



**PROPOSED CONSTRUCTION OF A PHOTOVOLTAIC POWER
STATION AND ASSOCIATED INFRASTRUCTURE ON THE FARM
BRAKFORTEIN 879 HN BETWEEN TAUNG AND REIVILO IN THE
NORTH WEST PROVINCE**

HERITAGE IMPACT ASSESSMENT

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DECLARATION OF INDEPENDENCE

The report has been compiled by PGS Heritage, an appointed Heritage Consultant for the Centre for Environmental Management. The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes.

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Report Title	Proposed Construction of a Photovoltaic Power Station and Associated Infrastructure on the Farm Brakfontein 879 HN between Taung and Reivilo in the Greater Taung Local Municipality, Dr Ruth Segomotsi Mompati District Municipality, North West Province.		
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EXECUTIVE SUMMARY

PGS Heritage was appointed by the Centre for Environmental Management to undertake a Heritage Impact Assessment for the proposed construction of a photovoltaic power station and associated infrastructure on the farm Brakfontein 879 HN, situated between Taung and Reivelo in the Greater Taung Local Municipality, Dr Ruth Segomotsi Mompati District Municipality, North West Province.

1) Desktop Studies

- Archival and Historical Maps

Three historical maps covering the study area, and specifically the farm Brakfontein, were located. No obvious heritage sites are indicated on the two early maps depicting the study area.

- History

An archival and historical study was undertaken which has shown that the surroundings of the study area have a long and significant history. However, even though this historical study was quite intensive and detailed, very little historical data with regard to the study area itself could be located.

- Archaeology

An investigation was undertaken of previous heritage studies conducted in the surroundings of the study area by utilising the South African Heritage Resources Information System (SAHRIS). Three such reports were found. The combined archaeological sites identified by these studies comprise a single low density surface scatter of Later Stone Age material. This suggests that the surroundings of the study area have a low archaeological site frequency. Furthermore, a general literature study of published archaeological books and journals augments the SAHRIS data in that no archaeological academic research appears to have taken place in the direct surroundings of the study area. The closest known published site to the study area is the Taung Skull World Heritage Site, with a number of sites located in the Harts River Valley (roughly 40 km east of the study area) also written on. The Taung Skull World Heritage Site is located 18 km south-east of the present study area and is famous for the fact that in 1924 Dr. Raymond Dart identified the skull of an infant gracile australopithecine from a limestone quarry at this site. Taung is one of only three localities in South Africa where fossil

evidence for early hominins were ever recovered, the other two being the Cradle of Humankind (with sites such as Sterkfontein and Kromdraai) and Makapansgat (Mitchell, 2002).

- Palaeontology

Dr. Gideon Groenewald conducted a palaeontological desktop study of the study area. His findings are that the entire development area falls on a highly sensitive dolomitic terrain, being both sensitive for dolomitic stromatolites and micro-fossils, as well as possible fossiliferous breccias.

The following recommendations are made in his report:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments contains significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages.
2. A qualified palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment to confirm the presence if significant fossils of stromatolites and possible cave breccia deposits on this site and to make the necessary recommendations regarding a possible Phase 2 PIA during the construction phase.
3. These recommendations should form part of the EMP of the project.

2) Fieldwork Findings

An experienced archaeologist conducted a walkthrough of the study area. No indications of any archaeological or historical sites were observed.

3) Conclusions and Recommendations

The proposed development is not expected to have any impact on archaeological or heritage sites. However, the palaeontological significance of the site has been assessed as Very High. As a result, certain mitigation measures are recommended (see above).

On the conditions that the recommendations made in this report are adhered to, the development may be allowed to continue.

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1. INTRODUCTION

PGS Heritage was appointed by the Centre for Environmental Management to undertake a Heritage Impact Assessment for the proposed construction of a photovoltaic power station and associated infrastructure on the farm Brakfontein 879 HN, situated between Taung and Reivilo in the Greater Taung Local Municipality, Dr Ruth Segomotsi Mompati District Municipality, North West Province.

1.1 Scope of the Study

The aim of the study is to identify all heritage sites and finds that occur in the proposed development area. The Heritage Impact Assessment aims to inform the EIA in the development of a comprehensive EMP to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

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

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

Polke Birkholtz, the Project Manager, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited with the CRM Section of ASAPA. He has 17 years experience in the heritage assessment and management field and holds a B.A. (cum laude) from the University of Pretoria specialising in Archaeology, Anthropology and History as well as a B.A. (Hons.) in Archaeology (cum laude) from the same university.

Jennifer Kitto, Co-Author of this Report, has 15 years' experience in the heritage sector, a large part of which involved working for a government department responsible for administering the National Heritage Resources Act, No 25 of 1999. She is therefore well-versed in the legislative requirements of heritage management. She holds a BA in Archaeology and Social Anthropology and a BA (Hons) in Social Anthropology.

Dr Gideon Groenewald, the appointed Palaeontologist, holds a PhD in Geology from the Nelson Mandela Metropolitan University (1996) and the National Diploma in Nature Conservation from the University of South Africa (1990). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

1.3 Assumptions and Limitations

The following assumptions and limitations exist:

- Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the fieldwork findings presented in this report do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. Therefore, the heritage resources included in this report do not necessarily represent all the possible heritage resources present within the area. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must be contacted immediately. Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well.
- The study area boundary was provided to the Project Manager in a Google Earth file format. This area was then assessed during both the desktop and fieldwork components.

