PV solar facility across an area of approximately **30ha** at the PPC Slurry Operations and a 11kV cable connecting to the Slurry plant, which is situated approximately 18km east of the town of Mahikeng. Two site alternatives, Alternative 1 (preferred) and Alternative 2 have been identified for the project. The report includes an Archaeological Impact Assessment (AIA) component and a Paleontological Desktop Assessment (PDA). These studies provide background information on the area's archaeology, paleontology and sense of landscape and place in terms of its representation in Southern Africa as well as project methodologies and results as well as heritage legislation and conservation policies. A copy of the report will be supplied to the South African Heritage Resources Agency (SAHRA) and recommendations contained in this document will be reviewed.

Project Title	Sturdee Energy PPC Slurry Solar Project
Project Location	**Site Alternative 1 (Preferred):** S25.821008° E25.828686° **Site Alternative 2:** S25.824630° E25.844909°
1:50 000 Map Sheet	2525DD
Farm Portion / Parcel	Portions of the farm Slurry 96 JO
Magisterial District / Municipal Area	Ngaka Modiri Molema District Municipality
Province	North West Province

A number of archaeological and historical studies have been conducted in the North West Province. These studies all infer a rich and diverse archaeological landscape mostly dominated by Stone Age and Colonial Period occurrences. Numerous sites, documenting Earlier, Middle and Later Stone Age habitation occur across the province, mostly in open air locales or in sediments alongside rivers or pans. Sites dating to the Iron Age Farmer Period occur throughout the province, particularly to the east and north but environmental factors delegated that the spread of Iron Age farming westwards from the 17th century was constrained mainly to the area east of the Langeberg Mountains. Moving into recent times, the archaeological record reflects the development of a rich colonial frontier, characterised by, amongst others, a complex industrial archaeological and farming landscape. The farm Rietvlei, which was later subdivided to form the Farm Slurry, was established towards the end of the 19th century and no particular reference to archaeological sites or features of heritage potential were recorded during an examination of published literature thematically or geographically related to Slurry. However, a previous Cultural Heritage Survey of the PPC Slurry Operation mining area conducted by Coetzee (2008) indicates the presence of a historically significant mining shed, a coal store and kilns sites as well as 3 cemeteries, one of which is relevant to this assessment.

In terms of palaeontology, it was established that the project option presented is situated on the Tertiary Kalahari. One of the formations in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in

height and up to 10 mm in diameter and can be present in the development area. The potential impact of the development on fossil heritage is moderate and the following is recommended:

- Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden. An appropriate Protocol and Management plan is attached for the Environmental Control Officer in the PDA (Addendum 4).
- Mitigation may be needed if fossils (stromatolites) are found.
- The Environmental Control Officer must familiarise him- or herself with the formations present and its fossils.
- The development may go ahead, but the ECO must survey for fossils before and or after clearing, blasting, drilling or excavating.
- 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.
- Care must be taken during the dolomite risk assessment as stromatolites may be present (according SANS 1936-1 (2012)) not to destroy any stromatolites.
- 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

In terms of archaeology, it has been noted that portions of Slurry, and the project area have been altered and transformed as a result of more recent mining and quarrying. During the survey, no heritage receptors were noted in **Site Alternative 1 (preferred)** and it might be assumed that this site alternative is favorable for development. This inference is made on the assumption that no previously-undetected heritage remains are encountered during pre-construction vegetation clearing, earth moving activities and construction. A large cemetery occurs in the footprint demarcated as **Site Alternative 2** and impact is likely should this alternative be selected for development. This site alternative is not favorable for development unless required mitigation measures (avoidance, conservation buffers, grave relocation, public consultation) are implemented. The following recommendations are made based on general observations in the proposed Sturdee Energy PPC Slurry Solar Project in terms of heritage resources management.

- Considering the localised nature of heritage remains, the general monitoring of the development progress by an ECO is recommended for all stages of the project. Should any subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.
- A large cemetery occurring in the footprint identified as Site Alternative 2 (**Site Exigo-PPCS-BP01**) is of high significance and the site might be impacted should this alternative be selected for development. It is primarily recommended that the burial be conserved *in situ* and that a conservation buffer of at least 100m, as required by SAHRA Burial Ground and Graves (BGG) Unit, be implemented around the heritage receptor. A fence and access gate should be erected around each burial site. A distance of at least 2m should be maintained between the graves and the fence which should be at least 1,8m high. Clear signboard should be erected indicating the heritage sensitivity of the sites and contact details for visitation of the graves. The developer should carefully

liaise with the heritage specialist and SAHRA with regards to the management and monitoring of any human grave or cemetery in order to detect and manage negative impact on the sites. In addition, a Site Management Plan should be implemented detailing conservation measures for the graves and responsible parties in this regard. Should direct impact on the resources prove inevitable, all graves in the cemetery should be relocated by a qualified archaeologist, and in accordance with relevant legislation, permitting, statutory permissions and subject to any local and regional provisions and laws and by-laws pertaining to human remains. A full social consultation process should occur in conjunction with the mitigation of cemeteries and burials.

- It should be stated that it is likely that further undetected archaeological remains might occur elsewhere in the project area along water sources and drainage lines, fountains and pans would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. Burials and historically significant structures dating to the Colonial Period occur on farms in the area and these resources should be avoided during all phases of construction and development, including the operational phases of the development.

Sturdee Energy PPC Slurry Solar Project Heritage Sites Locations

Site Code	Coordinate S E	Short Description	Mitigation Action
Exigo-PPCS-BP01	S25.82279° E25.85091°	**Burial Site in Site Alternative 2 footprint.**	**Avoidance: 100**m conservation buffers, site fencing and access control, site management plan **Site monitoring:** Site monitoring by the heritage consultant or an ECO familiar with the heritage of the area. **Grave Relocation:** Grave relocation subject to authorizations and permitting if impacted on.

This report details the methodology, limitations and recommendations relevant to these heritage areas, as well as areas of proposed development. It should be noted that recommendations and possible mitigation measures are valid for the duration of the development process, and mitigation measures might have to be implemented on additional features of heritage importance not detected during this Phase 1 assessment (e.g. uncovered during the construction process).

NOTATIONS AND TERMS/TERMINOLOGY

Absolute dating: Absolute dating provides specific dates or range of dates expressed in years.

Archaeological record: The archaeological record minimally includes all the material remains documented by archaeologists. More comprehensive definitions also include the record of culture history and everything written about the past by archaeologists.

Artefact: Entities whose characteristics result or partially result from human activity. The shape and other characteristics of the artefact are not altered by removal of the surroundings in which they are discovered. In the Southern African context examples of artefacts include potsherds, iron objects, stone tools, beads and hut remains.

Assemblage: A group of artefacts recurring together at a particular time and place, and representing the sum of human activities.

Context: An artefact's context usually consists of its immediate *matrix*, its *provenience* and its *association* with other artefacts. When found in *primary context*, the original artefact or structure was undisturbed by natural or human factors until excavation and if in *secondary context,* disturbance or displacement by later ecological action or human activities occurred.

Cultural Heritage Resource: The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

Cultural landscape: A cultural landscape refers to a distinctive geographic area with cultural significance.

Cultural Resource Management (CRM): A system of measures for safeguarding the archaeological heritage of a given area, generally applied within the framework of legislation designed to safeguard the past.

Feature: Non-portable artefacts, in other words artefacts that cannot be removed from their surroundings without destroying or altering their original form. Hearths, roads, and storage pits are examples of archaeological features

Impact: A description of the effect of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.

Lithic: Stone tools or waste from stone tool manufacturing found on archaeological sites.

Matrix: The material in which an artefact is situated (sediments such as sand, ashy soil, mud, water, etcetera). The matrix may be of natural origin or human-made.

Midden: Refuse that accumulates in a concentrated heap.
Microlith: A small stone tool, typically knapped of flint or chert, usually about three centimetres long or less.
Monolith: A geological feature such as a large rock, consisting of a single massive stone or rock, or a single piece of rock placed as, or within, a monument or site.

Phase 1 CRM Assessment: An Impact Assessment which identifies archaeological and heritage sites, assesses their significance and comments on the impact of a given development on the sites. Recommendations for site mitigation or conservation are also made during this phase.

Phase 2 CRM Study: In-depth studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required. Mitigation / Rescue involves planning the protection of significant sites or sampling through excavation or collection (in terms of a permit) at sites that may be lost as a result of a given development.

Phase 3 CRM Measure: A Heritage Site Management Plan (for heritage conservation), is required in rare cases where the site is so important that development will not be allowed and sometimes developers are encouraged to enhance the value of the sites retained on their properties with appropriate interpretive material or displays.

Provenience: Provenience is the three-dimensional (horizontal and vertical) position in which artefacts are found. Fundamental to ascertaining the provenience of an artefact is *association,* the co-occurrence of an artefact with other archaeological remains; and *superposition,* the principle whereby artefacts in lower levels of a matrix were deposited before the artefacts found in the layers above them, and are therefore older.

Random Sampling: A probabilistic sampling strategy whereby randomly selected sample blocks in an area are surveyed. These are fixed by drawing coordinates of the sample blocks from a table of random numbers.

Scoping Assessment: The process of determining the spatial and temporal boundaries (i.e. extent) and key issues to be addressed in an impact assessment. The main purpose is to focus the impact assessment on a manageable number of important questions on which decision making is expected to focus and to ensure that only key issues and reasonable alternatives are examined. The outcome of the scoping process is a Scoping Report that includes issues raised during the scoping process, appropriate responses and, where required, terms of reference for specialist involvement.

Site (Archaeological): A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity. These include surface sites, caves and rock shelters, larger open-air sites, sealed sites (deposits) and river deposits. Common functions of archaeological sites include living or habitation sites, kill sites, ceremonial sites, burial sites, trading, quarry, and art sites,

Stratigraphy: This principle examines and describes the observable layers of sediments and the arrangement of strata in deposits

Systematic Sampling: A probabilistic sampling strategy whereby a grid of sample blocks is set up over the survey area and each of these blocks is equally spaced and searched.

Trigger: A particular characteristic of either the receiving environment or the proposed project which indicates that there is likely to be an *issue* and/or potentially significant *impact* associated with that proposed development that may require specialist input. Legal requirements of existing and future legislation may also trigger the need for specialist involvement.

LIST OF ABBREVIATIONS

Abbreviation	Description
ASAPA	Association for South African Professional Archaeologists
AIA	Archaeological Impact Assessment
BP	Before Present
BCE	Before Common Era
BGG	Burial Grounds and Graves
CRM	Culture Resources Management
EIA	Early Iron Age (also Early Farmer Period)
EIA	Environmental Impact Assessment
EFP	Early Farmer Period (also Early Iron Age)
ESA	Earlier Stone Age
GIS	Geographic Information Systems
HIA	Heritage Impact Assessment
ICOMOS	International Council on Monuments and Sites
K2/Map	K2/Mapungubwe Period
LFP	Later Farmer Period (also Later Iron Age)
LIA	Later Iron Age (also Later Farmer Period)
LSA	Later Stone Age
MIA	Middle Iron Age (also Early later Farmer Period)
MRA	Mining Right Area
MSA	Middle Stone Age
NHRA	National Heritage Resources Act No.25 of 1999, Section 35
PFS	Pre-Feasibility Study
PHRA	Provincial Heritage Resources Authorities
SAFA	Society for Africanist Archaeologists
SAHRA	South African Heritage Resources Association
YCE	Years before Common Era (Present)

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1 BACKGROUND

1.1 Scope and Motivation

Exigo Sustainability (Pty) Ltd (Exigo) was commissioned by CES to conduct a Heritage Impact Assessment (HIA) study in support of an Environmental Impact Assessment (EIA) process for the proposed Sturdee Energy PPC Slurry Solar Project in the North West Province. The rationale of this AIA is to determine the presence of heritage resources such as archaeological and historical sites and features, graves and places of religious and cultural significance as well as palaeontological features in previously unstudied areas; to consider the impact of the proposed project on such heritage resources, and to submit appropriate recommendations with regard to the cultural resources management measures that may be required at affected sites / features.

1.2 Project Direction

Exigo's expertise ensures that all projects be conducted to the highest international ethical and professional standards. As archaeological specialist for Exigo Sustainability, Mr Neels Kruger acted as field director for the project; responsible for the assimilation of all information, the compilation of the final consolidated AIA report and recommendations in terms of heritage resources on the demarcated project areas. Mr Kruger is an accredited archaeologist and Culture Resources Management (CRM) practitioner with the Association of South African Professional Archaeologists (ASAPA), a member of the Society for Africanist Archaeologists (SAFA) and the Pan African Archaeological Association (PAA) as well as a Master's Degree candidate in archaeology at the University of Pretoria.

1.3 Project Brief

CES was appointed by Sturdee Energy to undertake the environmental impact assessment process (EIA) for the proposed PV Solar Plant at the PPC Slurry Operation on Portions of the farm Slurry 96 JO, Ngaka Modiri Molema District Municipality in the North West Province (hereafter referred to as the "Sturdee Energy PPC Slurry Solar Project"). Two site alternatives, **Alternative 1 (preferred)** and **Alternative 2** have been identified for the project. For the integrated HIA, an AIA and a PDA[1] (refer to Addendum 4) were commissioned.

The location of the solar PV plant has been optimized within the allocated land parcels provided by the Client. A Medium Voltage (MV) overhead line (OHL) has been proposed to interconnect the PV plant to the PPC main distribution substation on each site. The following infrastructure components are proposed:

- **Mounting Structures.**

The structures chosen are oriented in a North-South axis along a single-axis horizontal axis system, which rotates the panels to orient them, at the sunrise, to the east and, at the sunset, to the West. The reason for this selection was done to enhance the total yield over the life-span of the PV system. On average this system will yield +-15% more energy (kWhrs) at the point of connection every year for the life of the plant, as compared to a fixed-tilt system at an angle of 25 degrees with no tracking. There is an additional capex associated with the tracking system due to the additional control, monitoring and associated tracker system requirements, however the Levelised Cost of Electricity (LCOE) when considered over 20 years will be significantly lower than a fixed-tilt

[1] Fourie, H. 2021. Sturdee Energy PPC Slurry Solar Project, Mahikeng Local Municipality, Ngaka Modiri District Municipality, North West Province

equivalent with all other variables held constant. This system thus has an advantage of providing a significantly lower LCOE owing to the greater solar PV yield. The tracker layout has been optimized to reduce shading significantly. This is achieved by spacing rows at a pitch of 6.5m apart thus preventing majority of inter-row shading losses and reducing back-tracking requirement. Where land is constrained, such as the De Hoek site, we had to reduce pitch distance to 4m to allow the full PV plant DC capacity to fit.

- **Buildings.**

• Substation & control room on site

• The building will be air-conditioned to maintain an adequate temperature-controlled environment for the electronic devices that will be housed within i.e. UPS, park controller, tracker controller, MV switchgear, etc.

• Building will contain fire extinguishers, PPE, toolbox, spares, and working table for on-site personnel

- **Civil Works**

All civil works are designed to capable of withstand a 100-year storm event, including the effects of water, extreme winds and other natural disasters, without flooding, erosion, settlement or damage.

- **Electrical Connections**

For the interconnection with the existing PPC substation it is required to design, build and commissioning a new 11kV or 6.6kV overhead line (OHL) capable of evacuating up to 10MVA on a continual basis. Eskom Distribution standards and specifications will be used as the reference requirements to design, construct and commission the MV overhead lines.

PPC Slurry Design Basis Summary:

Project Pre-design Input	**PPC Slurry** **Solar PV Plant Specification**
Contracted Capacity (AC)	10MW
Maximum Export Capacity (AC)	10MW
Plant nameplate DC capacity	11MW
DC/AC Ratio	110%
PV module type	Jinko Tiger JKM460-7RL3 Mono-crystalline N-Type bifacial module
Number of modules	23 920
Number of module strings	920
Mounting structure	Single-axis ground-mount N-S tracker with back-tracking
Tracker specification	30x1 modules in portrait Pitch of 6.5m GCR = 34.8% Angle rotation +-60º
Bi-facial system specification	Ground albedo = 20% Bi-faciality factor = 74% Rear shading factor = 5% Axis height above ground = 2m
Axis tilt	0 degrees
PV inverter type	Siemens Sinacon PV2500 2500kW 1500V outdoor grid-tied central inverter
Inverter continuous AC rated capacity	4x 2500kWac
Plant Transformer rating	4x 3MVA 400V/6.6kV
Plant grid interconnection voltage	6.6kV
Planned grid interconnection	850m 6.6kV overhead line to PPC 6.6kV Main Distribution Substation

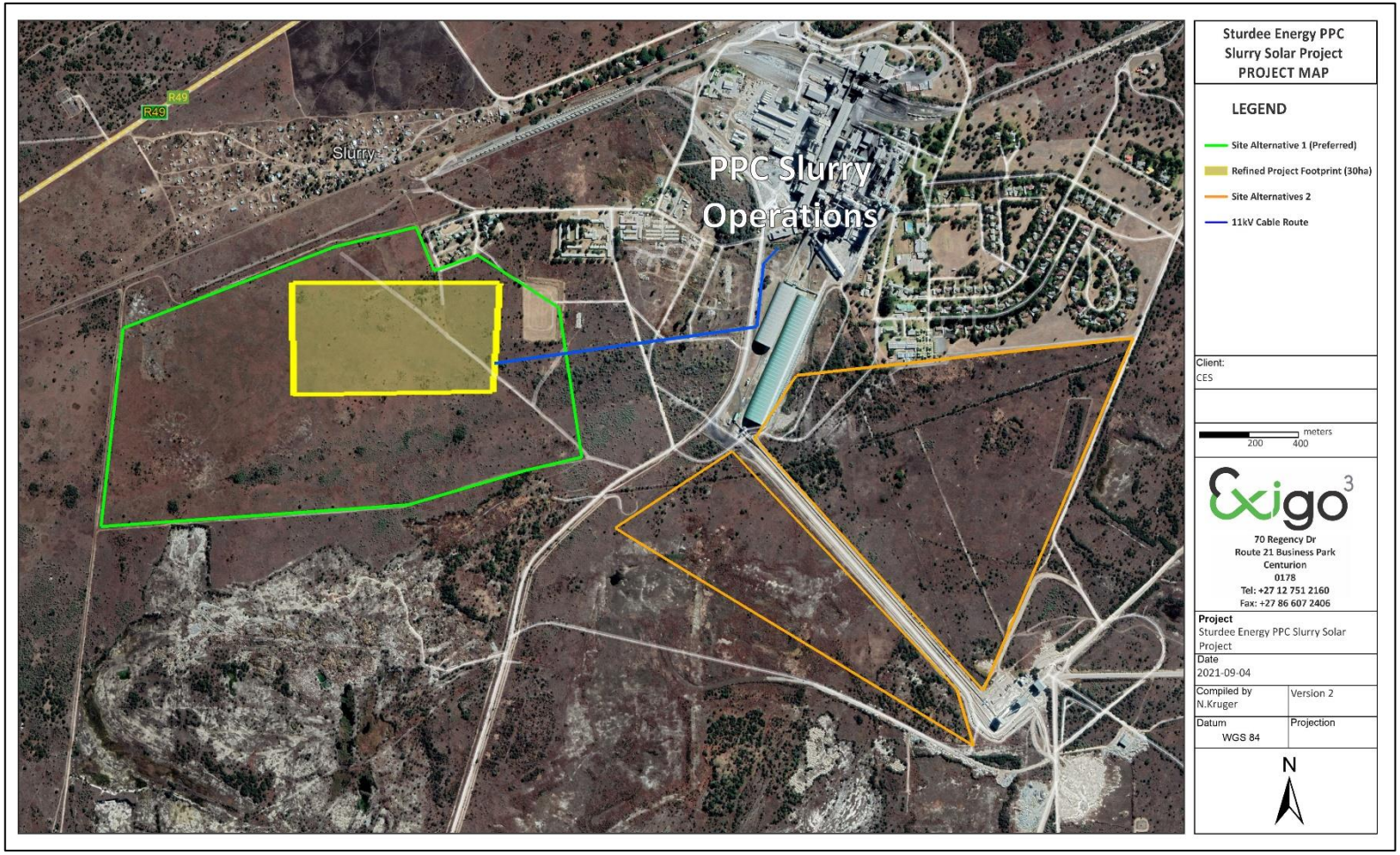


Figure 1-1: Map indicating the project areas subject to the proposed Sturdee Energy PPC Slurry Solar Project.

1.4 Terms of Reference

Heritage specialist input into the Environmental Impact Assessment (EIA) process is essential to ensure that, through the management of change, developments still conserve our heritage resources. It is also a legal requirement for certain development categories which may have an impact on heritage resources. Thus, EIAs should always include an assessment of heritage resources. The heritage component of the EIA is provided for in the **National Environmental Management Act, (Act 107 of 1998)** and endorsed by section 38 of the **National Heritage Resources Act (NHRA - Act 25 of 1999)**. In addition, the NHRA protects all structures and features older than 60 years, archaeological sites and material and graves as well as burial sites. The objective of this legislation is to ensure that developers implement measures to limit the potentially negative effects that the development could have on heritage resources.

Based hereon, this project functioned according to the following **terms of reference for** heritage specialist input**:**

- *Provide a detailed description of all archaeological artefacts, structures (including graves) and settlements as well as paleontological receptors which may be affected, if any.*
- *Assess the nature and degree of significance of such resources within the area.*
- *Establish heritage informants/constraints to guide the development process through establishing thresholds of impact significance;*
- *Assess and rate any possible impact on the archaeological and historical remains within the area emanating from the proposed development activities.*
- *Propose possible heritage management measures provided that such action is necessitated by the development.*
- *Liaise and consult with the South African Heritage Resources Agency (SAHRA). A Notification of Intent to Develop (NID) will be submitted to SAHRA at the soonest opportunity.*

1.5 CRM: Legislation, Conservation and Heritage Management

The broad generic term *Cultural Heritage Resources* refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

1.5.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and its provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

a. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act No 25 of 1999 (section 35) the following features are protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years

b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography

c. Objects of decorative and visual arts

d. Military objects, structures and sites older than 75 years

e. Historical objects, structures and sites older than 60 years

f. Proclaimed heritage sites

g. Grave yards and graves older than 60 years

h. Meteorites and fossils

i. Objects, structures and sites of scientific or technological value.

In addition, the national estate includes the following:

a. Places, buildings, structures and equipment of cultural significance

b. Places to which oral traditions are attached or which are associated with living heritage

c. Historical settlements and townscapes

d. Landscapes and features of cultural significance

e. Geological sites of scientific or cultural importance

f. Archaeological and paleontological sites

g. Graves and burial grounds

h. Sites of significance relating to the history of slavery

i. Movable objects (e.g. archaeological, paleontological, meteorites, geological specimens, military, ethnographic, books etc.)

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58)."

and

"No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(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;

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60)."

b. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves and burial grounds are commonly divided into the following subsets:

a. ancestral graves
b. royal graves and graves of traditional leaders
c. graves of victims of conflict
d. graves designated by the Minister
e. historical graves and cemeteries
f. human remains

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and Ordinance on Excavations (Ordinance no. 12 of 1980) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments.

c. National Heritage Resources Act No 25 of 1999, section 35

This act (Act 107 of 1998) states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made. Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

1.5.2 Background to HIA and AIA Studies

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are 'generally' protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

A detailed guideline of statutory terms and requirements is supplied in Addendum 1.

2 REGIONAL CONTEXT

2.1 Area Location

The proposed Sturdee Energy PPC Slurry Solar Project occurs on Portions of the farm Slurry 96 JO in the Ngaka Modiri Molema District Municipality, North West Province. The project area is situated approximately 18km east of the town of Mahikeng at the PPC Slurry Operations plant. The site lies along the R49 road which connects the town of Zeerust to Slurry and Mahikeng. The study areas appear on 1:50000 map sheet 2525DD (see Figure 2-1) and a key location point for the project is:

- **Site Alternative 1 (Preferred): S25.821008° E25.828686°**
- **Site Alternative 2: S25.824630° E25.844909°**

2.2 Area Description: Receiving Environment

The development site lies within the larger Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The original vegetation is classified as Moist Cool Highveld Grassland. The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. The general landscape is characterised by undulating, Highveld grassland. The development site lies within the Savanna biome which is the largest biome in Southern Africa. It is characterized by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). The environmental factors delimiting the biome are complex and include altitude, rainfall, geology and soil types, with rainfall being the major delimiting factor. Fire and grazing also keep the grassy layer dominant. The most recent classification of the area by Mucina & Rutherford shows that the site is classified as Ghaap Plateau Vaalbosveld. The landscape features of the Ghaap Plateau Vaalbosveld vegetation type is a flat plateau with well-developed shrub layer dominated by *Tarchonanthus camphoratus* underlain by surface limestone and dolomite. The conservation status of the Ghaap Plateau Vaalbosveld is Least Threatened with none conserved in statutory reserves and only 1% transformed (Mucina & Rutherford, 2006). This vegetation type covers most of the Ghaap Plateau, and is found on different types of soils, such as calcareous tufa, dark brown to red sands and acid gravels, all underlain by dolomite. An ecological assessment will be conducted and included in the EIA Report.

2.3 Site Description

The proposed project is situated at the PPC Slurry Operations plant in a rural agricultural zone of in the North West Province. Vegetation in the project area range from moderately dense to dense surface cover which has been altered in places by agricultural activities, digging and refuse dumping. A shallow quarry occurs along the western boundary of the project area where calcrete rock banks, which seems to constitute much of the substrate of the project area, were exposed. Heaps of rock, building rubble and refuse occur in places in the area. A small wetland occurs in the project area but no other prominent landscape features (e.g. hills, drainage lines) occur within or in the immediate surroundings of the study area. The region consists mostly of crop, cattle and game farms but an increasing number of mines and quarries occur around rich limestone and cement resources. The major land use of the study area as classified by the Environmental Potential Atlas of South Africa (2000) is vacant / unspecified land.

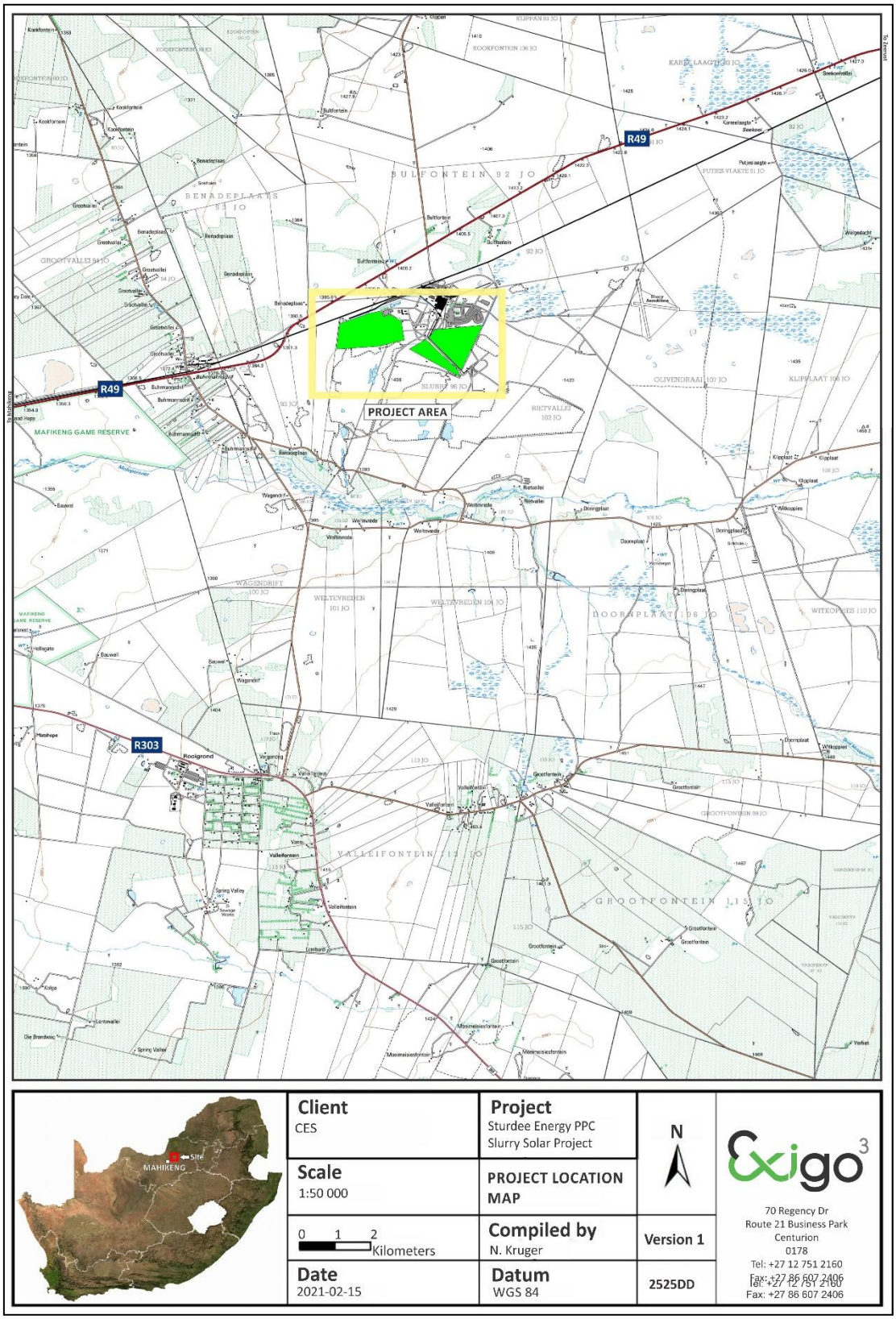


Figure 2-1: 1:50 00 Map representation of the location of the proposed Sturdee Energy PPC Slurry Solar Project (sheet 2525DD).

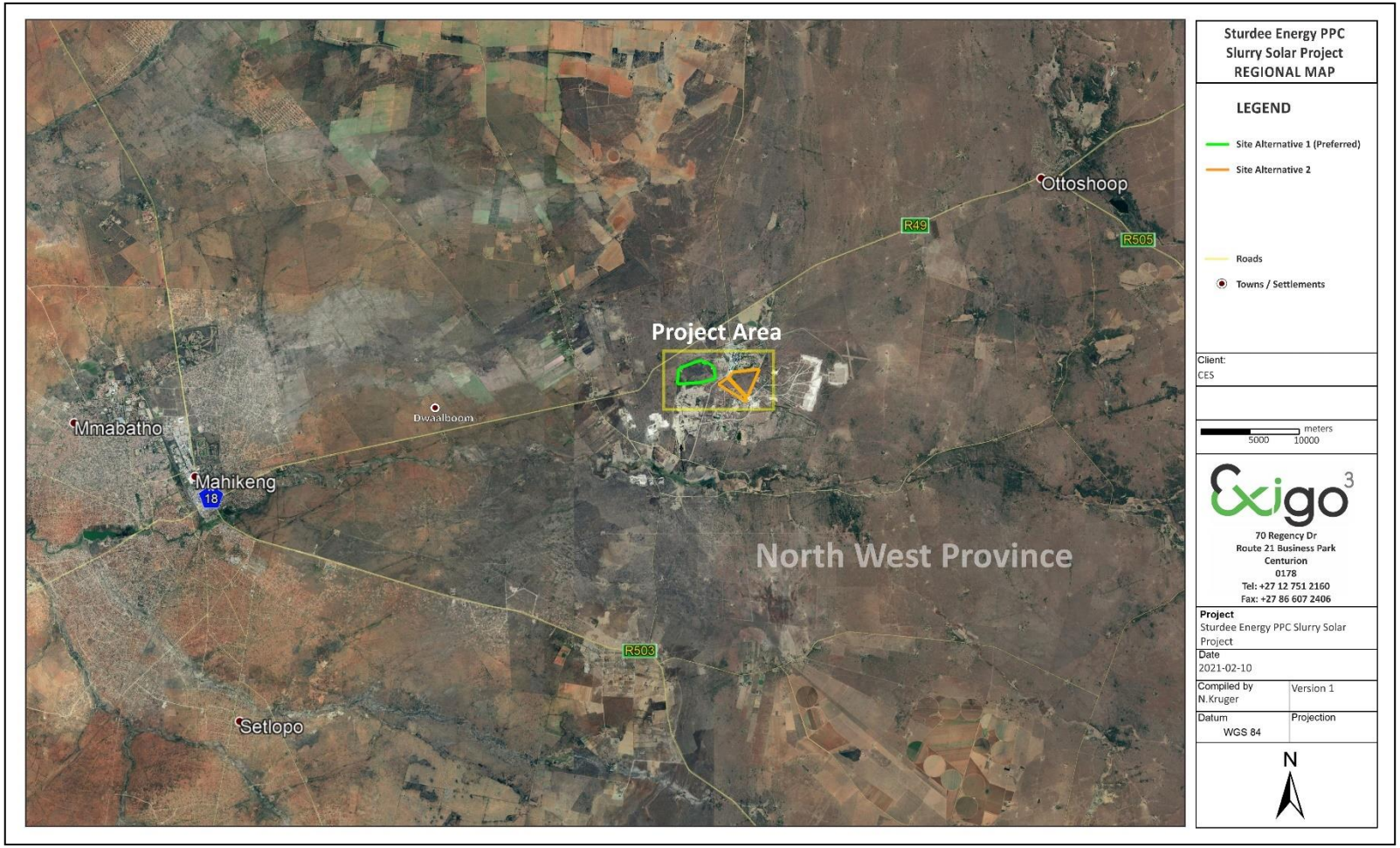


Figure 2-2: Aerial map providing a regional context for the proposed Sturdee Energy PPC Slurry Solar Project.

3 ARCHAEO-HISTORICAL CONTEXT

3.1 The Paleontological Landscape (refer to Fourie 2021 in Addendum 4)

3.1.1 Regional Geological History

Over areas totalling fully 40% of Southern Africa the 'hard rocks', from the oldest to the Quaternary, are concealed by normally unconformable deposits – principally sand, gravel, sandstone, and limestone. Inland deposits are much more extensive than marine deposits and are terrestrial and usually unfossiliferous. Some of these deposits date back well into the Tertiary, whereas others are still accumulating. Owing to the all-to-often lack of fossils and of rocks suitable for radiometric or palaeomagnetic dating, no clear-cut dividing line between the Tertiary and Quaternary successions could be established (Kent 1980). The alluvium sands were deposited by a river system and reworked by wind action (Snyman 1996). A thick cover of Kalahari reddish sand blankets most outcrops and is dominated by the typical Kalahari thornveld (Norman and Whitfield 2006).

The Kalahari deposits extend in age down to at least the Late and probably the Early Tertiary (65 million years ago). Fossils are scarce, and are of terrestrial plants and animals with close affinity to living forms. Included in the Kalahari Group are the Quaternary alluvium, terrace gravels, surface limestone, silcrete, and aeolian sand. Four major types of sands have been delineated (Kent 1980, Visser 1989). The alluvium sands were deposited by a river system and reworked by wind action (Snyman 1996). A thick cover of Kalahari reddish sand blankets most outcrops and is dominated by the typical Kalahari thornveld (Norman and Whitfield 2006). The Kalahari Group is underlain by the Uitenhage and Zululand Groups (McCarthy and Rubidge 2005). The Gordonia Formation (Qg) is of Late Pliocene / Pleistocene to Recent in age (the well-known "Kalahari Sands"). It can be up to 30 m thick and form part of a vast dune sea or erg that stretches northwards to the equator and beyond (Almond and Pether 2009).

The Transvaal Supergroup fills an east-west elongated basin in the south-central part of the old Transvaal (now North – West, Gauteng and Mpumalanga) as far south as Potchefstroom. It is Vaalian in age, approximately 2600 Ma to 2100 Ma. A maximum thickness of the Transvaal Supergroup reaches 2000 m in the north-eastern section. The east-west elongated basin is filled with clastic, volcanic and chemical sedimentary rocks. Three groups based on lithological differences have been established: they are the Rooiberg, Pretoria and Chuniespoort Groups as well as other smaller groups (Kent 1980, Snyman 1996). It is the Bushveld Complex that is responsible for the tilting of the Transvaal sediments and the heat of its intrusion having created andalusite crystals (Norman and Whitfield 2006). This Supergroup is underlain by the Ventersdorp, Witwatersrand and Pongola Supergroups, and the Dominion Group. Three prominent ridges are present from the oldest to the youngest, the Time Ball Hill, Daspoort and Magaliesberg Formations (Norman and Whitfield 2006).