1.3 Legislative Context

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

- i. National Environmental Management Act (NEMA), Act 107 of 1998
- ii. National Heritage Resources Act (NHRA), Act 25 of 1999

- iii. Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002
- iv. Development Facilitation Act (DFA), Act 67 of 1995

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

- i. National Environmental Management Act (NEMA) Act 107 of 1998
 - a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
 - b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
 - c. Environmental Impact Assessment (EIA) – Section (32)(2)(d)
 - d. Environmental Management Plan (EMP) – Section (34)(b)
- ii. National Heritage Resources Act (NHRA) Act 25 of 1999
 - a. Protection of Heritage Resources – Sections 34 to 36; and
 - b. Heritage Resources Management – Section 38
- iii. Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
 - a. Section 39(3)
- iv. Development Facilitation Act (DFA) Act 67 of 1995
 - a. The GNR.1 of 7 January 2000: Regulations and rules in terms of the Development Facilitation Act, 1995. Section 31.

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

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

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

1.4 Terminology and Abbreviations

Archaeological resources

This includes:

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

Cultural significance

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

Development

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

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

Early Stone Age

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

Fossil

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

Heritage

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

Heritage resources

This means any place or object of cultural significance

Holocene

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

Late Stone Age

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

Late Iron Age (Early Farming Communities)

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

Middle Stone Age

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

Palaeontology

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

The table below provides a description of the abbreviations which are used in this report:

Acronyms	Description
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
CMP	Conservation Management Plan
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GIS	Geographic Information System
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Later Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
PSSA	Paleontological Society of South Africa
ROD	Record of Decision
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

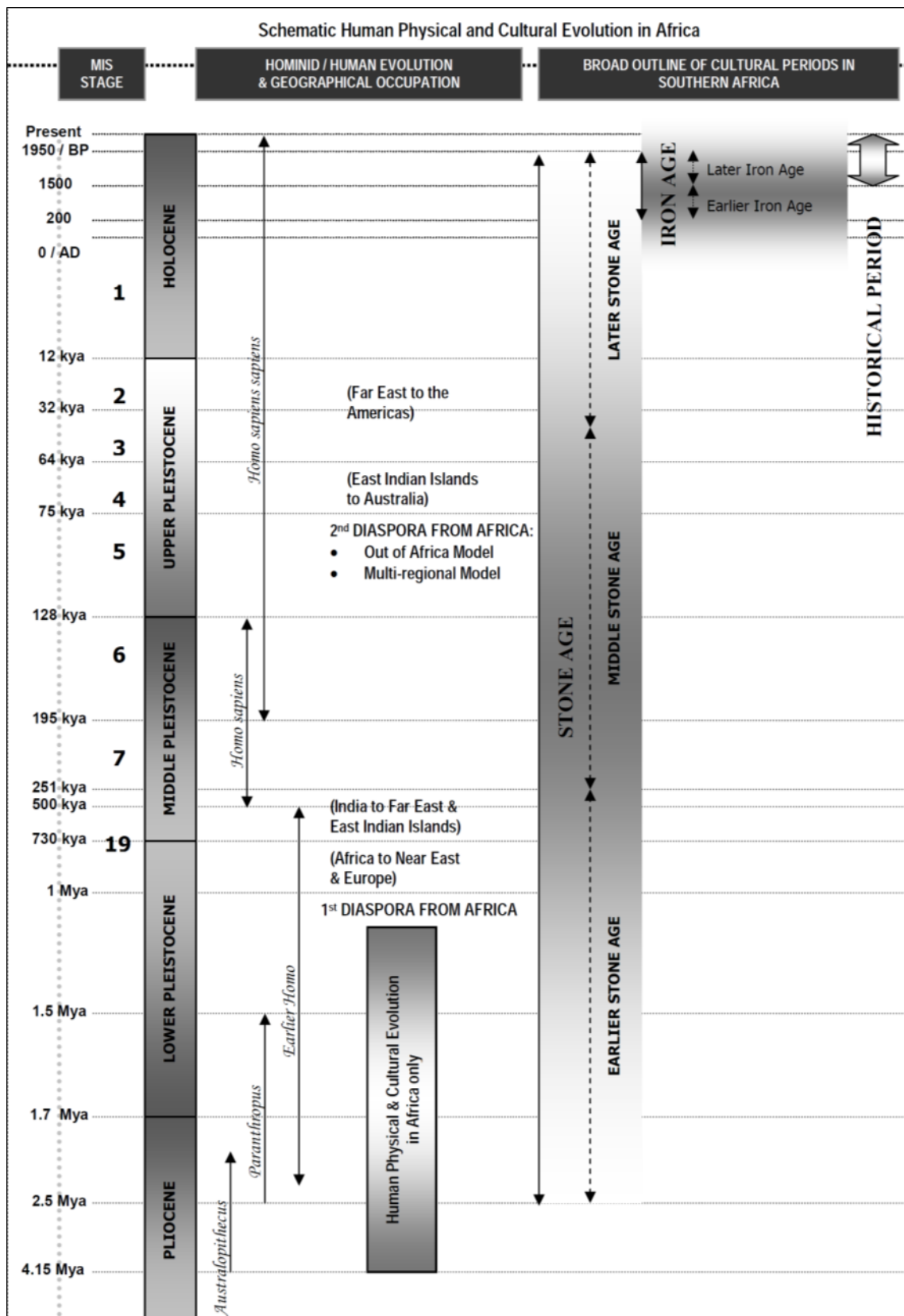


Figure 1 - Human and Cultural Time line in Africa (Morris, 2008)

2. TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Coordinates	A: S 27° 34' 00.86" E 24° 23' 40.24" C: S 27° 34' 37.12" E 24° 24' 05.51" E: S 27° 34' 25.52" E 24° 24' 56.37" G: S 27° 35' 31.83" E 24° 25' 58.98"	B: S 27° 34' 00.76" E 24° 23' 41.76" D: S 27° 34' 20.61" E 24° 24' 45.03" F: S 27° 35' 21.51" E 24° 25' 59.25" H: S 27° 35' 31.74" E 24° 24' 39.76"
Property	The proposed activity is located within the farm Brakfontein 879 HN, North West Province	
Location	The study area is located south- of the R372 between Taung and Reivilo in the Greater Taung Local Municipality, Dr Ruth Segomotsi Mompati District Municipality, North West Province. The study area is situated approximately 35 km west of Taung and 21 km east of Reivilo.	
Extent	The study area covers an area of approximately 350 hectares. The proposed new 75MW PV solar power plant will cover approximately 275 hectares of the study area (Figure 3).	
Land Description	The study area is located on a flat and desolate portion of land with some open grassy areas interposed by dense vegetation such as thorn trees and bushes. The Umbrella Thorn Acacia (<i>Acacia tortiles</i>) appears to be prevalent on site. The study area seems to contain a thin layer of sand with a dolomite bank underneath. No evidence for farmhouses or dwellings could be seen within the area forming part of the project study area.	



Figure 2 - Locality plan depicting the position of the study area within its regional context.

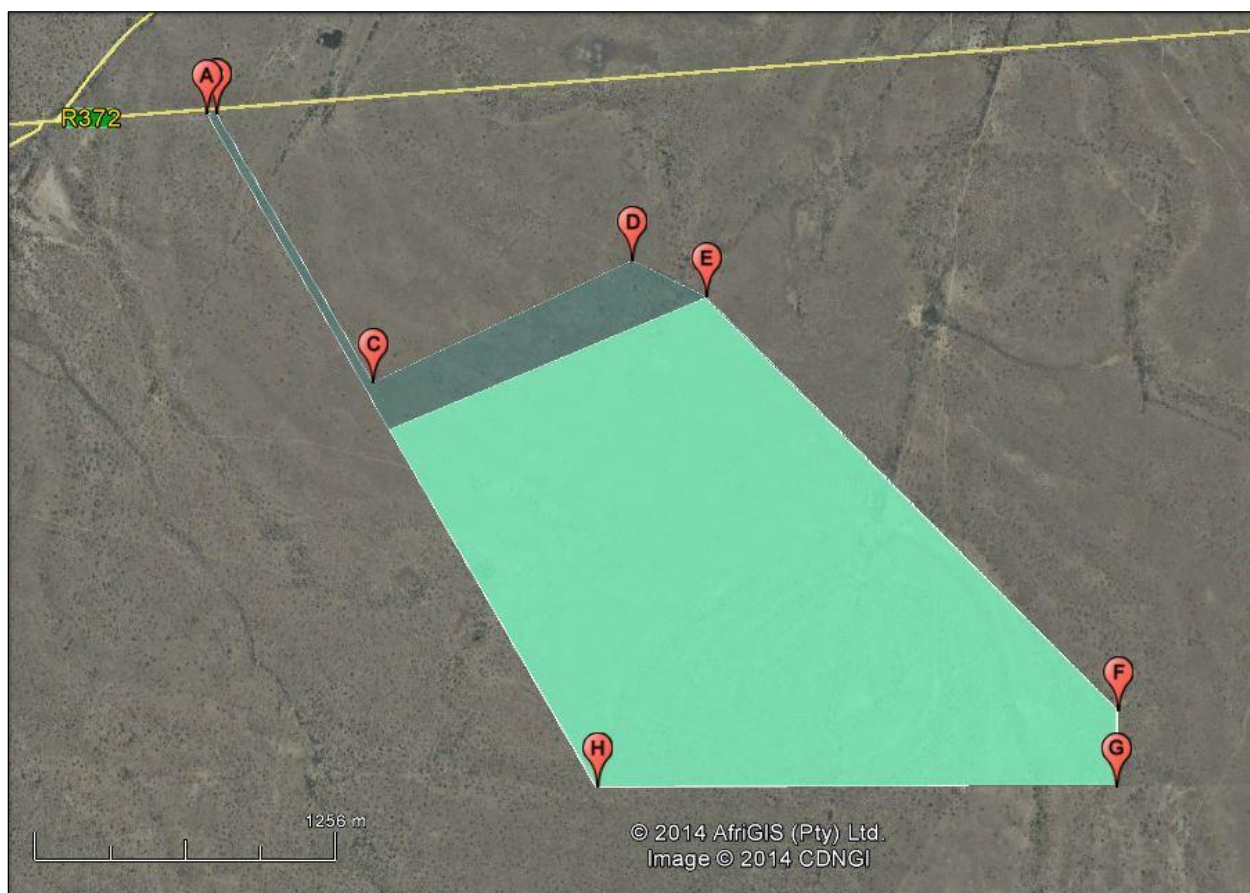


Figure 3 - Google Earth image depicting the study area. The Google Earth file depicting this study area was provided by the client. The icons depicted here correlate with the letters used in the list of coordinates above.