The Chuniespoort Group is made up of chemical and biochemical sediments such as dolomite, chert, limestone and banded iron formation, carbonaceous shale is also present. At the top of the Malmani Subgroup is the Duitschland Formation underlain by the Penge and Monte Christo Formations. Sandstone is mostly absent. It is this formation that has great economic value for its lead, zinc, dolomite, and manganese (Kent 1980, Snyman 1996). Fluorspar, concrete aggregate, iron ore and manganese are also mined from this formation. Cave formation in the dolomite is a major concern in developing areas, especially in the 1500m thick dolomite of the Malmani Subgroup. Chemical sediments such as fine-grained limestone and dolomite is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. The Black Reef Formation is known for

stromatolite carbonates and fossiliferous Late Cenozoic cave breccias similar to the Malmani dolomite.

The Black Reef Formation of the Transvaal Supergroup consists of quartzite with lenses of grit and conglomerate. Shale is always present, particularly near the top close to the contact with the overlying dolomite (Kent 1980). It is Vaalian in age and not very thick, only up to 500m in the north-east. It contains a fair amount of gold and the limestone is mined (Snyman 1996). The Black Reef Formation is known for stromatolite carbonates and fossiliferous Late Cenozoic cave breccias similar to the Malmani dolomite. Algal microfossils are reported from shales and are probably from diagenetic origin. Stromatolites are preserved in the subordinate carbonate rocks.

The Ventersdorp Supergroup consists mainly of andesitic lava, tuff and agglomerate. The Klipriviersberg Group and the Platberg Group are Randian in age, where the Rietgat Formation is Vaalian in age (Sheet information 2626 Wes Rand). The Ventersdorp Supergroup sits disconformably on the Witwatersrand Supergroup and is made up of the lower Klipriviersberg Group, the middle Platberg Group, and two formations (Bothaville and Allanridge). Together it can reach a maximum thickness of 4,260 m in some areas. It is described as an elliptical basin named after the town of Ventersdorp. Sediments accumulated in fault-bounded troughs or grabens and gold can be present (Norman and Whitfield 2006).

A volcanic event that started 2,714 million years ago is responsible for the Klipriviersberg Group of the Ventersdorp Supergroup, further eruptions of basalt and rhyolite formed the Platberg Group (McCarthy and Rubidge 2005). The Klipriviersberg Group comprises the lowest Westonaria, followed by the Alberton, Orkney, Jeannette, Loraine, and with the uppermost Edenville Formations (Kent 1980). Several formations make up the Platberg Group, the basal Kameeldoorns, Makwassie, and upper Rietgat Formations, the Bothaville and Allanridge Formations are grouped separately (Kent 1980). The Platberg Group consists predominantly of Randian age and Vaalian age rocks. The Rietgat Formation which is the predominant formation in the development area sits concordantly on the Makwassie Formation consisting of green-grey amygdaloidal, porphyritic lava (Garfield Member), interlayered with shale, tuff, greywacke conglomerate, and impure lacustrine limestone with algal stromatolites (2626 Wes Rand sheet info, Kent 1980). Soils forming can be divided into three groups with the solid lavas creating excellent conditions for foundations, the residual soils and the tuffs are not ideal for foundations (Snyman 1996). The Allanridge Formation is andesitic overlying the Bothaville Formation conformably (Kent 1980).

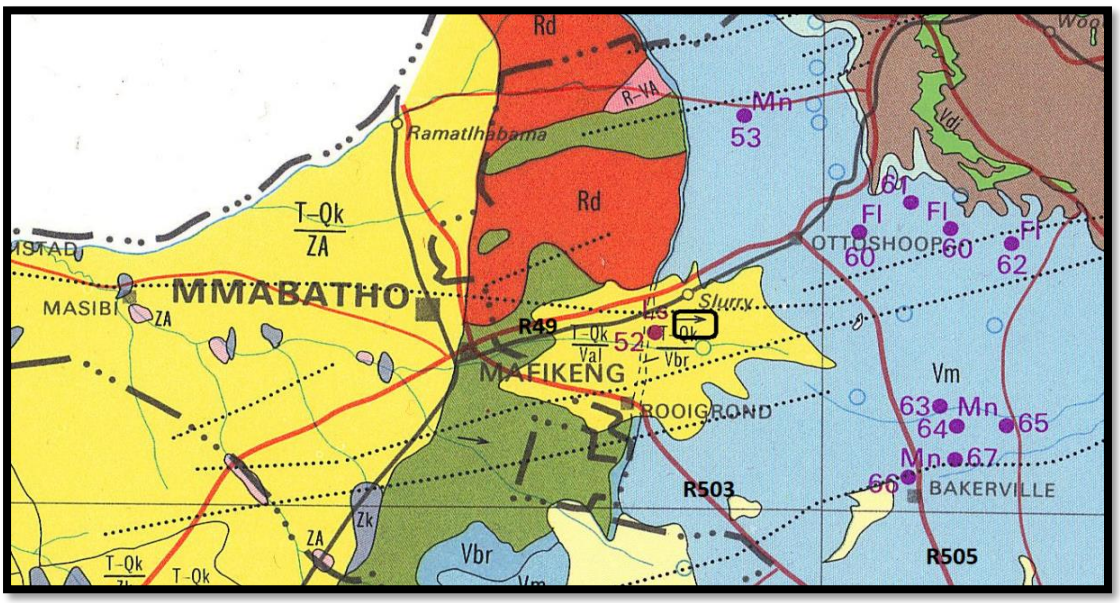


Figure 3-1: Excerpt of 1:100 000 Geological Map (1h).

Legend to map and short explanation.
T-Qk/Vbr – Sand, limestone (T-Qk) (yellow). Kalahari. Quaternary. [M]
Vm – Dolomite, chert (blue). Malmani Subgroup, Chuniespoort Group, Transvaal Supergroup. Vaalian. [H]
Vbr – Quartzite, conglomerate, shale, basalt (dark blue). Black Reef Formation, Transvaal Supergroup. Vaalian. [M]
Val – Andesite (green). Allanridge Formation, Ventersdorp Supergroup. Vaalian. [L]
→ - Dip of normal bed.
------ – (black) Lineament (Landsat, aeromagnetic).
------ - Concealed geological boundary.
⊥37˚ – Strike and dip of bed.
□ – Proposed development (blocked in black).

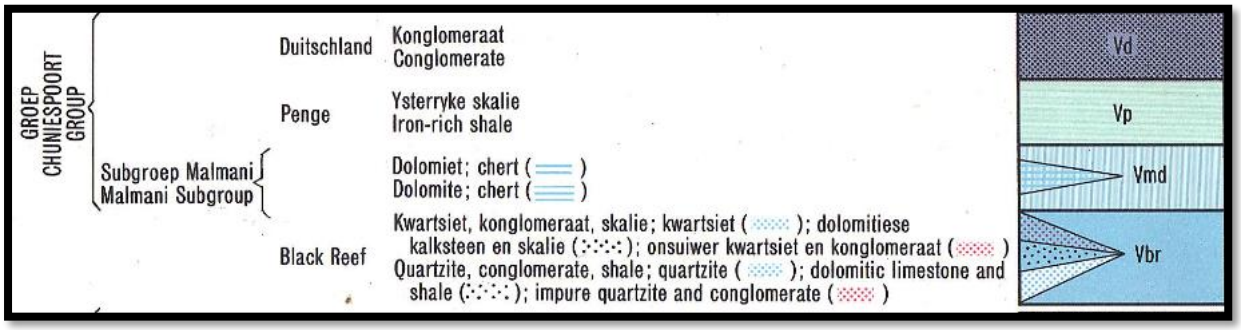


Figure 3-2: Lithostratigraphy (Walraven 1978).

3.1.2 Local Geology

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).

One of the formations in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area.

Figure 3-3: Photograph of a stromatolite (E. Butler).

A very wide range of possible fossil remains occur in the Cenozoic, though these are often sparse, such as: mammalian bones and teeth, tortoise remains, ostrich eggshells, non-marine mollusc shells, ostracods, diatoms, and other micro fossil groups, trace fossils (e.g. calcretised termitaria, rhizoliths, burrows, vertebrate tracks), freshwater stromatolites, plant material such as peats, foliage, wood, pollens, within calc tufa. Stromatolite structures range from a centimetre to several tens of metres in size. They are the result of algal growth in shallow water, indicating a very rich growth that would have caused an enrichment in the amount of oxygen in the atmosphere (Groenewald and Groenewald 2014).

Fossils will be present in caves, calctufa and pans and examples are a wide range of mammalian bones and teeth, tortoise remains, ostrich egg, non-marine mollusc shells, ostracods, diatoms, other micro fossils, trace fossils, stromatolites, plant remains and wood (Groenewald and Groenewald 2014).

Stromatolites are significant indicators of palaeoenvironments and provide evidence of algal growth between 2640 and 2432 million years ago (Groenewald and Groenewald 2014). Caves in the Malmani dolomite (Vmd) of the Transvaal Supergroup provided a refuge for man's distant ancestors (Norman and Whitfield 2006). These caves are also home to Middle and Late Stone Age cultures. The cave breccia in the Cradle of Humankind, near Johannesburg, yielded internationally renowned hominins such as *Australopithecus africanus and robustus* and extinct mammals and other fauna. The caves are actively being researched and excavated and this has led to many international collaborations. The caves are filled with sediments from the Kalahari Group.

Chemical sediments such as fine-grained limestone and dolomite of the Malmani Subgroup is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006). Chert may contain fossils such as echinoids or sponges if nodular, although not common and is rated unlikely.

In the rocks overlying the Black Reef Formation there is evidence for life on an abundant scale as cyanobacteria came to dominate the shallow sea forming stromatolites of varying shapes. Large, elongate stromatolite domes can be seen at Boetsap in the North West Province (McCarthy and Rubidge 2005) and the algal microfossils reported from the Time Ball Hill Formation shales are probably of diagenetic origin (Eriksson 1999).

KALAHARI (@k; @k1))			Gordonia (Qg);		Aeolian sand	Palynomorphs, root casts (rhizomorphs / rhizoliths) and burrows (eg termitaria), rare vertebrate remains (mammals, fish, ostrich egg shell etc), diatoms, freshwater stromatolites, freshwater and terrestrial shells (gastropods, bivalves), ostracods, charophytes	Fossils mainly associated with ancient pans, lakes and river systems Palaeontology poorly studied. Basal Late Cretaceous gravels and lacustrine clays probably fossiliferous (bones, teeth, petrified wood, palynomorphs) but v. rarely exposed.
			Qsi; Qa		Fluvial gravels, sands, lacustrine and pan mudrocks, diatomites and diatomaceous limestones, evaporites, consolidated to unconsolidated aeolian sands, pedocretes (especially calcrete) Late Cretaceous to Recent 90 Ma to 0 Ma		
			Lonely (Qlo)				
			Makolanen (@mo; @mo1; @mo2; @mo3)				
			Eden (Te; Te1; Te2; Te3; Te4; Te5; Te6; Te7; Te8)				
			Budin (Tbu; Tbu1)				
			T-Qc; Tl; T12				

	CHUNIESPOORT			(Vp; Vla; Qd; Vda; Vk; Vpe)		Banded ironstone	Stromatolites	ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS WITHIN "TRANSVAAL DOLOMITE" OUTCROP AREA (breccias not individually mapped)
		Malmani (Vm; Vma)		Mma; Vmm; Vmo; Vmo1; Vmo2; Vmf; Vme; Ve; Ve1; Vml; Va1; Va2; Va3; Vmd; Vm; Vc; Vb; Vf; Vfr; Vfr1; Vfr2; Ve; Vl; Vmo1; Vmo2; Vmo3; Vo; Voa		Stromatolitic carbonates (limestones / dolomites), minor secondary cherts, mudrocks including carbonaceous shales	Range of shallow marine to intertidal stromatolites (domes, columns etc), organic-walled microfossils	
				Black Reef (Vbr); Vryburg (Vv; Vvr; Vvr1; Vvk; Vvq)		Quartzite, conglomerate and shale. Stromatolitic carbonates	Stromatolites	
	SKILPADHEK (Vsk)					Conglomerate, basic and acid lava, tuff and quartzite	No fossils recorded	
VENTERSDORP (Rv; R)				Allanridge (R; Ra)		Basaltic lava and tuff	No fossils recorded	
				Bothaville (Rbt)		Quartzite, conglomerate and greywacke	No fossils recorded	
	PLATBERG (Rp)			Ra; Rb; Rm; Rma; Rgb; Rka; Rkm; Rka1; Rka2		Basic and acid volcanics with subordinate siliciclastic sediments (breccias, conglomerates, sandstones, mudrocks), with minor limestones and cherts in upper part of succession Late Archaean Randian 2.7-2.5	Lacustrine stromatolites and possible microfossils	Stromatolites and possible microfossils recorded from sediments of Platberg Group elsewhere (Northern Free State) and therefore might also be present in North West Province
				Rietgat (Rr; Rrg; Rrg2)		Predominantly lavas with minor metasediments (fluvial and lacustrine conglomerates, breccias, minor shales, stromatolitic carbonates, cherts)	Lacustrine stromatolites reported in carbonates,of Rietgat Formation (Platberg Group); possible organic-walled microfossils in cherts. LIP (Large Igneous Province) with voluminous eruptions of basaltic and other lavas.	Stromatolites recorded from borehole cores. Any surface occurrences would be of considerable interest.
				Rm; Rgb; Rkm			Possible stromatolites	
	KLIPRIVIERSBERG (Rk)			Rk; Ral; Rmk		Basic and acid volcanics with subordinate siliciclastic sediments	No fossils recorded	

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 LOW to VERY HIGH.

3.2 The Archaeological Landscape

Archaeology in Southern Africa is typically divided into two main fields of study, the **Stone Age** and the **Iron Age** or **Farmer Period**. The following table provides a concise outline of the chronological sequence of periods, events, cultural groups and material expressions in Southern African pre-history and history.

Table 1 Chronological Periods across Southern Africa

Period	Epoch	Associated cultural groups	Typical Material Expressions
Early Stone Age 2.5m – 250 000 YCE	Pleistocene	Early Hominins: *Australopithecines* *Homo habilis* *Homo erectus*	Typically large stone tools such as hand axes, choppers and cleavers.
Middle Stone Age 250 000 – 25 000 YCE	Pleistocene	First *Homo sapiens* species	Typically smaller stone tools such as scrapers, blades and points.
Late Stone Age 20 000 BC – present	Pleistocene / Holocene	*Homo sapiens sapiens* including San people	Typically small to minute stone tools such as arrow heads, points and bladelets.
Early Iron Age / Early Farmer Period 300 – 900 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	First Bantu-speaking groups	Typically distinct ceramics, bead ware, iron objects, grinding stones.
Middle Iron Age (Mapungubwe / K2) / early Later Farmer Period 900 – 1350 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	Bantu-speaking groups, ancestors of present-day groups	Typically distinct ceramics, bead ware and iron / gold / copper objects, trade goods and grinding stones.
Late Iron Age / Later Farmer Period 1400 AD -1850 AD **(commonly restricted to the interior and north-east coastal areas of Southern Africa)**	Holocene	Various Bantu-speaking groups including Venda, Thonga, Sotho-Tswana and Zulu	Distinct ceramics, grinding stones, iron objects, trade objects, remains of iron smelting activities including iron smelting furnace, iron slag and residue as well as iron ore.
Historical / Colonial Period ±1850 AD – present	Holocene	Various Bantu-speaking groups as well as European farmers, settlers and explorers	Remains of historical structures e.g. homesteads, missionary schools etc. as well as, glass, porcelain, metal and ceramics.

3.3 Discussion: The North West Heritage Landscape

The North West Province and its surroundings is very rich in history and remnants of cultural activities from the past. Several of the old Batswana tribes take their origins back to this region during the 18th century and 19th century. The natural dolomite underground cavern system at Lepalong represents remains of a time of strife during the Later Iron Age. The Vredefort Dome contains many caves and rock shelters, stone-walled ruins of Iron Age settlements, pioneer European farmsteads, remains of gold mining and Anglo-Boer War relics. The first South African War of Independence (1880-1881) and the Anglo-Boer War (1899-1902) had a

significant influence on the North West Province.

3.3.1 Early History and the Stone Ages

According to archaeological research, the earliest ancestors of modern humans emerged some two to three million years ago. The remains of Australopithecine and Homo habilis have been found in dolomite caves and underground dwellings in the Bankeveld at places such as Sterkfontein and Swartkrans near Krugersdorp. Homo habilis, one of the Early Stone Age hominids, is associated with Oldowan artefacts, which include crude implements manufactured from large pebbles. The Acheulian industrial complex replaced the Oldowan industrial complex during the Early Stone Age. This phase of human existence was widely distributed across South Africa and is associated with *Homo erectus*, who manufactured hand axes and cleavers from as early as one and a half million years ago. Oldowan and Acheulian artefacts were also found four to five decades ago in some of the older gravels (ancient river beds and terraces) of the Vaal River and the Klip River in Vereeniging. The earliest ancestors of modern man may therefore have roamed the Vaal valley at the same time that their contemporaries occupied some of the dolomite caves near Krugersdorp. Middle Stone Age sites dating from as early as two hundred thousand years ago have been found all over South Africa. Middle Stone Age hunter-gatherer bands also lived and hunted in the Orange and Vaal River valleys. These people, who probably looked like modern humans, occupied campsites near water but also used caves as dwellings. They manufactured a wide range of stone tools, including blades and point s that may have had long wooden sticks as hafts and were used as spears. The Late Stone Age commenced twenty thousand years ago or somewhat earlier. The various types of Stone Age industries scattered across the country are associated with the historical San and Khoi-Khoi people. The San were renowned as formidable hunter-gatherers, while the Khoi-Khoi herded cattle and small stock during the last two thousand years. Late Stone Age people manufactured tools that were small but highly effective, such as arrow heads and knives. The Late Iron Age people were also known for their rock art skills. At least one rock engraving site exists near Vereeniging, at Redan.

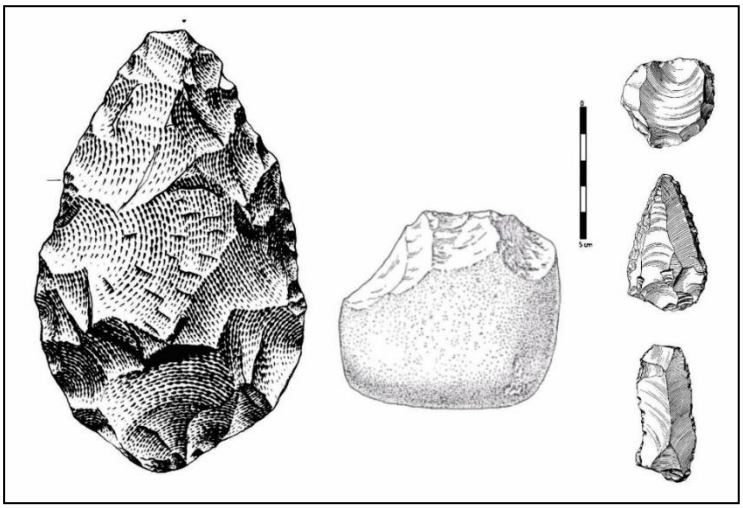


Figure 3-4: Typical ESA handaxe (left) and cleaver (center). To the right is a MSA scraper (right, top), point (right, middle) and blade (right, bottom).

3.3.2 Pastoralism and the last 2000 years

Until 2000 years ago, hunter-gatherer communities traded, exchanged goods, encountered and interacted with other hunter-gatherer communities. From about 2000 years ago the social dynamics of the Southern African landscape started changing with the immigration of two 'other' groups of people, different in physique, political, economic and social systems, beliefs and rituals. One of these groups, the Khoekhoe pastoralists or herders entered Southern Africa with domestic animals, namely fat-tailed sheep and goats, travelling through

the south towards the coast. They also introduced thin-walled pottery common in the interior and along the coastal regions of Southern Africa. Their economic systems were directed by the accumulation of wealth in domestic stock numbers and their political make-up was more hierarchical than that of the hunter-gatherers.

3.3.3 Iron Age / Farmer Period

The beginnings of the Iron Age (Farmer Period) in Southern Africa are associated with the arrival of a new Bantu speaking population group at around the third century AD. These newcomers introduced a new way of life into areas that were occupied by Later Stone Age hunter-gatherers and Khoekhoe herders. Distinctive features of the Iron Age are a settled village life, food production (agriculture and animal husbandry), metallurgy (the mining, smelting and working of iron, copper and gold) and the manufacture of pottery. Iron Age people moved into Southern Africa by c. AD 200, entering the area either by moving down the coastal plains, or by using a more central route. From the coast they followed the various rivers inland. Being cultivators, they preferred rich alluvial soils. The Iron Age can be divided into three phases. The Early Iron Age includes the majority of the first millennium A.D. and is characterised by traditions such as Happy Rest and Silver Leaves. The Middle Iron Age spans the 10th to the 13th Centuries A.D. and includes such well known cultures as those at K2 and Mapungubwe. The Late Iron Age is taken to stretch from the 14th Century up to the colonial period and includes traditions such as Icon and Letaba.

The archaeological record of the Free State and North West Province represents a long time span during the human past. The area is exceptionally rich in terms of Iron Age living sites, which date between mid 17th century and early 19th century (Maggs 1976, Mason 1962, 1986, Evers 1988). For various reasons, there is still a relative lack in research results from the Free State, but certain Later Iron Age sites, have produced important archaeological information (Maggs1976, Dreyer 1996). The Later Iron Age phase brought people who cultivated crops, kept livestock,produced an abundance of pottery in a variety of shapes and sizes and smeltedmetals. Extensive stone-walled enclosures characterise their permanent settlements. These living places are known from the prominent Sotho/Tswana settlements along the Renoster and Vals Rivers near Kroonstad and Bothaville and in the Magaliesberg. A number of Taaibos Korana and Griqua groups, remnants of the Later Stone Age peoples, managed to survive the assimilation by Sotho/Tswana tribes at Mamusa near Schweizer Reneke (Van den Berg 1996). Dramatic climate changes resulted in a rapid population growth along the east coast of South Africa. Increased pressure on the natural resources and attempts to control trade during the early 19th century brought the emergence of powerful leaders in the coastal area. Subsequent power struggles developed in a period of instability on the central Highveld. This time of strife or wars of devastation, known as “difaqane” (Sotho/Tswana) or “Mfecane” (Nguni), affected many of the Black tribes in the interior. Attacks from east of the escarpment initiated by the AmaZulu impis of Chaka in about 1822, were sustained by the AmaNdebele of Mzilikazi and the AmaNgwane of Matiwane into the Free State and North West Province, thus uprooting among others, the Batlokwa of Sekonyela and Mantatise and various smaller Sotho/Tswana tribes further inland. On their turn, the Batlokwa drove off the Bafokeng of Sebetoane from Kurutlele near Senekal in the Free State, who, in their effort to escape the pursuit by the AmaNdebele forces, eventually landed up in the Caprivi (Dreyer & Kilby 2003). This period of unrest directly affected the peoples of the Free State and North West Province, resulting in the displacement of scores of tribesmen, women and children. The stronger tribal groups, such as the AmaNdebele of Mzilikazi, assimilated many of these Batswana refugees. Early European missionaries and travellers ventured into the interior of the country during the 19th century (Dreyer 2001) and the Rev James Archbell established the missionary at Thaba Nchu by 1834. Several of the marauding hordes affected the lives of the Batswana people living at Dithakong near the mission station of Robert and Mary Moffat near Kuruman.

The Iron Age archaeology of the Free State and North West Province is characterised by a wide distribution of stone-walled sites on the flat-topped ridges and hills. There is detail and consistency in the arrangement and design of these structures. People's expression of culture has left its imprint on the material environment. The settlement patterns display human perceptions with regard to social clustering, economic system and political organisation. Patterns culminate in the arrangement of huts, byres and middens in a particular order and in relation to one another. Spatial organisation in general is characterised by the central position of stock byres and the placing of the main dwelling area on the perimeter of the settlement. Although a variety of different classes and types of settlement have been defined, these are all variations of the Central Cattle Pattern (CCP), a specific model for the organisation and use of space in Zulu and Sotho/Tswana settlements. The classification of sites is based on the assumption that settlement layout is bound and prescribed by cultural perceptions. The identification of different ethnic groups is thus possible from the way in which these traditional peoples organised their different living places in terms of space and time. The result was directed by cultural preference (choice) and function. The significance of livestock, personal status, kinship, social organisation and the diverse roles of men, women and offspring have always been important in the understanding of settlement patterns. The Later Iron Age classification of settlement patterns formulated by Maggs (1976) and Mason (1986), produced a standardised archaeological framework for the ordering of structures and sites characterised respectively by stock enclosures with connecting walls, in certain cases including corbelled huts (Type V), surrounding walls (Type N) and huts with bilobial courtyards (Type Z). Associated pottery assemblages with different decoration styles confirm the classification of sites based on layout (Maggs 1976:290). Different settlement patterns also produced huts of different materials in different styles.

3.3.4 Later History: Reorganization, Colonial Contact and living heritage.

The Historical period in Southern Africa encompass the course of Europe's discovery of South Africa and the spreading of European settlements along the East Coast and subsequently into the interior. In addition, the formation stages of this period are marked by the large-scale movements of various Bantu-speaking groups in the interior of South Africa, which profoundly influenced the course of European settlement. Finally, the final retreat of the San and Khoekhoen groups into their present-day living areas also occurred in the Historical period in Southern Africa.

Mahikeng, commonly known as Mafikeng (and previously Mafeking) is the headquarters of the Barolong Boo Ratshidi people. The town was founded by Molema Tawana (c. 1822 – January 1882). Born in Khunwana during the difaqane period, Molema was the son of Kgosi Tawana of the Tshidi Barolong. Molema's brother and close confidant, Montshiwa, later became chief. During the period that the Tshidi Barolong resided at Thaba Nchu, where they found refuge during the difaqane, Molema was converted to Christianity by the Wesleyan missionaries based there. Molema's son and heir, Silas Molema, was educated at Healdtown College. In 1857 Molema led an advance guard to scout out the area along the Molopo River. This was a familiar area as they had previously lived in nearby Khunwana. Molema settled at Mahikeng (known in its early years as "Molema's town"), while the main body of the Barolong under Montshiwa followed. But Montshiwa did not feel safe at Mahikeng due to the close presence and encroachment of the Boers in the Transvaal. He led his followers to Moshaneng in the territory of the Bangwaketse in present-day Botswana. Molema remained at Mahikeng to ensure that the Barolong retained a presence there. Several of Montshiwa's other brothers were also stationed at crucial sites in the proximity of the Molopo. Molema had to use all his diplomatic skills on several occasions to prevent Boer incursion and settlement near Mafikeng. He has been described as a man of "strong personality and exceptional gifts...and Montshiwa's chief counsellor in vital matters". (S.M Molema:35) After negotiations with Molema, Montshiwa decided to return to Mafikeng in 1876.

Molema was a firm believer in Western education, having attended Healdtown; he opened a school for the Barolong once they had settled in the district. Molema became a farmer and businessman, as well as advising his brother Montshiwa. He died in 1882. One of his sons, Silas Molema, became a Doctor and historian of the Barolong. The settlement was named Mahikeng, a Setswana name meaning "place of stones". Later British settlers spelled the name as "Mafeking". The Jameson Raid started from Pitsani Pothlugo (or Potlogo) 24 miles (39 km) north of Mafeking on December 29, 1895. At the outbreak of the Second Boer War in 1899, the town was besieged. The Siege of Mafeking lasted 217 days from October 1899 to May 1900, and turned Robert Baden-Powell into a national hero. In September 1904, Lord Roberts unveiled an obelisk at Mafeking bearing the names of those who fell in defence of the town. British losses during the siege were 212 people killed, soldiers and civilians, and more than 600 wounded. Boer losses were significantly higher. Although it was outside the protectorate's borders, Mafeking served as capital of the Bechuanaland Protectorate from 1894 until 1965, when Gaborone was made the capital of what was to become Botswana. Mafeking also briefly served as capital of the Bantustan of Bophuthatswana in the 1970s, before the adjoining town of Mmabatho was established as capital when Bophuthatswana became nominally independent in 1977. Following a local referendum, Mafeking joined Bophuthatswana in 1980 and was renamed Mafikeng. The town was treated as a suburb of Mmabatho. Following the end of apartheid in 1994, Bophuthatswana was formally reincorporated into South Africa. With that, the merged Mafikeng and Mmabatho became capital of the new North-West Province under the name Mafikeng.

4 METHOD OF ENQUIRY

4.1 Sources of Information: PDA

Please refer to Fourie 2021 (see Addendum 4).

4.2 Sources of Information: AIA

Data from detailed desktop, aerial and field studies were employed in order to sample surface areas systematically and to ensure a high probability of heritage site recording.

4.2.1 Desktop Study

The larger landscape of Waterberg has been well documented in terms of its archaeology and history. A desktop study was prepared in order to contextualize the proposed project within a larger historical milieu. Numerous academic papers and research articles supplied a historical context for the proposed project and archival sources, aerial photographs, historical maps and local histories were used to create a baseline of the landscape's heritage. In addition, the study drew on available unpublished Heritage Assessment reports to give a comprehensive representation of known sites in the study area. Of particular interest to this assessment is the following previous assessment:

- ***Coetzee, F. 2008. Cultural Heritage Survey of the PPC Slurry Operation near Zeerust, North West Province. Department of Anthropology & Archaeology, University of South Africa***

4.2.2 Aerial Survey

Aerial photography is often employed to locate and study archaeological sites, particularly where larger scale area surveys are performed. The site assessment of the project area relied on this method to assist the foot and automotive site survey. Here, depressions, variation in vegetation, soil marks and landmarks were examined and specific attention was given to shadow sites (shadows of walls or earthworks which are visible early or late in the day), crop mark sites (crop mark sites are visible because disturbances beneath crops cause variations in their height, vigour and type) and soil marks (e.g. differently coloured or textured soil (soil marks) might indicate ploughed-out burial mounds). Attention was also given to moisture differences,

as prolonged dampening of soil as a result of precipitation frequently occurs over walls or embankments. In addition, historical aerial photos obtained during the archival search were scrutinized and features that were regarded as important in terms of heritage value were identified and if they were located within the boundaries of the project area they were physically visited in an effort to determine whether they still exist and in order to assess their current condition and significance. By superimposing high frequency aerial photographs with images generated with Google Earth as well as historical aerial imagery, potential sensitive areas were subsequently identified, geo-referenced and transferred to a handheld GPS device. These areas served as reference points from where further vehicular and pedestrian surveys were carried out.

4.2.3 Mapping of sites

Similar to the aerial survey, the site assessment of the project area relied on archive and more recent map renderings of Slurry to assist the foot survey where historical and current maps of the project area were examined. By merging data obtained from the desktop study and the aerial survey, sites and areas of possible heritage potential were plotted on these maps of the larger Waterberg region using GIS software. These maps were then superimposed on high-definition aerial representations in order to graphically demonstrate the geographical locations and distribution of potentially sensitive landscapes.

4.2.4 Field Survey

Archaeological survey implies the systematic procedure of the identification of archaeological sites. An archaeological survey of the Sturdee Energy PPC Slurry Solar Project area was conducted in February 2021. The process encompassed a random field survey in accordance with standard archaeological practice by which heritage resources are observed and documented. Particular focus was placed on GPS reference points identified during the aerial and mapping survey. Where possible, random spot checks were made and potentially sensitive heritage areas were investigated. Using a Garmin GPS, the survey was tracked and general surroundings were photographed with a Samsung Digital camera. Real time aerial orientation, by means of a mobile Google Earth application was also employed to investigate possible disturbed areas during the survey.

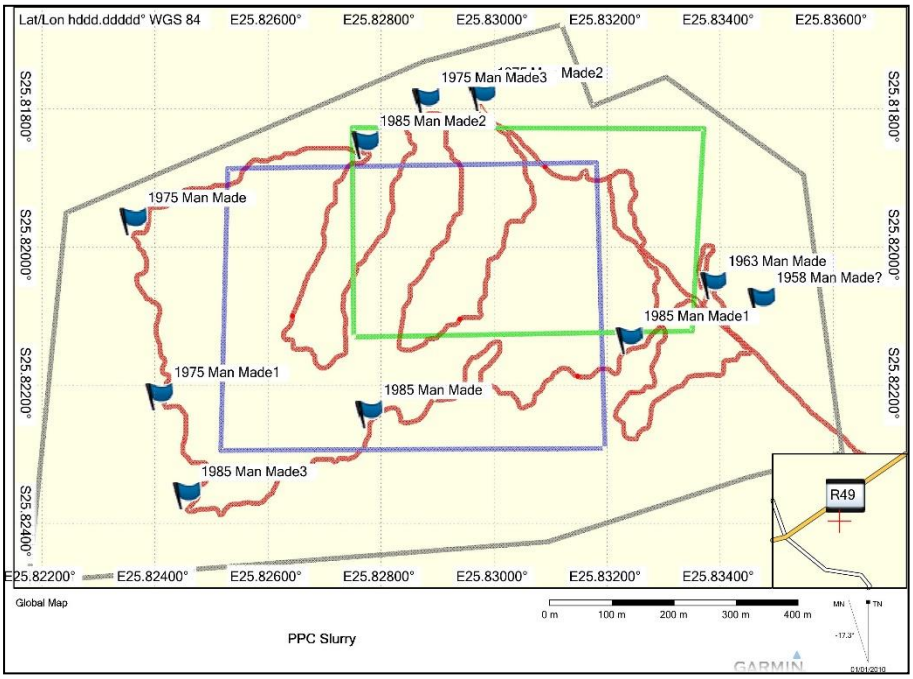


Figure 4-1: Map indicating the GPS Track log for the site survey (red lines). The initial project footprint is indicated by the blue rectangle, the final project footprint is indicated by the green rectangle and the total project area is indicated by the grey polygon. Place markers indicate *potential* man-made features identified from aerial photos.

4.2.5 General Public Liaison

Consultation with officials from PPC who are familiar with the area in question did not identify any heritage receptors in the project area.

4.3 Limitations

The site survey for the Sturdee Energy PPC Slurry Solar Project AIA primarily focused around areas tentatively identified as sensitive and of high heritage probability (i.e. those noted during the mapping and aerial survey) as well as areas of potential high human settlement catchment In terms of on-site limitations during the survey, the following should be noted:

- The project area is accessed via a mine service road connecting to the R49 road. Access control was arranged for the site assessment and no access restrictions onto the site were encountered during the site visit.
- The surrounding vegetation in the project area mostly comprised out of occasional trees and mixed grasslands with pioneering species occurring in places and the general visibility at the time of the site inspection (February 2021) proved to be a minor constraint in the project area.

Cognisant of the constraints noted above, it should be stated that the possibility exists that individual sites could be missed due to the localised nature of some heritage remains as well as the possible presence of sub-surface archaeology. Therefore, maintaining due cognisance of the integrity and accuracy of the archaeological survey, it should be stated that the heritage resources identified during the study do not necessarily represent all the heritage resources present in the project area. The subterranean nature of some archaeological sites, dense vegetation cover and visibility constraints sometimes distort heritage representations and any additional heritage resources located during consequent development phases must be reported to the Heritage Resources Authority or an archaeological specialist

Figure 4-2: View of an exposed rock face in the project area.

Figure 4-3: View of surface grasses along a small wetland in the project area.

Figure 4-4: Another view of vegetation in the project area.

Figure 4-5: View of occasional trees and scattered rocks in the project area.

Figure 4-6: A view of large overgrown earth heaps in the project area.

Figure 4-7: View of exposed decomposing calcrete formations in the project areas, the PPC Slurry plant is visible in the background.

Figure 4-8: View of a shallow quarry along the western boundary of the project area.

Figure 4-9: View of soil heaps along a quarry in the project area.

Figure 4-10: View of densely vegetated areas in the project area.

Figure 4-11: View of general surroundings in the project area, looking north.

4.4 Impact Assessment

For consistency among specialists, impacts were rated and assessed using an Impact and Risk Assessment Methodology provided by CES[2], for the Scoping Phase of the EIA process in accordance with the requirement of EIA Regulations. **Please refer to Section 6 and Addendum 2**.