2.2 Technical Project Description

This section was provided by the Centre for Environmental Management (CEM).

The applicant, Brakfontein Solar Plant (Pty) Ltd., proposes to develop a 75MW PV solar power plant covering approximately 275 ha, with associated infrastructure, on the farm Brakfontein 879 HN, south of the R372 between Taung and Reivilo in the Greater Taung Local Municipality, Dr Ruth Segomotsi Mompati District Municipality, North West Province.

The project will include the following:

- One 75 MW solar PV plant, developed on a single 275 ha site;
- A new substation next to the existing 132 kV Eskom power line;
- A new 1.8 km long main gravel access road of 10 m reserve width from the R372 road to the solar PV plant development, which will be constructed along the western boundary of the farm.

- The PV plant will also include the following related infrastructure:
 - Buildings and Services (Control room, small office and workshop)
 - Parking Area
 - Perimeter Fencing
 - Security System
 - Internal and perimeter service roads of 3m surface width and 5 m reserve width
 - Meteorological Stations
 - Drainage Systems
 - Inverters and Concentrator Boxes
 - Transformation Centre
 - Electrical Reticulation
 - Evacuation Line
 - Lightning Protection System
 - Auxiliary Supply
 - Emergency power Supply
 - Monitoring and Control systems
 - Trenches

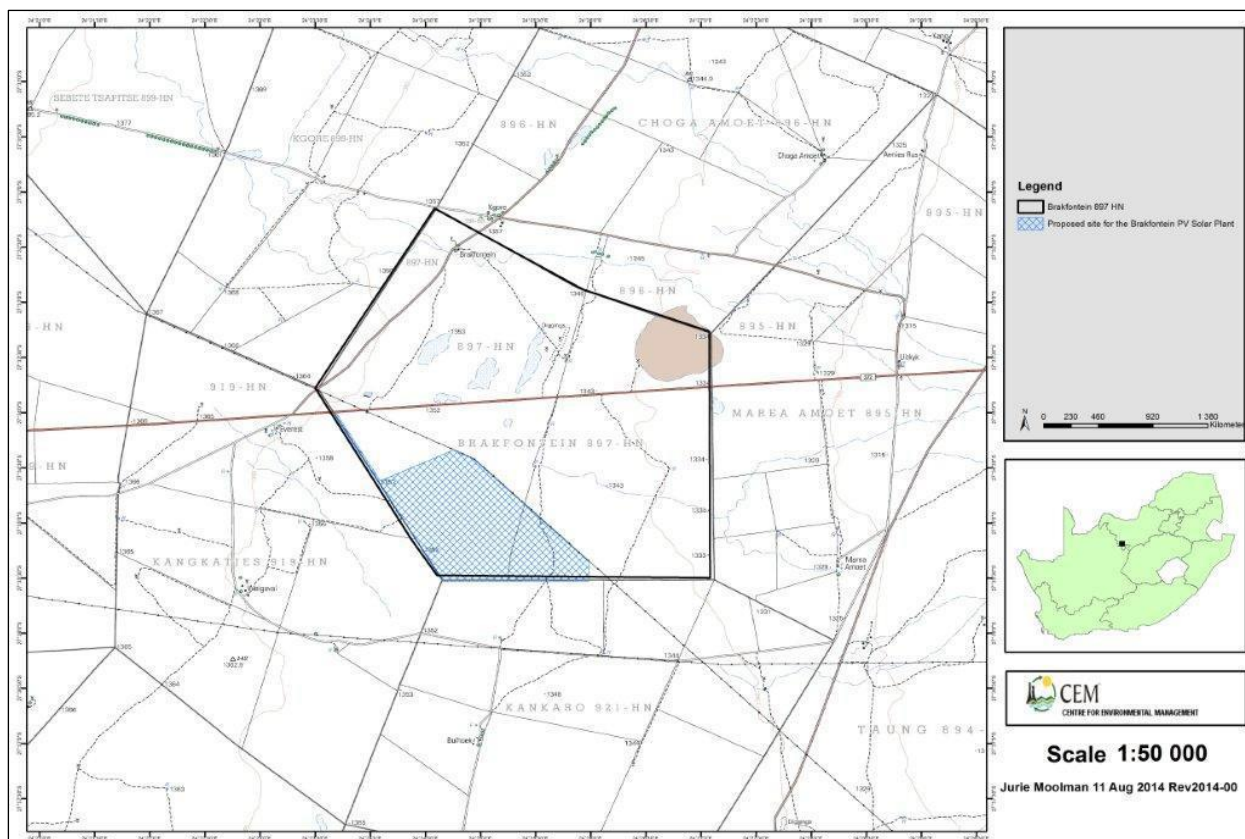


Figure 4 – This image depicts the farm and study area where the proposed PV power plant will be built (blue cross-hatched area). Map provided by the Centre for Environmental Management.

3. METHODOLOGY

3.1 General Methodology

This report was compiled by PGS Heritage for a proposed new 75MW PV solar power plant covering approximately 275 ha, with associated infrastructure, on the farm Brakfontein 879 HN, between Taung and Reivilo in the Greater Taung Local Municipality, Dr Ruth Segomotsi Mompati District Municipality, North West Province. The applicable maps, tables and figures are included as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (no 107 of 1998).

The Heritage Impact Assessment process consisted of three steps:

Step I – Literature Review: The background information to the field survey leans greatly on the archival and historical cartographic material assessed as part of the study as well as a study of the available literature.

Step II – Physical Survey: A physical survey of the study area was conducted over three days from 23 to 25 October 2014. The field survey was undertaken by an experienced professional archaeologist and was undertaken on foot and by vehicle.

Step III – Report: The final step involved the recording and documentation of relevant heritage resources, as well as the assessment of resources regarding the heritage impact assessment criteria and report writing, as well as mapping and recommendations.

3.2 Methodology for Assessing Heritage Site Significance

The assessment of significance of heritage sites was based on five main criteria:

- site integrity (i.e. primary vs. secondary context),
- amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter)
 - Low - <10/50m²
 - Medium - 10-50/50m²
 - High - >50/50m²
- uniqueness and
- potential to answer present research questions.

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

A - No further action necessary;

B - Mapping of the site and controlled sampling required;

C - No-go or relocate development position

D - Preserve site, or extensive data collection and mapping of the site; and

E - Preserve site

Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for

the Southern African Development Community (SADC) region, were used for the purpose of this report (see **Table 1**).

Table 1: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High/Medium	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium	Recording before destruction
Generally Protected C (GP.C)	Grade 4D	Low	Destruction

3.3 Methodology for Impact Assessment

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

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

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

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

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

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

Significance Assessment

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

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

Table 3: Description of the significance rating scale

RATING	DESCRIPTION
5 VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4 HIGH	Impact is of substantial order within the bounds of impacts which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.

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

Spatial Scale

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

Table 4: Description of the spatial significance rating scale

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of possible impacts, and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50 km from the proposed site / corridor.

3	Local	The impact will affect an area up to 5 km from the proposed site.
2	Study Area	The impact will affect an area not exceeding the boundary of the study area.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the site.

Temporal/Duration Scale

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

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

Table 5: Description of the temporal rating scale

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

Degree of Probability

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

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

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

Degree of Certainty

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

Table 7: Description of the degree of certainty rating scale

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

Quantitative Description of Impacts

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

$$\text{Impact Risk} = \frac{(\text{SIGNIFICANCE} + \text{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

3

5

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

Table 8: Example of Rating Scale

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	Low	Local	Medium Term	Could Happen	Low
Impact on heritage structures	2	3	3	3	1.6

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

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

Table 9: Impact Risk Classes

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

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

4. CURRENT STATUS QUO

4.1 Description of the Study Area

The proposed development is a 75MW PV solar power plant covering approximately 275 ha, with associated infrastructure, on the farm Brakfontein 879 HN, south of the R372 between Taung and Reivilo in the Greater Taung Local Municipality, Dr Ruth Segomotsi Mompati District Municipality, North West Province.

The study area is located on a flat and desolate portion of land with some open grassy areas interposed by dense vegetation such as thorn trees and bushes. The Umbrella Thorn Acacia (*Acacia tortilis*) appears to be prevalent on site. The study area seems to contain a thin layer of sand with a dolomite bank underneath. No evidence for farmhouses or dwellings could be seen within the area forming part of the project study area.



Figure 5 – General view of a section of the study area



Figure 7 – Another general view of the study area



Figure 6 – A further view of the study area



Figure 8 – One of the dolomite outcrops found on site

5. HISTORICAL AND ARCHAEOLOGICAL DESKTOP STUDY FINDINGS

5.1 Archival and Historic Maps of the Study Area and Surrounding Landscape

5.1.1 Vryburg Sheet of the Imperial Map Series (National Archives, Maps, 3/499)

During the first year of the South African War (1899-1902) the Imperial Map Series was compiled across large sections of South Africa. The map depicted below is the Vryburg sheet and was compiled in 1900.

The following observations can be made from the depicted sheet:

- With the exception of two secondary roads, one running south-west and one south-east across the farm, no heritage sites are depicted within the boundaries of the farm Brakfontein.
- The Kaukwe Native Reserve, which was established in 1895, is depicted a short distance north-west of the farm Brakfontein.
- The R372 between Reivilo and Taung did not yet exist.