5 RESULTS: AIA & PDA

5.1 Anticipated Paleontology (refer to Fourie 2021 in Addendum 4)

Chemical sediments such as fine-grained limestone and dolomite of the Malmani Subgroup is made up of deposits of organically derived carbonate shells, particles or precipitate. Dolomite is magnesium-rich limestone formed from algal beds and stromatolites. These Early Proterozoic Transvaal stromatolitic dolomites formed and released free oxygen at around 2900 – 2400 Ma. Stromatolites are common in the Malmani dolomites, accepted to be the fossil remnants of the simplest single-celled organisms. They are finely layered, concentric, mound-like structures formed by microscopic algal organisms (Norman and Whitfield 2006). Chert may contain fossils such as echinoids or sponges if nodular, although not common and is rated unlikely.

In the rocks overlying the Black Reef Formation there is evidence for life on an abundant scale as cyanobacteria came to dominate the shallow sea forming stromatolites of varying shapes. Large, elongate stromatolite domes can be seen at Boetsap in the North West Province (McCarthy and Rubidge 2005) and the algal microfossils reported from the Time Ball Hill Formation shales are probably of diagenetic origin (Eriksson 1999). All of the formations in the development area may contain stromatolites.

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.

5.2 Anticipated Archaeology

5.2.1 The Off-Site Desktop Survey

In terms of heritage resources, the general landscape around the project area is primarily well known for its Iron Age Farmer and Colonial / Historical Period archaeology related to farming, rural expansion and warfare of the past century. No particular reference to archaeological sites or features of heritage potential were recorded during an examination of published literature thematically or geographically related to the Slurry property. However, Coetzee (2008) conducted a Cultural Heritage Survey of the PPC Slurry Operation mining area and in his unpublished report[3], he mentions the presence of a historically significant mining shed, a coal store and kilns sites which are older than 60 years and therefore protected by the NHRA (Act No 25 of 1999). He also indicated the existence of 3 cemeteries around the area which is mined by PPC Slurry Operation, one of which is relevant to this assessment (see Section 5.2.4). An analysis of historical aerial imagery and archive maps reveals the following (see Figure 5-1 to Figure 5-6):

- The farm Rietvlei, which was later subdivided to form the Farm Slurry, was established towards the end of the 19th century and the property is indicated on an early map of the Transvaal region (Jeppe, 1899).

[2] CES Risk Assessment Methodologies Internal guideline document, 2019

[3] Coetzee, F. 2008. Cultural Heritage Survey of the PPC Slurry Operation near Zeerust, North West Province. Department of Anthropology & Archaeology, University of South Africa

- A number of so-called “huts”, a “kampong” (worker’s compound) and sewage works are indicated on topographic maps of the area dating to 1968, 1979 and 1981.
- Aerial imagery dating to 1958, 1963, 1975 and 1985 indicate that portions of the Slurry property - and particularly areas subject to this assessment - have been altered by more recent mining activities. Possible buildings and potential man-made structures appear to exist within the project area on these images.
- Van Warmelo (1935) indicates a number of Barolong groups residing in and around Mahikeng and the project area in 1935.

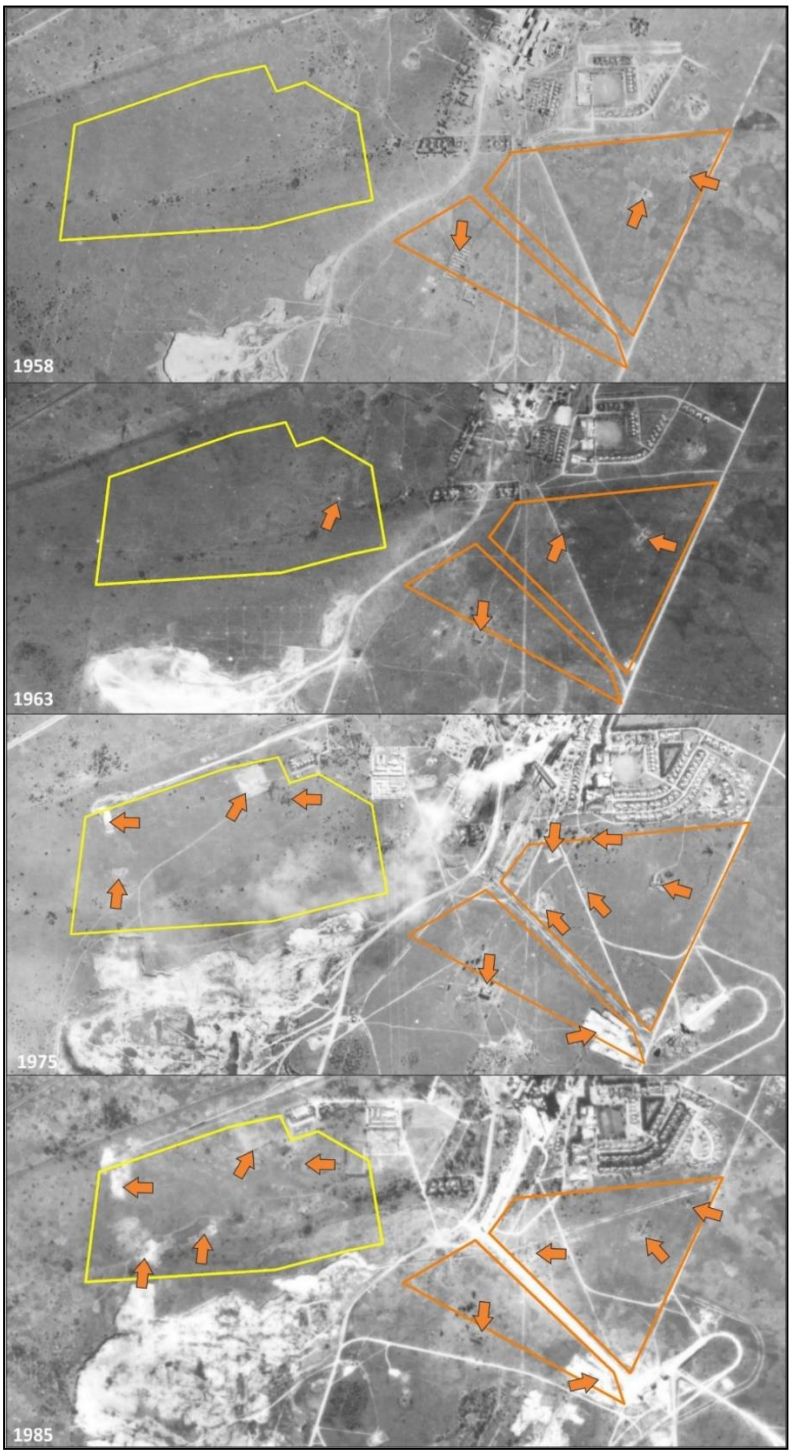
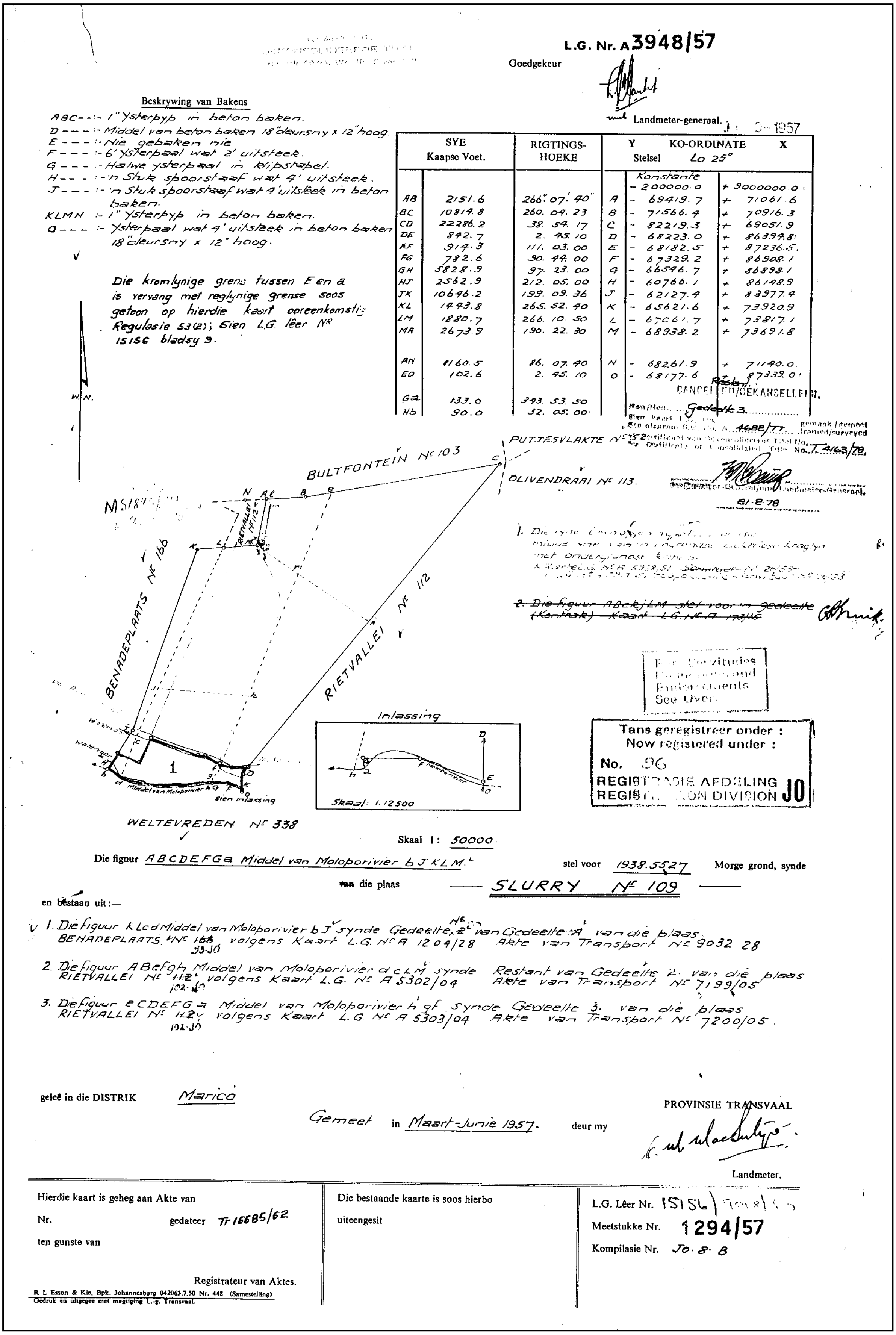


Figure 5-1: Historical aerial images of the project site on Slurry (yellow and orange outlines) indicating potential man-made structures or features of heritage potential, indicated by orange arrows.


L.G. Nr. A3948/57

Goedgekeur

Landmeter-generaal.

Beskrywing van Bakens

ABC - - :- 1" Ysterpyp in beton baken.
D - - - :- Middel van beton baken 18"deursny x 12" hoog.
E - - - :- Nie gebaken nie
F - - - :- 6' Ysterpaal wat 2' uitsteek.
G - - - :- Halwe ysterpaal in klipstapel.
H - - - :- 'n Stuk spoorstaaf wat 4' uitsteek.
J - - - :- 'n Stuk spoorstaaf wat 4' uitsteek in beton baken.
KLMN :- 1" Ysterpyp in beton baken.
a - - - :- Ysterpaal wat 4' uitsteek in beton baken 18"deursny x 12" hoog.

Die kromlynige grens tussen E en a is vervang met reglynige grense soos getoon op hierdie kaart ooreenkomstig Regulasie 53(2); Sien L.G. lêer Nº 15156 bladsy 3.

	SYE Kaapse Voet.	RIGTINGS-HOEKE		Y KO-ORDINATE Stelsel Lo 25°	X
				Konstante − 200000.0	+ 9000000.0
AB	2151.6	266° 07' 40"	A	− 69419.7	+ 71061.6
BC	10819.8	260. 04. 23	B	− 71566.4	+ 70916.3
CD	22286.2	38. 54. 17	C	− 82219.3	+ 69051.9
DE	842.7	2. 45. 10	D	− 68223.0	+ 86399.8
EF	914.3	111. 03. 00	E	− 68182.5	+ 87236.5
FG	782.6	90. 44. 00	F	− 67329.2	+ 86908.1
GH	5828.9	97. 23. 00	G	− 66596.7	+ 86898.1
HJ	2562.9	212. 05. 00	H	− 60766.1	+ 86148.9
JK	10646.2	199. 09. 36	J	− 62127.4	+ 83977.4
KL	1443.8	265. 52. 40	K	− 65621.6	+ 73920.9
LM	1880.7	266. 10. 50	L	− 67061.7	+ 73817.1
MA	2673.9	190. 22. 30	M	− 68938.2	+ 73691.8
AN	1160.5	86. 07. 40	N	− 68261.9	+ 71140.0
EO	102.6	2. 45. 10	O	− 68177.6	+ 87339.0
Ga	133.0	343. 53. 50			
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Restant. CANCELLED/GEKANSELLEER. Gedeelte 3.

Sien diagram S.G. No. A 4688/77. Sertifikaat van Gekonsolideerde Titel No. / Certificate of Consolidated Title No. T.4463/78.

Landmeter-Generaal 21.2.78

2. Die figuur ABckjLM staan voor 'n gedeelte (Kontrak) Kaart LG Nº A 12415

Tans geregistreer onder: Now registered under: No. 96 REGISTRASIE AFDELING REGISTRATION DIVISION JO

Skaal 1: 50000.

Die figuur ABCDEFGa Middel van Moloporivier bJKLM. stel voor 1938.5527 Morge grond, synde die plaas SLURRY Nº 109 en bestaan uit:—

1. Die figuur KLcdMiddel van Moloporivier bJ synde Gedeelte 2 van Gedeelte "A" van die plaas BENADEPLAATS Nº 166 volgens Kaart L.G. Nº A 1204/28 Akte van Transport Nº 9032 28
2. Die figuur ABefgh Middel van Moloporivier dcLM synde Restant van Gedeelte 2 van die plaas RIETVALLEI Nº 112 volgens Kaart L.G. Nº A 5302/04 Akte van Transport Nº 7199/05
3. Die figuur eCDEFGa Middel van Moloporivier hgf synde Gedeelte 3 van die plaas RIETVALLEI Nº 112 volgens Kaart L.G. Nº A 5303/04 Akte van Transport Nº 7200/05.

geleë in die DISTRIK Marico PROVINSIE TRANSVAAL

Gemeet in Maart-Junie 1957. deur my

Landmeter.

Hierdie kaart is geheg aan Akte van Nr. gedateer Tr 16685/62 ten gunste van

Registrateur van Aktes.

Die bestaande kaarte is soos hierbo uiteengesit

L.G. Lêer Nr. 15156
Meetstukke Nr. 1294/57
Kompilasie Nr. Jo. 8. B

R. L. Esson & Kie, Bpk. Johannesburg 042063.7.50 Nr. 448 (Samestelling)
Gedruk en uitgegee met magtiging L.-g. Transvaal.

Figure 5-2: A title deed for the farm Slurry dating to 1957.

Figure 5-3: Historical map of the old Transvaal region dating to 1899 (Jeppe) indicating the presence of the farm Rietvlei (yellow outline) which was later subdivided to form the Farm Slurry.