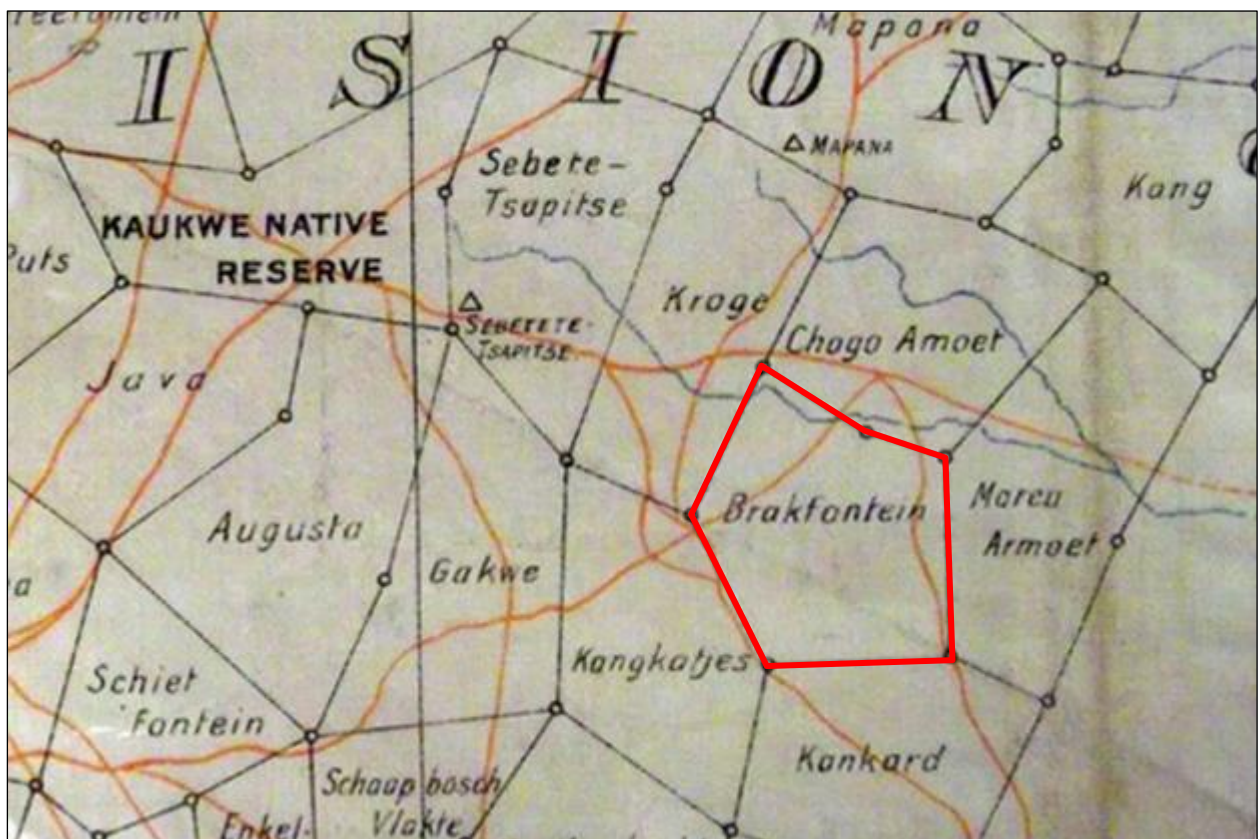


Figure 9 – Detail view of the Vryburg Sheet showing the farm Brakfontein within its local context.

5.1.2 Taungs Division Sheet (William Cullen Library, Map BMX 685.c.2 (1142))

This map was published by the Surveyor General as a revised edition, dated 1903. It was compiled from the farm surveys of the Transvaal and all available material.

The following observations can be made from the depicted sheet:

- The two secondary roads indicated on the earlier map can still be seen.
- The map depicts a number of buildings (in all likelihood farmsteads and farm buildings) on a number of the farms located in proximity to Brakfontein. However, no building is depicted on Brakfontein itself.

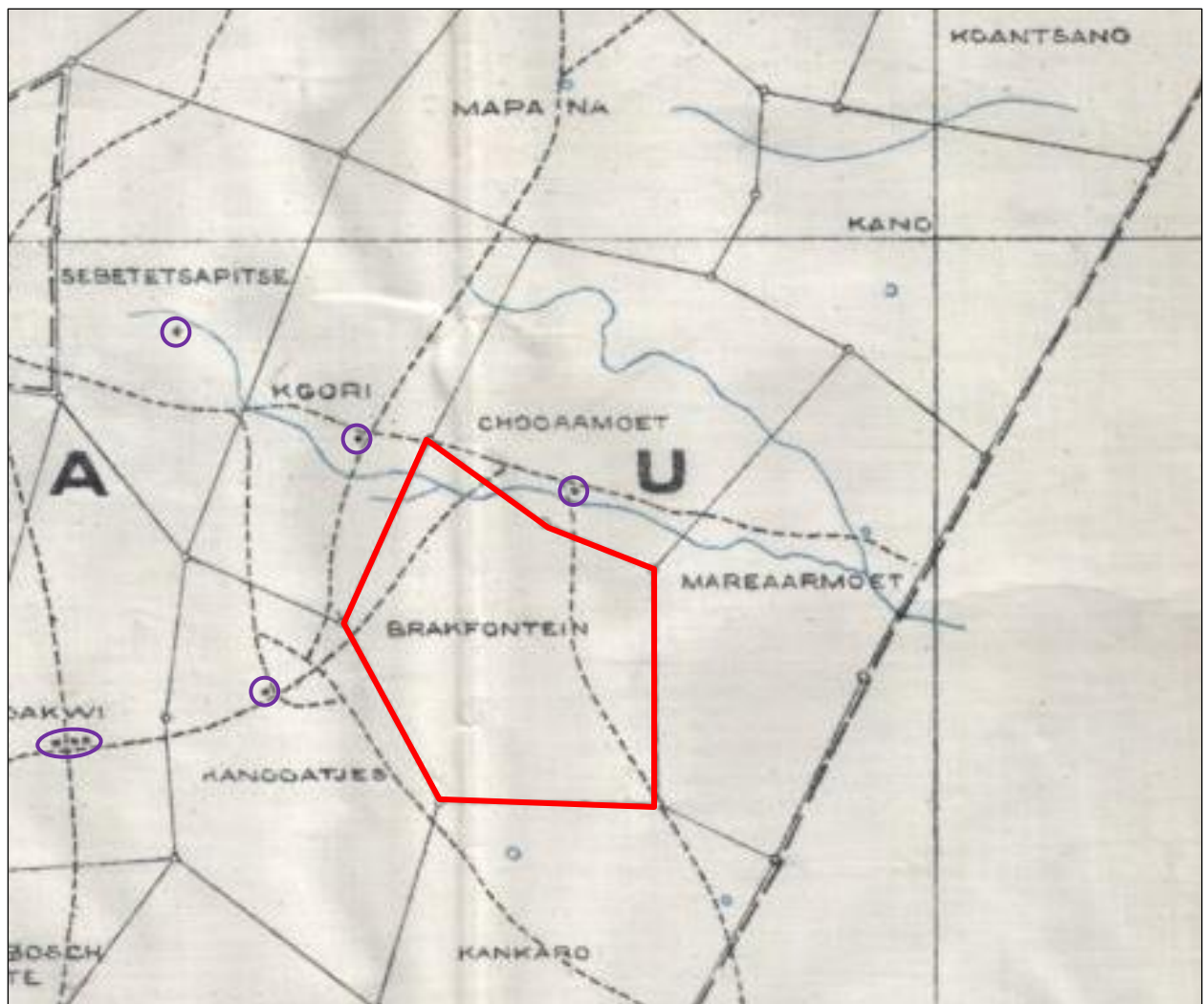


Figure 10 – Detail view of the Taungs Division Sheet showing the farm Brakfontein within its local context.

5.1.3 First Edition of the 2724CB Topographical Sheet

The map depicted below is a section of the First Edition of the 2724 Topographical Sheet. This map sheet was based on aerial photography conducted in 1968 and was surveyed in 1973. The map was printed in 1975 by the Director-General of Surveys. The following observations can be made from the map:

- No heritage sites are depicted within the study area.
- The Brakfontein farmstead is depicted near the northern end of the farm boundary, and as a result is a long distance away from the present study area. This is still the situation at present.

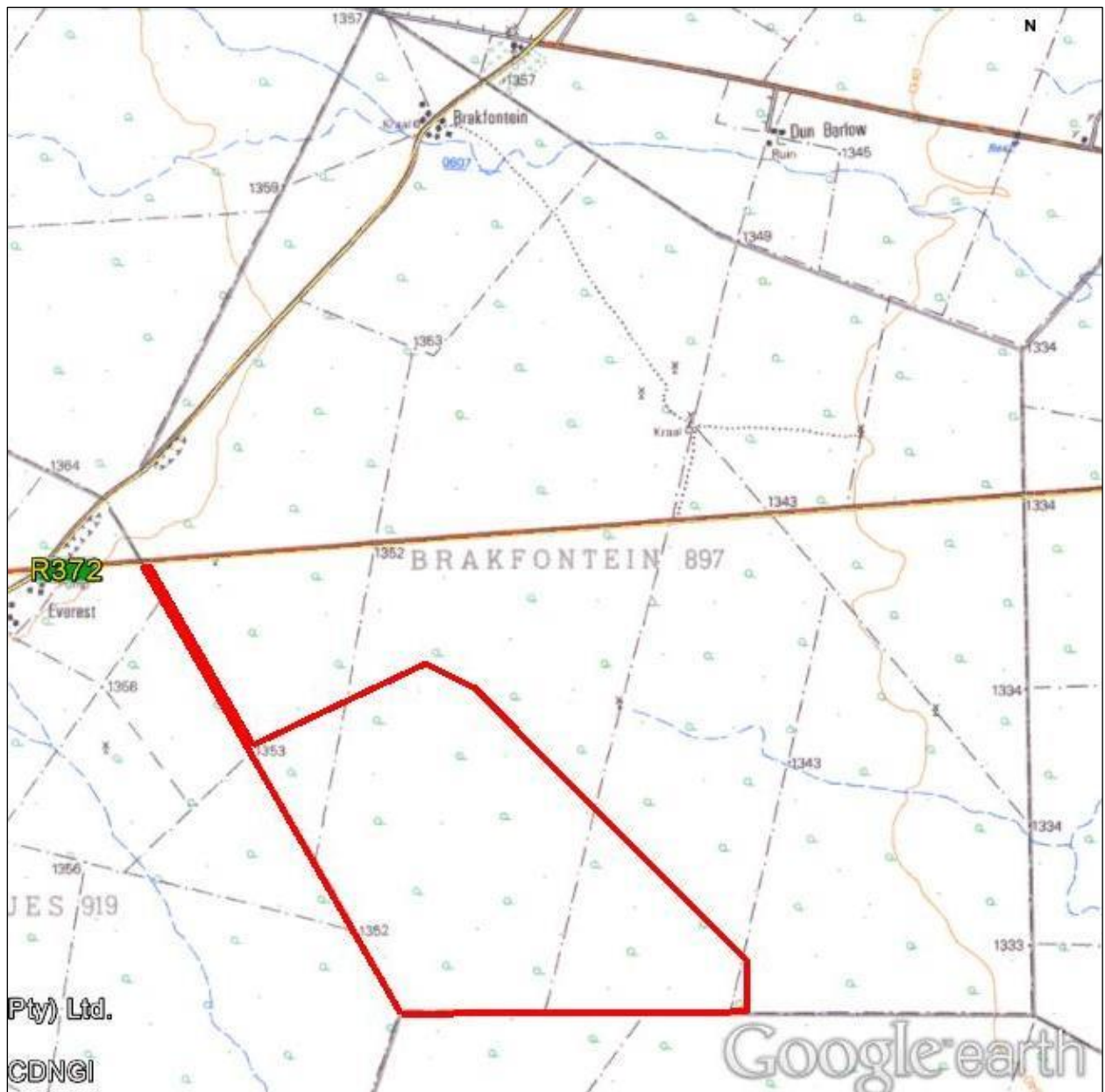


Figure 11 – Detail view of the First Edition of the 2724CB Topographical Map that was surveyed in 1973. The study area boundaries are depicted in red.