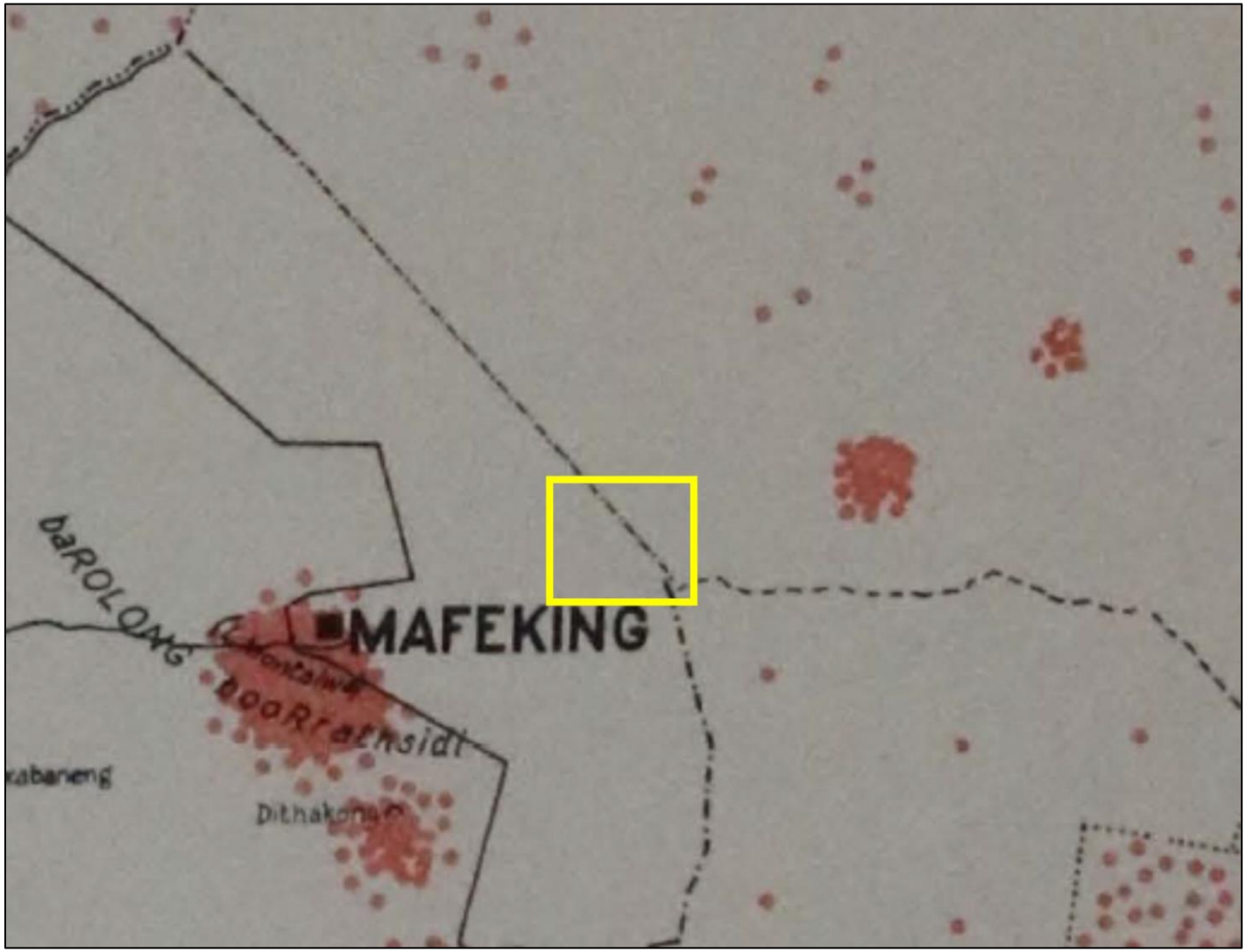
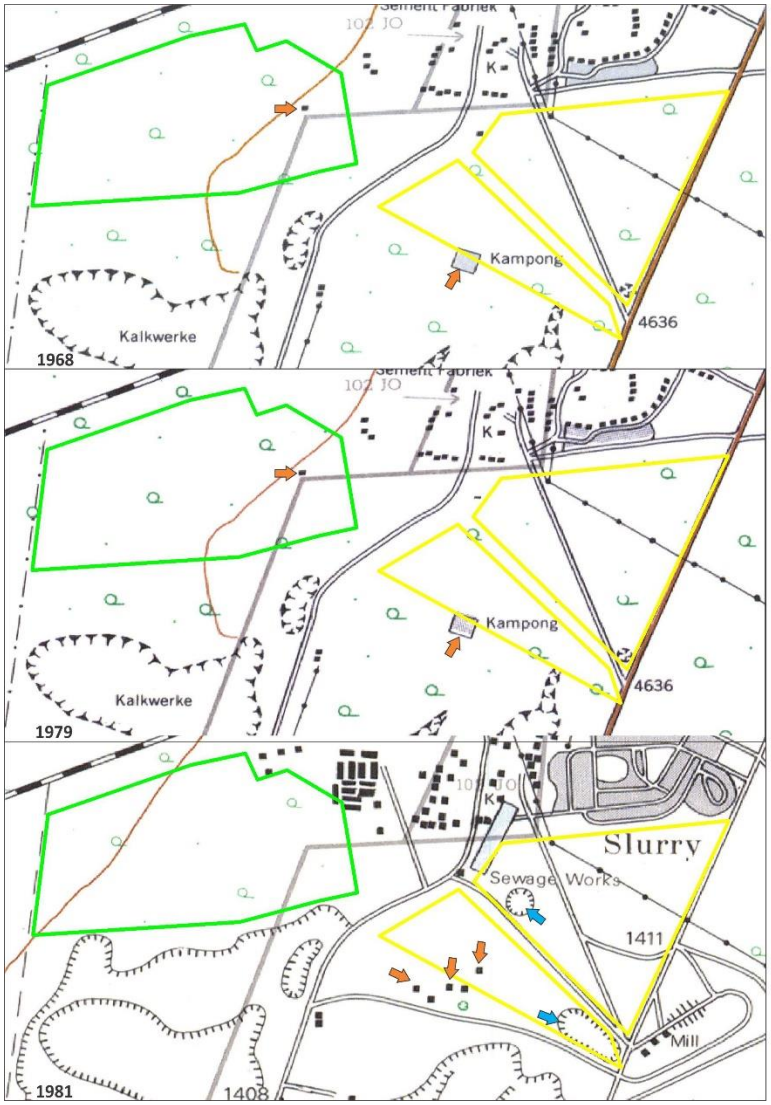


Figure 5-4: An excerpt of Van Warmelo's Map of the project landscape (the project area is indicated by the yellow block) dating to 1935. Each red dot represents "10 taxpayers". Note that the larger landscape was relatively densely populated by Barolong groups at the time.



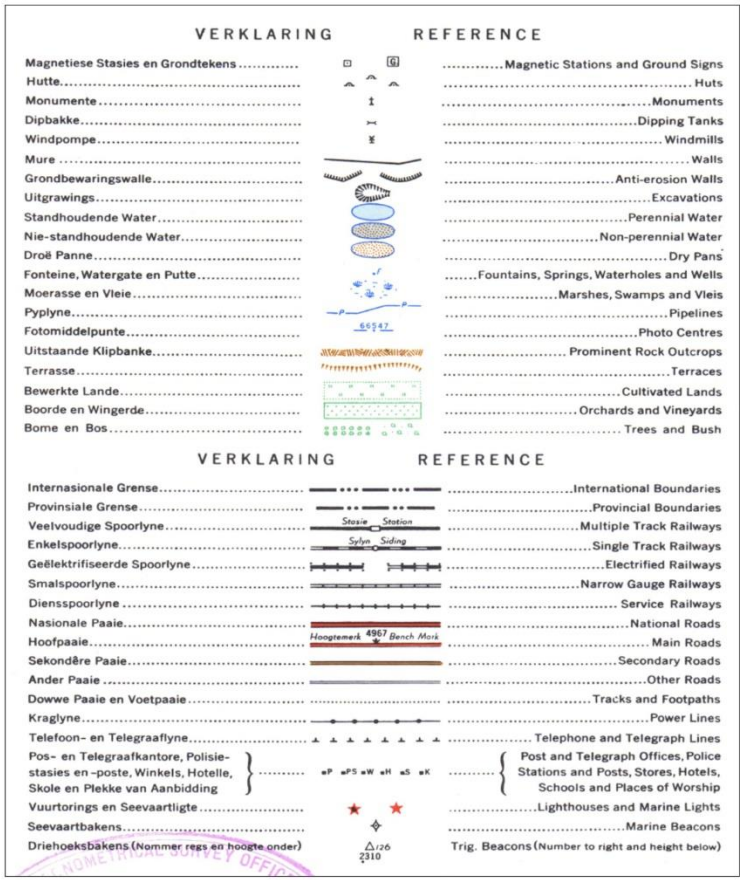


Figure 5-5: Historical topographic maps of Slurry indicating the locations of project areas (green and yellow outlines) in the past decades. Orange arrows indicate man-made structures and features and the blue arrows indicate a diggings / sewage works.

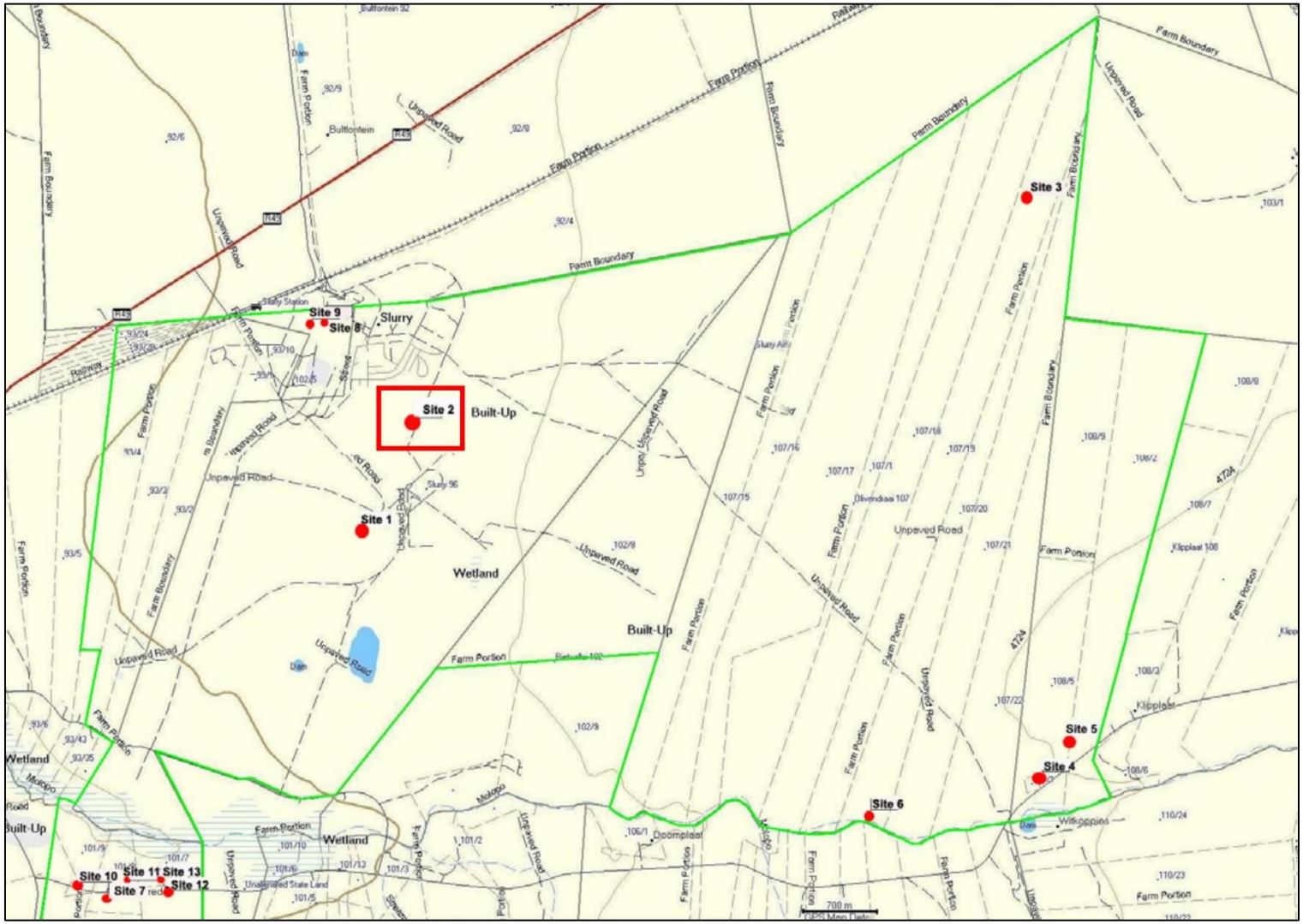


Figure 5-6: Map indicating the location of heritage sites in the larger PPC Slurry Operation mining area documented by Coetzee in 2008. "Site 2", indicated by the red block, is relevant to this assessment (after Coetzee 2008).

5.2.2 The Archaeological Site Survey

An analysis of historical aerial imagery and archive maps of areas subject to this assessment suggests a landscape which has been subjected to more recent mining activities possibly sterilising the area of heritage remains. This inference was confirmed during an archaeological site assessment but a single heritage site was nonetheless encountered. The following observations were made during the site survey:

- **The Stone Age**

Stone Age material generally occurs along drainage lines and exposed surfaces in the landscape. During the site survey no Stone Age occurrences were documented in Site Alternative 1 or Site Alternative 2.

- **The Iron Age Farmer Period**

A frontier zone between the east and the west, the Northern North West landscape holds vast amounts of Iron Age (Farmer period) remnants but no Farmer Period occurrences were noted in Site Alternative 1 or Site Alternative 2.

- **Historical / Colonial Period and recent times**

Mahikeng and its surroundings have a long and extensive Colonial Period settlement history. From around the first half of the 19th century, the area was frequented by explorers, missionaries and farmers who all contributed to a recent history of contact and conflict. The remnants of recent occupation and mining are scattered across the landscape but no Historical / Colonial Period occurrences were observed in Site Alternative 1 or Site Alternative 2. In terms of the built environment, the project area has no significance, as there are no old buildings, structures, or features, old equipment, public memorial or monuments in the footprint areas.

- **Graves**

No graves of human burial places were noted during the site investigation of Site Alternative 1 but a cemetery occurs in the footprint demarcated as Site Alternative 2.

  - **Site Exigo-PPCS-BP01 (S25.82279°S E25.85091°)**
    Cemetery

A large cemetery occurs in the footprint demarcated as Site Alternative 2. The site, which was first documented by Coetzee (2008) as “Site 2” consists of a cemetery measuring approximately 200 x 30 metres in extent. The graveyard holds in excess of 800 graves which are mostly demarcated by packed stones, except for a few with cement bases and headstones. The graves have an east-west orientation with headstones on the western side. Most of the graves have no inscriptions on the headstones therefore their age could not be determined. The burial site, which is of high heritage significance, occurs within the Alternative 2 site proposed for the project area and impact might occur (see Section 6).

Figure 5-7: View of burials with a head stone and grave dressings visible at Site Exigo-PPCS-BP01.

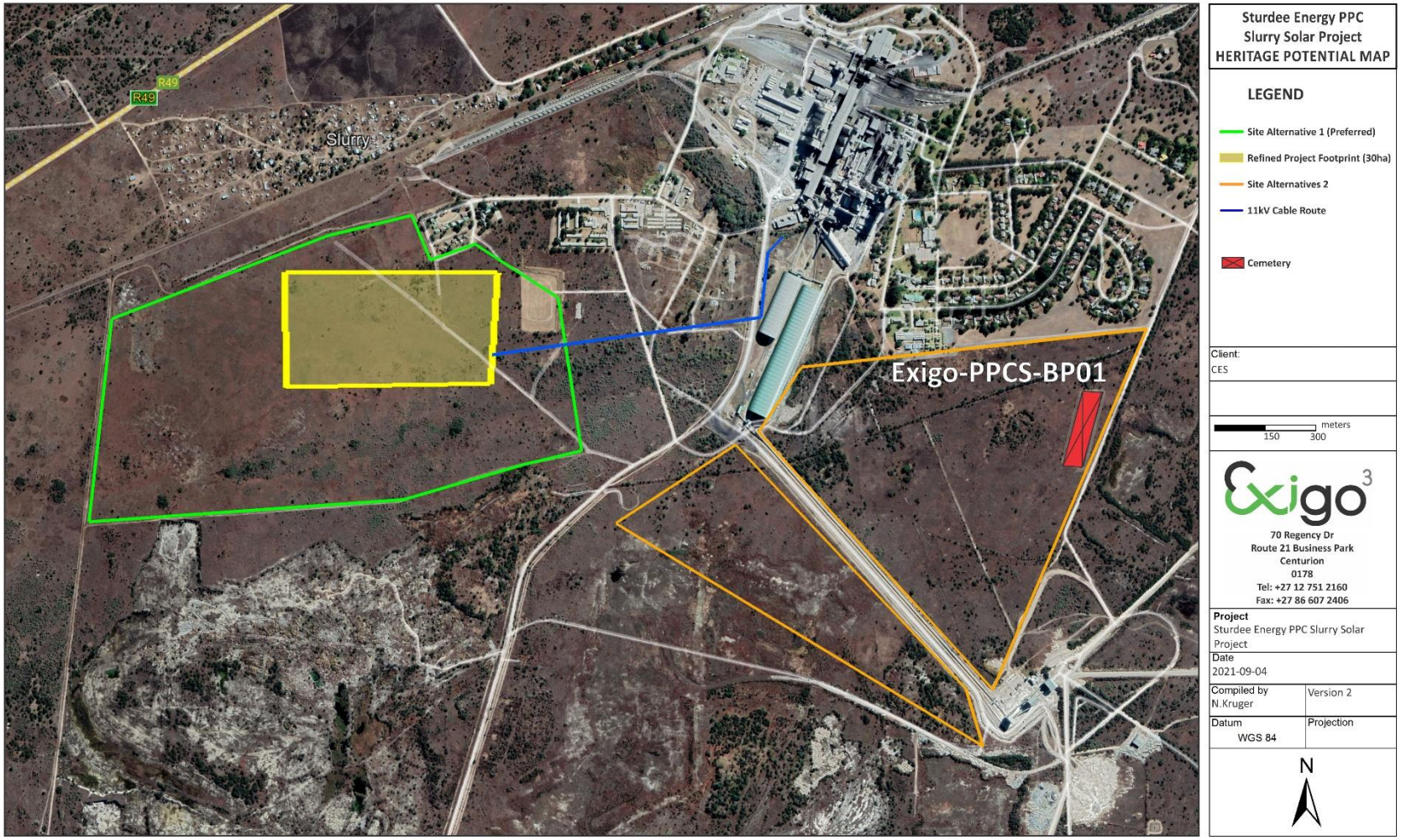


Figure 5-8: Aerial map indicating the location of the heritage site discussed in the text.

6 RESULTS: STATEMENT OF SIGNIFICANCE AND IMPACT RATING

6.1 Potential Impacts and Significance Ratings[4]

The following section provides a background to the identification and assessment of possible impacts and alternatives, as well as a range of risk situations and scenarios commonly associated with heritage resources management. A guideline for the rating of impacts and recommendation of management actions for areas of heritage potential within the study area is supplied in Section 10.2 of Addendum 3.

6.2 General assessment of impacts on heritage resources

Generally, the value and significance of archaeological and other heritage sites might be impacted on by any activity that would result immediately or in the future in the destruction, damage, excavation, alteration, removal or collection from its original position, of any archaeological material or object (as indicated in the National Heritage Resources Act (No 25 of 1999)). Thus, the destructive impacts that are possible in terms of heritage resources would tend to be direct, once-off events occurring during the initial construction period. However, in the long run, the proximity of operations in any given area could result in secondary indirect impacts. The EIA process therefore specifies impact assessment criteria which can be utilised from the perspective of a heritage specialist study which elucidates the overall extent of impacts.

6.2.1 Issues Identification Matrix

As noted previously, impacts were rated and assessed using an Impact and Risk Assessment Methodology provided by CES, for the Scoping Phase of the EIA process in accordance with the requirement of EIA Regulations. **Please refer to Addendum 2**.

The following tables summarize impacts to heritage receptors for the proposed Sturdee Energy PPC Slurry Solar Project.

[4] Based on: W inter, S. & Baumann, N. 2005. *Guideline for involving heritage specialists in EIA processes: Edition 1.*

Impact Assessment: Palaeontology

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Site Alternative 2	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE
Site Alternative 1 (Preferred)	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Impact Assessment: Archaeology

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Site Alternative 2	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE
Site Alternative 1 (Preferred)	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Impact Assessment: Built Environment

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Site Alternative 2	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE
Site Alternative 1 (Preferred)	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Impact Assessment: Cultural Landscape

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Site Alternative 2	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE
Site Alternative 1 (Preferred)	Negative	Short term	Study area	Slight	Definite	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Impact Assessment: Human Burial Sites

Criteria	Nature	Temporal Scale	Spatial Scale	Severity	Probability	Overall Significance before mitigation	Reversibility	Irreplaceable Loss	Mitigation Potential	Overall Significance after mitigation
Impact 1: Loss of Heritage Resources										
Site Alternative 2	Negative	Permanent	Regional	Severe/ Beneficial	Definite	VERY HIGH NEGATIVE	Irreversible	Resource will be lost	Achievable	VERY HIGH NEGATIVE
Site Alternative 1 (Preferred)	Negative	Short term	Study area	Slight/ Slightly Beneficial	Unlikely	LOW NEGATIVE	Irreversible	Resource will not be lost	Achievable	LOW NEGATIVE

Previous studies conducted in the Western North West Province and the Waterberg suggest a rich and diverse archaeological landscape. Generally, the area is highly suitable for pre-colonial habitation and, even though the project area contains no visible tangible heritage remains, the probability of exposing archaeological remains that might be present in surface and sub-surface deposits along drainage lines and in pristine areas during development should not be excluded.

6.2.2 Palaeontology (Fourie 2021)

The only Option presented is situated on the Tertiary Kalahari. One of the formations in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area. The potential impact of the development on fossil heritage is moderate.

6.2.3 Archaeology

The study did not identify any archaeological receptors which will be directly impacted by the proposed project and no impact on archaeological sites or features is anticipated.

6.2.4 Built Environment

The study identified no buildings or structures of historical or heritage significance. For the rest of the project area, the general landscape holds varied significance in terms of the built environment as the area comprises historical farming remnants and relatively newly established industrial zones, settlements and townlands. However, no impact on built environment sites is anticipated.

6.2.5 Cultural Landscape

Generally, the proposed project area and its surrounds are characterised by open fields and farmlands. Further away from the project area, the landscape is typical of the rural north North West with undulating hills with flatter plains in-between. This landscape stretches over many kilometres and the proposed project is unlikely to result in a significant impact on the landscape.

6.2.6 Graves / Human Burials Sites

No graves of human burial places were noted during the site investigation of Site Alternative 1 but a cemetery occurs in the footprint demarcated as Site Alternative 2 and impact is likely should this alternative be selected for development. In the rural areas of the North West Province graves and cemeteries sometimes occur within settlements or around homesteads but they are also randomly scattered around archaeological and historical settlements. The probability of additional and informal human burials encountered during development should thus not be excluded. In addition, human remains and burials are commonly found close to archaeological sites; they may be found in "lost" graveyards, or occur sporadically anywhere as a result of prehistoric activity, victims of conflict or crime. It is often difficult to detect the presence of archaeological human remains on the landscape as these burials, in most cases, are not marked at the surface.

Human remains are usually observed when they are exposed through erosion. In some instances packed stones or rocks may indicate the presence of informal pre-colonial burials. If any human bones are found during the course of construction work then they should be reported to an archaeologist and work in the immediate vicinity should cease until the appropriate actions have been carried out by the archaeologist. Where human remains are part of a burial they would need to be exhumed under a permit from SAHRA (for pre-colonial burials as well as burials later than about AD 1500). Should any unmarked human burials/remains

be found during the course of construction, work in the immediate vicinity should cease and the find must immediately be reported to the archaeologist, or the South African Heritage Resources Agency (SAHRA). Under no circumstances may burials be disturbed or removed until such time as necessary statutory procedures required for grave relocation have been met.

6.3 Discussion: Alternatives analysis

Clearing for the construction of the PV Solar Plant will result in the transformation of the landscape and features present and the project activity will likely involve digging into subterranean deposits.

- In terms of palaeontology, it was noted that the project will benefit the environment, economy, and social development of the community. The Preferred Choice is presented and possible. 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 30m no-go barrier constructed, and a palaeontologist should be called in to determine proper mitigation measures
- In terms of archaeology, no heritage resources were noted in **Site Alternative 1** and it has been established that these areas have seen historical transformation as a result of more recent mining and quarrying. It might be assumed that development of this site will result in a minimal (if any) impact on heritage resources and this site alternative is favorable for development. This inference is made on the assumption that no previously-undetected heritage remains are encountered during pre-construction vegetation clearing, earth moving activities and construction. A large cemetery occurs in the footprint demarcated as **Site Alternative 2** and impact is likely should this alternative be selected for development. This site alternative is not favorable for development unless required mitigation measures (avoidance, conservation buffers, grave relocation, public consultation) are implemented.

6.4 Management actions

Recommendations for relevant heritage resource management actions are vital to the conservation of heritage resources. A general guideline for recommended management actions is included in Section 10.4 of Addendum 3.

OBJECTIVE: ensure conservation of heritage resources of significance, prevent unnecessary disturbance and/or destruction of previously undetected heritage receptors.

6.4.1 Palaeontology (refer to Fourie 2021 in Addendum 4)

There is no objection to the development, it may be necessary to request a Phase 1 Palaeontological Impact Assessment: Field study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity is **MODERATE** with a Phase 2 Palaeontological Mitigation is when a Phase 1 Palaeontological Assessment identified a fossiliferous formation or surface fossils, or if fossils are found during clearing, construction excavations, drilling and blasting. The following recommendations are made in terms of palaeontology:

- Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden. An appropriate Protocol and Management plan is attached for the Environmental Control Officer in the PDA (Addendum 4).
- Mitigation may be needed if fossils (stromatolites) are found.
- The Environmental Control Officer must familiarise him- or herself with the formations present and its fossils.

- The development may go ahead, but the ECO must survey for fossils before and or after clearing, blasting, drilling or excavating.
- 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.
- Care must be taken during the dolomite risk assessment as stromatolites may be present (according SANS 1936-1 (2012)) not to destroy any stromatolites.
- 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.

6.4.2 Archaeology

- *For the highly significant burial site (**Site Exigo-PPCS-BP01**) occurring in the Site Alternative 2 for the proposed Sturdee Energy PPC Slurry Solar Project the following are required in terms of heritage management and mitigation:*

PROJECT COMPONENT/S	All phases of construction and operation.	
POTENTIAL IMPACT	Damage/disturbance to subsurface burials and surface burial features.	
ACTIVITY RISK/SOURCE	Digging foundations and trenches into sensitive deposits that are not visible at the surface.	
MITIGATION: TARGET/OBJECTIVE	To locate human burials as soon as possible after disturbance so as to maximize the chances of successful rescue/mitigation work.	
MITIGATION: ACTION/CONTROL	**RESPONSIBILITY**	**TIMEFRAME**
Preferred Mitigation Procedure		
Avoidance: Implement a heritage conservation buffer of at least 100m around the burial sites, redesign project infostructure to avoid the heritage resource and the proposed conservation buffer. Erect fences around the burial sites and apply access control with signage to indicate visitation contacts. Strict and continuous monitoring of the burial sites during development, implementation of a site management plan detailing site management conservation measures.	DEVELOPER QUALIFIED HERITAGE SPECIALIST	Prior to the commencement of construction and earth-moving.
Alterative Mitigation Procedure (**if preferred mitigation procedure is not feasible**)		
Grave relocation: relocation of the burial to the nearby cemetery, documentation of site, full social consultation with affected parties, possible conservation management and protection measures. subject to authorisations and relevant permitting from heritage authorities and affected parties	QUALIFIED HERITAGE SPECIALIST	Prior to the commencement of construction and earth-moving.
Fixed Mitigation Procedure (**required**)		
Site Monitoring: Regular examination of trenches and excavations in this area in order to avoid the destruction of previously undetected burials or heritage remains.	ECO	Monitor as frequently as practically possible.
PERFORMANCE INDICATOR	Archaeological sites are discovered and mitigated with the minimum amount of unnecessary disturbance.	
MONITORING	Successful location of sites by person/s monitoring.	

- *The following general recommendations should be considered for the Sturdee Energy PPC Slurry Solar Project:*

PROJECT COMPONENT/S	All phases of construction and operation.
POTENTIAL IMPACT	Damage/destruction of sites.
ACTIVITY RISK/SOURCE	Digging foundations and trenches into sensitive deposits that are not visible at the surface.

MITIGATION: TARGET/OBJECTIVE	To locate previously undetected heritage remains / graves as soon as possible after disturbance so as to maximize the chances of successful rescue/mitigation work.		
MITIGATION: ACTION/CONTROL		**RESPONSIBILITY**	**TIMEFRAME**
Fixed Mitigation Procedure (**required**)			
General Site Monitoring: Regular examination of trenches and excavations for the total duration of construction.		ECO, HERITAGE SPECIALST	Monitor as frequently as practically possible.
PERFORMANCE INDICATOR	Archaeological sites are discovered and mitigated with the minimum amount of unnecessary disturbance.		
MONITORING	Successful location of sites by person/s monitoring.		

7 RECOMMENDATIONS

The larger landscape around the project area indicates a rich heritage horizon encompassing Iron Age Farmer and Colonial / Historical Period archaeology primarily related to farming, rural expansion and warfare of the past century.. Cognisance should be taken of archaeological material that might be present in surface and sub-surface deposits, along drainage lines and in pristine areas. The following recommendations are made based on general observations in the proposed Sturdee Energy PPC Slurry Solar Project area.

In terms of palaeontology, it was established that the project option presented is situated on the Tertiary Kalahari. One of the formations in the development area may contain fossils. Nixon *et al.* (1988) described the black shales south-west of Potchefstroom as consisting of overlapping laminated basal mounds which are stromatolitic as well as spheroidal possible planktonic fossil algae. These can range in size from 3.5 - 17 mm in height and up to 10 mm in diameter and can be present in the development area. The potential impact of the development on fossil heritage is moderate and the following is recommended:

- Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden. An appropriate Protocol and Management plan is attached for the Environmental Control Officer in the PDA (Addendum 4).
- Mitigation may be needed if fossils (stromatolites) are found.
- The Environmental Control Officer must familiarise him- or herself with the formations present and its fossils.
- The development may go ahead, but the ECO must survey for fossils before and or after clearing, blasting, drilling or excavating.
- 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.
- Care must be taken during the dolomite risk assessment as stromatolites may be present (according SANS 1936-1 (2012)) not to destroy any stromatolites.
- 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.

In terms of archaeology, it has been noted that the project area has seen transformation as a result of more recent mining and quarrying potentially sterilising surface and subsurface of heritage remains, especially those dating to pre-colonial and prehistorical times

- Considering the localised nature of heritage remains, the general monitoring of the development progress by an ECO is recommended for all stages of the project. Should any

subsurface palaeontological, archaeological or historical material, or burials be exposed during construction activities, all activities should be suspended and the archaeological specialist should be notified immediately.

- A large cemetery occurring in the footprint identified as Site Alternative 2 (**Site Exigo-PPCS-BP01**) is of high significance and the site might be impacted should this alternative be selected for development. It is primarily recommended that the burial be conserved *in situ* and that a conservation buffer of at least 100m, as required by SAHRA Burial Ground and Graves (BGG) Unit, be implemented around the heritage receptor. A fence and access gate should be erected around each burial site. A distance of at least 2m should be maintained between the graves and the fence which should be at least 1,8m high. Clear signboard should be erected indicating the heritage sensitivity of the sites and contact details for visitation of the graves. The developer should carefully liaise with the heritage specialist and SAHRA with regards to the management and monitoring of any human grave or cemetery in order to detect and manage negative impact on the sites. In addition, a Site Management Plan should be implemented detailing conservation measures for the graves and responsible parties in this regard. Should direct impact on the resources prove inevitable, all graves in the cemetery should be relocated by a qualified archaeologist, and in accordance with relevant legislation, permitting, statutory permissions and subject to any local and regional provisions and laws and by-laws pertaining to human remains. A full social consultation process should occur in conjunction with the mitigation of cemeteries and burials (see Addendum 1
- It should be stated that it is likely that further undetected archaeological remains might occur elsewhere in the Study Area along water sources and drainage lines, fountains and pans would often have attracted human activity in the past. Also, since Stone Age material seems to originate from below present soil surfaces in eroded areas, the larger landscape should be regarded as potentially sensitive in terms of possible subsurface deposits. Burials and historically significant structures dating to the Colonial Period occur on farms in the area and these resources should be avoided during all phases of construction and development, including the operational phases of the development.

In addition to these site-specific recommendations, careful cognizance should be taken of the following:

- As Palaeontological remains occur where bedrock has been exposed, all geological features should be regarded as sensitive.
- Water sources such as drainage lines, fountains and pans would often have attracted human activity in the past. As Stone Age material occur in the larger landscape, such resources should be regarded as potentially sensitive in terms of possible subsurface deposits.

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9 ADDENDUM 1: HERITAGE LEGISLATION BACKGROUND

9.1 CRM: Legislation, Conservation and Heritage Management

The broad generic term Cultural Heritage Resources refers to any physical and spiritual property associated with past and present human use or occupation of the environment, cultural activities and history. The term includes sites, structures, places, natural features and material of palaeontological, archaeological, historical, aesthetic, scientific, architectural, religious, symbolic or traditional importance to specific individuals or groups, traditional systems of cultural practice, belief or social interaction.

9.1.1 Legislation regarding archaeology and heritage sites

The South African Heritage Resources Agency (SAHRA) and their provincial offices aim to conserve and control the management, research, alteration and destruction of cultural resources of South Africa. It is therefore vitally important to adhere to heritage resource legislation at all times.

d. National Heritage Resources Act No 25 of 1999, section 35

According to the National Heritage Resources Act of 1999 a historical site is any identifiable building or part thereof, marker, milestone, gravestone, landmark or tell older than 60 years. This clause is commonly known as the "60-years clause". Buildings are amongst the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Iron Age settlements. "Tell" refers to the evidence of human existence which is no longer above ground level, such as building foundations and buried remains of settlements (including artefacts).

The Act identifies heritage objects as:

- objects recovered from the soil or waters of South Africa including archaeological and palaeontological objects, meteorites and rare geological specimens
- visual art objects
- military objects
- numismatic objects
- objects of cultural and historical significance
- objects to which oral traditions are attached and which are associated with living heritage
- objects of scientific or technological interest
- any other prescribed category

With regards to activities and work on archaeological and heritage sites this Act states that:

"No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit by the relevant provincial heritage resources authority." (34. [1] 1999:58)

and

"No person may, without a permit issued by the responsible heritage resources authority-

(d) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;

(e) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;

(f) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or

(g) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites. (35. [4] 1999:58).”

and

“No person may, without a permit issued by SAHRA or a provincial heritage resources agency-

(h) 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;

(i) 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;

(j) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals (36. [3] 1999:60).”

e. Human Tissue Act of 1983 and Ordinance on the Removal of Graves and Dead Bodies of 1925

Graves 60 years or older are heritage resources and fall under the jurisdiction of both the National Heritage Resources Act and the Human Tissues Act of 1983. However, graves younger than 60 years are specifically protected by the Human Tissues Act (Act 65 of 1983) and the Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) as well as any local and regional provisions, laws and by-laws. Such burial places also fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities.

9.1.2 Background to HIA and AIA Studies

South Africa’s unique and non-renewable archaeological and palaeontological heritage sites are ‘generally’ protected in terms of the National Heritage Resources Act (Act No 25 of 1999, section 35) and may not be disturbed at all without a permit from the relevant heritage resources authority. Heritage sites are frequently threatened by development projects and both the environmental and heritage legislation require impact assessments (HIAs & AIAs) that identify all heritage resources in areas to be developed. Particularly, these assessments are required to make recommendations for protection or mitigation of the impact of the sites. HIAs and AIAs should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources including archaeological and palaeontological sites that might occur in areas of developed and (b) make recommendations for protection or mitigation of the impact on the sites.

The National Heritage Resources Act (Act No. 25 of 1999, section 38) provides guidelines for Cultural Resources Management and prospective developments:

***“38.** (1) 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, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

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

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

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

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

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

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

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

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development."

And:

"The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

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

(l) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;

(m) an assessment of the impact of the development on such heritage resources;

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

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

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

(q) plans for mitigation of any adverse effects during and after the completion of the proposed development (38. [3] 1999:64)."

Consequently, section 35 of the Act requires Heritage Impact Assessments (HIAs) or Archaeological Impact Assessments (AIAs) to be done for such developments in order for all heritage resources, that is, all places or objects of aesthetics, architectural, historic, scientific, social, spiritual, linguistic or technological value or significance to be protected. Thus any assessment should make provision for the protection of all these heritage components, including archaeology, shipwrecks, battlefields, graves, and structures older than 60

years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects. Heritage resources management and conservation.

9.2 Assessing the Significance of Heritage Resources

Archaeological sites, as previously defined in the National Heritage Resources Act (Act 25 of 1999) are places in the landscape where people have lived in the past – generally more than 60 years ago – and have left traces of their presence behind. In South Africa, archaeological sites include hominid fossil sites, places where people of the Earlier, Middle and Later Stone Age lived in open sites, river gravels, rock shelters and caves, Iron Age sites, graves, and a variety of historical sites and structures in rural areas, towns and cities. Palaeontological sites are those with fossil remains of plants and animals where people were not involved in the accumulation of the deposits. The basic principle of cultural heritage conservation is that archaeological and other heritage sites are valuable, scarce and *non-renewable.* Many such sites are unfortunately lost on a daily basis through development for housing, roads and infrastructure and once archaeological sites are damaged, they cannot be re-created as site integrity and authenticity is permanently lost. Archaeological sites have the potential to contribute to our understanding of the history of the region and of our country and continent. By preserving links with our past, we may not be able to revive lost cultural traditions, but it enables us to appreciate the role they have played in the history of our country.

- Categories of significance

Rating the significance of archaeological sites, and consequently grading the potential impact on the resources is linked to the significance of the site itself. The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences. The guidelines as provided by the NHRA (Act No. 25 of 1999) in Section 3, with special reference to subsection 3 are used when determining the cultural significance or other special value of archaeological or historical sites. In addition, ICOMOS (the Australian Committee of the International Council on Monuments and Sites) highlights four cultural attributes, which are valuable to any given culture:

- *Aesthetic value:*

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria include consideration of the form, scale, colour, texture and material of the fabric, the general atmosphere associated with the place and its uses and also the aesthetic values commonly assessed in the analysis of landscapes and townscape.

- *Historic value:*

Historic value encompasses the history of aesthetics, science and society and therefore to a large extent underlies all of the attributes discussed here. Usually a place has historical value because of some kind of influence by an event, person, phase or activity.

- *Scientific value:*

The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality and on the degree to which the place may contribute further substantial information.

- *Social value:*

Social value includes the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a certain group.

It is important for heritage specialist input in the EIA process to take into account the heritage management structure set up by the NHR Act. It makes provision for a 3-tier system of management including the South Africa Heritage Resources Agency (SAHRA) at a national level, Provincial Heritage Resources Authorities (PHRAs) at a provincial and the local authority. The Act makes provision for two types or forms of protection of heritage resources; i.e. formally protected and generally protected sites:

Formally protected sites:

- Grade 1 or national heritage sites, which are managed by SAHRA
- Grade 2 or provincial heritage sites, which are managed by the provincial HRA (MP-PHRA).
- Grade 3 or local heritage sites.

Generally protected sites:

- Human burials older than 60 years.
- Archaeological and palaeontological sites.
- Shipwrecks and associated remains older than 60 years.
- Structures older than 60 years.

With reference to the evaluation of sites, the certainty of prediction is definite, unless stated otherwise and if the significance of the site is rated high, the significance of the impact will also result in a high rating. The same rule applies if the significance rating of the site is low. The significance of archaeological sites is generally
ranked into the following categories.

Significance	Rating Action
No significance: sites that do not require mitigation.	None
Low significance: sites, which may require mitigation.	2a. Recording and documentation (Phase 1) of site; no further action required 2b. Controlled sampling (shovel test pits, auguring), mapping and documentation (Phase 2 investigation); permit required for sampling and destruction
Medium significance: sites, which require mitigation.	3. Excavation of representative sample, C14 dating, mapping and documentation (Phase 2 investigation); permit required for sampling and destruction [including 2a & 2b]
High significance: sites, where disturbance should be avoided.	4a. Nomination for listing on Heritage Register (National, Provincial or Local) (Phase 2 & 3 investigation); site management plan; permit required if utilised for education or tourism
High significance: Graves and burial places	4b. Locate demonstrable descendants through social consulting; obtain permits from applicable legislation, ordinances and regional by-laws; exhumation and reinternment [including 2a, 2b & 3]

Furthermore, the significance of archaeological sites was based on six main criteria:

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter),
- Social value,
- Uniqueness, and
- Potential to answer current and future research questions.

10 ADDENDUM 2: IMPACT ASSESSMENT METHODOLOGY

10.1.1 Issues Identification Matrix

impacts were rated and assessed using an Impact and Risk Assessment Methodology provided by CES, for the Scoping Phase of the EIA process in accordance with the requirement of EIA Regulations. Here, two parameters and five factors are considered when assessing the significance of the identified issues, and each is scored. ***Significance*** is achieved by ranking the five criteria presented in Table 1 below, to determine the overall significance of an issue. The ranking for the "effect" (which includes scores for duration; extent; consequence and probability) and reversibility / mitigation are then read off the matrix presented in Table 2 below, to determine the overall significance of the issue. The overall significance is either negative or positive.

- ***Duration*** - The temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.

- ***Extent*** - The spatial scale defines the physical extent of the impact.

- ***Consequence*** - The consequence scale is used in order to, as far as possible, objectively evaluate how severe a number of negative impacts associated with the issue
under consideration might be, or how beneficial a number of positive impacts associated with the issue under consideration might be.

- The ***probability*** of the impact occurring - The likelihood of impacts taking place as a result of project actions arising from the various alternatives. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development and alternatives. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

- ***Reversibility / Mitigation*** – The degree of difficulty of reversing and/or mitigating the various impacts ranges from easily achievable to very difficult. The four categories used are listed and explained in Table 1 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

10.1.2 Assessing Impacts

The CES rating scale used in this assessment takes into consideration the following criteria, and includes the new criteria for assessing post mitigation significance (residual impacts), by incorporating the principles of reversibility and irreplaceability:

- **Nature of impact** (Negative or positive impact on the environment).
- **Type of impact** (Direct, indirect and/or cumulative effect of impact on the environment).
- **Duration, Extent, Probability** (see **Table** below)

Duration (Temporal Scale)		Score
Short term	Less than 5 years	1
Medium term	Between 5-20 years	2
Long term	Between 20 and 40 years (a generation) and from a human perspective also permanent	3
Permanent	Over 40 years and resulting in a permanent and lasting change that will always be there	4
Extent (Spatial Scale)		
Localised	At localised scale and a few hectares in extent	1
Study Area	The proposed site and its immediate environs	2
Regional	District and Provincial level	3
National	Country	3
International	Internationally	4
Probability (Likelihood)		
Unlikely	The likelihood of these impacts occurring is slight	1
May Occur	The likelihood of these impacts occurring is possible	2
Probable	The likelihood of these impacts occurring is probable	3
Definite	The likelihood is that this impact will definitely occur	4

- **Severity or benefits**

Impact Severity (The severity of negative impacts, or how beneficial positive impacts would be on a particular affected system or affected party)		Score
Very severe	**Very beneficial**	**4**
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.	
Severe	**Beneficial**	**3**
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming, or some combination of these. For example, the clearing of forest vegetation.	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these. For example an increase in the local economy.	
Moderately severe	**Moderately beneficial**	**2**
Medium to long term impacts on the affected system(s) or party (ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.	
Slight	**Slightly beneficial**	**1**
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.	
No effect	**Don't know/Can't know**	
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.	

** In certain cases it may not be possible to determine the severity of an impact thus it may be determined: Don't know/Can't know*

The scores for the three criteria in the Tables above are added to obtain a composite score. They must then be considered against the severity rating to determine the overall significance of an activity. This is because the severity of the impact is far more important than the other three criteria. The overall significance is then obtained by reading off the matrix presented in the table below. The overall significance is either negative or positive (Criterion 1) and direct, indirect or cumulative (Criterion 2).

SEVERITY	COMPOSITE DURATION, EXTENT & PROBABILITY SCORE									
	3	4	5	6	7	8	9	10	11	12
Slight	3	4	5	6	7	8	9	10	11	12
Mod severe	3	4	5	6	7	8	9	10	11	12
Severe	3	4	5	6	7	8	9	10	11	12
Very severe	3	4	5	6	7	8	9	10	11	12

The **environmental significance** scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

OVERALL SIGNIFICANCE *(The combination of all the above criteria as an overall significance)*	
VERY HIGH NEGATIVE	**VERY BENEFICIAL**
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects. *Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.* *Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.*	
HIGH NEGATIVE	**BENEFICIAL**
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. *Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.* *Example: The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.*	
MODERATE NEGATIVE	**SOME BENEFITS**
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. *Example: The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.*	
LOW NEGATIVE	**FEW BENEFITS**
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. *Example: The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels.* *Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.*	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. *Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.*	
DON'T KNOW	
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. *Example: The effect of a particular development on people's psychological perspective of the environment.*	

10.1.3 Post Mitigation Significance

Once mitigation measure are proposed, the following criteria are then used to determine the overall post mitigation significance of the impact:

- Reversibility: The degree to which an environment can be returned to its original/partially original state.
- Irreplaceable loss: The degree of loss which an impact may cause.
- Mitigation potential: The degree of difficulty of reversing and/or mitigating the various impacts ranges from very difficult to easily achievable. The four categories used are listed and explained in Table 5 below. Both the practical feasibility of the measure, the potential cost and the potential effectiveness is taken into consideration when determining the appropriate degree of difficulty.

Reversibility	
Reversible	*The activity will lead to an impact that can be reversed provided appropriate mitigation measures are implemented.*
Irreversible	*The activity will lead to an impact that is permanent regardless of the implementation of mitigation measures.*
Irreplaceable loss	
Resource will not be lost	*The resource will not be lost/destroyed provided mitigation measures are implemented.*
Resource will be partly lost	*The resource will be partially destroyed even though mitigation measures are implemented.*
Resource will be lost	*The resource will be lost despite the implementation of mitigation measures.*
Mitigation potential	
Easily achievable	*The impact can be easily, effectively and cost effectively mitigated/reversed.*
Achievable	*The impact can be effectively mitigated/reversed without much difficulty or cost.*
Difficult	*The impact could be mitigated/reversed but there will be some difficultly in ensuring effectiveness and/or implementation, and significant costs.*
Very Difficult	*The impact could be mitigated/reversed but it would be very difficult to ensure effectiveness, technically very challenging and financially very costly.*

11 ADDENDUM 3: CONVENTIONS USED TO ASSESS THE SIGNIFICANCE OF HERITAGE

11.1 Site Significance Matrix

According to the NHRA, Section 2(vi) the **significance** of heritage sites and artefacts is determined by it aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technical value in relation to the uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these. The following matrix is used for assessing the significance of each identified site/feature.

2. SITE EVALUATION			
2.1 Heritage Value (NHRA, section 2 [3])	High	Medium	Low
It has importance to the community or pattern of South Africa's history or pre-colonial history.			
It possesses unique, uncommon, rare or endangered aspects of South Africa's natural or cultural heritage.			
It has potential to yield information that will contribute to an understanding of South Africa's natural and cultural heritage.			
It is of importance in demonstrating the principle characteristics of a particular class of South Africa's natural or cultural places or objects.			
It has importance in exhibiting particular aesthetic characteristics valued by a particular community or cultural group.			
It has importance in demonstrating a high degree of creative or technical achievement at a particular period.			
It has marked or special association with a particular community or cultural group for social, cultural or spiritual reasons (sense of place).			
It has strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.			
It has significance through contributing towards the promotion of a local sociocultural identity and can be developed as a tourist destination.			
It has significance relating to the history of slavery in South Africa.			
It has importance to the wider understanding of temporal changes within cultural landscapes, settlement patterns and human occupation.			
2.2 Field Register Rating			
National/Grade 1 [should be registered, retained]			
Provincial/Grade 2 [should be registered, retained]			
Local/Grade 3A [should be registered, mitigation not advised]			
Local/Grade 3B [High significance; mitigation, partly retained]			
Generally Protected A [High/Medium significance, mitigation]			
Generally protected B [Medium significance, to be recorded]			
Generally Protected C [Low significance, no further action]			
2.3 Sphere of Significance	High	Medium	Low
International			
National			
Provincial			
Local			
Specific community			

11.2 Impact Assessment Criteria

The following table provides a guideline for the rating of impacts and recommendation of management actions for sites of heritage potential.

Significance of the heritage resource

This is a statement of the nature and degree of significance of the heritage resource being affected by the activity. From a heritage management perspective, it is useful to distinguish between whether the significance is embedded in the physical fabric or in associations with events or persons or in the experience of a place; i.e. its visual and non-visual qualities. This statement is a primary informant to the nature and degree of significance of an impact and thus needs to be thoroughly considered. Consideration needs to be given to the significance of a heritage resource at different scales (i.e. site-specific, local, regional, national or international) and the relationship between the heritage resource, its setting and its associations.

Nature of the impact

This is an assessment of the nature of the impact of the activity on a heritage resource, with some indication of its positive and/or negative effect/s. It is strongly informed by the statement of resource significance. In other words, the nature of the impact may be historical, aesthetic, social, scientific, linguistic or architectural, intrinsic, associational or contextual (visual or non-visual). In many cases, the nature of the impact will include more than one value.

Extent

Here it should be indicated whether the impact will be experienced:

- On a site scale, i.e. extend only as far as the activity;
- Within the immediate context of a heritage resource;
- On a local scale, e.g. town or suburb
- On a metropolitan or regional scale; or
- On a national/international scale.

Duration

Here it should be indicated whether the lifespan of the impact will be:

- Short term, (needs to be defined in context)
- Medium term, (needs to be defined in context)
- Long term where the impact will persist indefinitely, possibly beyond the operational life of the activity, either because of natural processes or by human intervention; or
- Permanent where mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

Of relevance to the duration of an impact are the following considerations:

- Reversibility of the impact; and
- Renewability of the heritage resource.

Intensity

Here it should be established whether the impact should be indicated as:

- Low, where the impact affects the resource in such a way that its heritage value is not affected;
- Medium, where the affected resource is altered but its heritage value continues to exist albeit in a modified way; and
- High, where heritage value is altered to the extent that it will temporarily or permanently be damaged or destroyed.

Probability

This should describe the likelihood of the impact actually occurring indicated as:

- Improbable, where the possibility of the impact to materialize is very low either because of design or historic experience;
- Probable, where there is a distinct possibility that the impact will occur;
- Highly probable, where it is most likely that the impact will occur; or
- Definite, where the impact will definitely occur regardless of any mitigation measures

Confidence

This should relate to the level of confidence that the specialist has in establishing the nature and degree of impacts. It relates to the level and reliability of information, the nature and degree of consultation with I&AP's and the dynamic of the broader socio-political context.

- High, where the information is comprehensive and accurate, where there has been a high degree of consultation and the socio-political context is relatively stable.
- Medium, where the information is sufficient but is based mainly on secondary sources, where there has been a limited targeted consultation and socio-political context is fluid.
- Low, where the information is poor, a high degree of contestation is evident and there is a state of socio-political flux.

Impact Significance

The significance of impacts can be determined through a synthesis of the aspects produced in terms of the nature and degree of heritage significance and the nature, duration, intensity, extent, probability and confidence of impacts and can be described as:

- Low; where it would have a negligible effect on heritage and on the decision
- Medium, where it would have a moderate effect on heritage and should influence the decision.
- High, where it would have, or there would be a high risk of, a big effect on heritage. Impacts of high significance should have a major influence on the decision;
- Very high, where it would have, or there would be high risk of, an irreversible and possibly irreplaceable negative impact on heritage. Impacts of very high significance should be a central factor in decision-making.

11.3 Direct Impact Assessment Criteria

The following table provides an outline of the relationship between the significance of a heritage context, the intensity of development and the significance of heritage impacts to be expected

	TYPE OF DEVELOPMENT			
HERITAGE CONTEXT	**CATEGORY A**	**CATEGORY B**	**CATEGORY C**	**CATEGORY D**
CONTEXT 1 High heritage Value	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected	Very high heritage impact expected
CONTEXT 2 Medium to high heritage value	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected	Very high heritage impact expected
CONTEXT 3 Medium to low heritage value	Little or no heritage impact expected	Minimal heritage impact expected	Moderate heritage impact expected	High heritage impact expected
CONTEXT 4 Low to no heritage value	Little or no heritage impact expected	Little or no heritage impact expected	Minimal heritage value expected	Moderate heritage impact expected

NOTE: A DEFAULT "LITTLE OR NO HERITAGE IMPACT EXPECTED" VALUE APPLIES WHERE A HERITAGE RESOURCE OCCURS OUTSIDE THE IMPACT ZONE OF THE DEVELOPMENT.

HERITAGE CONTEXTS	**CATEGORIES OF DEVELOPMENT**
Context 1: Of high intrinsic, associational and contextual heritage value within a national, provincial and local context, i.e. formally declared or potential Grade 1, 2 or 3A heritage resources **Context 2:** Of moderate to high intrinsic, associational and contextual value within a local context, i.e. potential Grade 3B heritage resources. **Context 3:**	**Category A: Minimal intensity development** - No rezoning involved; within existing use rights. - No subdivision involved. - Upgrading of existing infrastructure within existing envelopes - Minor internal changes to existing structures - New building footprints limited to less than 1000m2. **Category B: Low-key intensity development** - Spot rezoning with no change to overall zoning of a site. - Linear development less than 100m

Of medium to low intrinsic, associational or contextual heritage value within a national, provincial and local context, i.e. potential Grade 3C heritage resources **Context 4:** Of little or no intrinsic, associational or contextual heritage value due to disturbed, degraded conditions or extent of irreversible damage.	- Building footprints between 1000m2-2000m2 - Minor changes to external envelop of existing structures (less than 25%) - Minor changes in relation to bulk and height of immediately adjacent structures (less than 25%). **Category C: Moderate intensity development** - Rezoning of a site between 5000m2-10 000m2. - Linear development between 100m and 300m. - Building footprints between 2000m2 and 5000m2 - Substantial changes to external envelop of existing structures (more than 50%) - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 50%) **Category D: High intensity development** - Rezoning of a site in excess of 10 000m2 - Linear development in excess of 300m. - Any development changing the character of a site exceeding 5000m2 or involving the subdivision of a site into three or more erven. - Substantial increase in bulk and height in relation to immediately adjacent buildings (more than 100%)

11.4 Management and Mitigation Actions

The following table provides a guideline of relevant heritage resources management actions is vital to the conservation of heritage resources.

No further action / Monitoring

Where no heritage resources have been documented, heritage resources occur well outside the impact zone of any development or the primary context of the surroundings at a development footprint has been largely destroyed or altered, no further immediate action is required. Site monitoring during development, by an ECO or the heritage specialist are often added to this recommendation in order to ensure that no undetected heritage\ remains are destroyed.

Avoidance

This is appropriate where any type of development occurs within a formally protected or significant or sensitive heritage context and is likely to have a high negative impact. Mitigation is not acceptable or not possible. This measure often includes the change / alteration of development planning and therefore impact zones in order not to impact on resources.

Mitigation

This is appropriate where development occurs in a context of heritage significance and where the impact is such that it can be mitigated to a degree of medium to low significance, e.g. the high to medium impact of a development on an archaeological site could be mitigated through sampling/excavation of the remains. Not all negative impacts can be mitigated.

Compensation

Compensation is generally not an appropriate heritage management action. The main function of management actions should be to conserve the resource for the benefit of future generations. Once lost it cannot be renewed. The circumstances around the potential public or heritage benefits would need to be exceptional to warrant this type of action, especially in the case of where the impact was high.

Rehabilitation

Rehabilitation is considered in heritage management terms as a intervention typically involving the adding of a new heritage layer to enable a new sustainable use. It is not appropriate when the process necessitates the removal of previous historical layers, i.e. restoration of a building or place to the previous state/period. It is an appropriate heritage management action in the following cases:

- The heritage resource is degraded or in the process of degradation and would benefit from rehabilitation.
- Where rehabilitation implies appropriate conservation interventions, i.e. adaptive reuse, repair and maintenance, consolidation and minimal loss of historical fabric.
- Where the rehabilitation process will not result in a negative impact on the intrinsic value of the resource.

Enhancement

ADDENDUM 4: PALAEONTOLOGICAL DESKTOP ASSESSMENT