5.2 Archaeological Overview and Findings

5.2.1 Overview of the archaeological fabric of the study area and surroundings

A small number of archaeological and heritage contract projects have been undertaken in the general surroundings of the study area. Of the three heritage studies located in this area, two were undertaken for proposed photovoltaic solar farms and one for an extension to an existing base metal mine. No purely academic archaeological research appears to have taken place in the direct vicinity of the study area, with the nearest known research locality the Taung Skull World Heritage Site situated 18.4 km south-east of the present study area. It is important to note that the information listed here does not necessarily represent all the previous archaeological work undertaken in the vicinity of the study area. The second source is information from reports that were accessed from the SAHRA electronic database known as SAHRIS, and which for the most part came about due to the requirement for archaeological and heritage impact assessments to be undertaken for mining (and other development) activities.

5.2.2 Archaeological Sites as Revealed Through a Study of Published Literature

The following sites were identified by studying archaeological journals and books. The sites are grouped according to their respective farm names. At the end of each description the approximate distance between the site and the present study area is provided. No information could however be obtained with regard to any archaeological research that was undertaken in close proximity to the study area. In the surrounding landscape the following archaeological sites are known:

Taung

In 1924 Raymond Dart identified the skull of an infant gracile australopithecine from a limestone quarry near Taung. While numerous fossils have been recovered from the same quarry, the skull of the Taung Child is the only hominin remains recovered from this site. Taung is one of only three localities in South Africa where fossil evidence for early hominins were ever recovered, the other two being the Cradle of Humankind (with sites such as Sterkfontein and Kromdraai) and Makapansgat (Mitchell, 2002). The Taung Skull World Heritage Site is located 18 km east of the present study area.

Harts River Valley Survey Project

In 1989 the University of the Witwatersrand was commissioned to conduct an archaeological survey of a section of the Harts River valley that was scheduled to be flooded by the proposed construction of the

Taung Dam. A total of 28 Stone Age and three pastoralist sites were identified during the survey. Of the 38 identified Stone Age sites, a total of 11 could be associated with the Early Stone Age.

The best-preserved sites identified during the survey were excavated in 1992, including two of the Early Stone Age sites namely 2724DB3 and 2724DB4. Incidentally, the research undertaken at these two sites has provided valuable insight into the Acheulian archaeology of South Africa. In the words of Prof. Kathleen Kuman (2001:20), the “...Harts Valley project provides further documentation for the South African part of this picture of technological continuity and the origins of prepared core technology within the Acheulian”.

Seven rock art sites were also identified in the footprint area of the proposed Taung Dam. These seven sites comprise finger paintings of geometric patterns as well as one site which contains paintings of “...riders on horseback...riders on horseback chasing an elephant...and two geometric patterns” (Dowson et.al., 1992:28).

If any of these sites identified before the construction of the Taung Dam still exists, they would be located roughly 40 km east-by-northeast of the present study area.



Figure 12 – Tracing of one of the rock art panels at a site located roughly 40 km east of the present study area (Dowson, et.al., 1992: 29).

Wonderwerk Cave

Wonderwerk Cave is located 44km south of Kuruman and some 88km south-west of the present study area. Its palaeontological and archaeological importance was first realised by B.D. Malan, Basil Cooke and Laurie Wells more than 60 years ago. Karl Butzer undertook excavations there between 1974 and 1977, while Peter Beaumont, Anne Thackeray and Francis Thackeray conducted fieldwork at the site during 1978 and 1979. Their work recovered Later Stone Age fauna, lithics and rock engravings. During 1980 Peter Beaumont continued his work at the cave, and his findings at the time included Early Stone Age deposits. More recently, work has been undertaken at the cave by Michael Chazan of the University of Toronto and Liora Kolska Horwitz of the Hebrew University (Bamford & Thackeray, 2009).

5.2.3 Archaeological Sites as Revealed Through a Study of the SAHRIS Database

The reports discussed here were all accessed from the SAHRA electronic database known as SAHRIS. It is important to note that the reports listed here do not necessarily represent all the previous archaeological work undertaken in the vicinity of the study area. An attempt was made to locate reports on the database dealing with farms located either within the present study area, or in close proximity to it. The archaeological reports with located sites are grouped according to the respective farms on which these studies were undertaken. At the end of each description the approximate distance between these sites and the present study area is provided.

Only three reports were identified on SAHRIS in proximity to the study area. These reports are as follows:

- *Archaeological Impact Assessment (AIA) of a demarcated surface portion on the farm Kangkatjes 919 HN for the proposed Vidigenix Photovoltaic Power Plant and Power Line Development, Greater Taung Local Municipality, Northwest Province. Prepared for: Vidigenix (Pty) Ltd. Compiled by N. Kruger. Africa Geo-Environmental Services Gauteng (Pty) Ltd. November 2013.*
 - This AIA survey covered a portion of the farm Kangkatjes which is located directed adjacent (and on the western end) of the farm Brakfontein.
 - No archaeological or heritage sites were identified.

- *Heritage Impact Assessment (HIA) for the Proposed Pering Mining Project, located on the farm Pering Mine 1023 HN, Reivilo, North West Province. Prepared for Marsh. Compiled by P Birkholtz. PGS Heritage and Grave Relocation Consultants. November 2011.*
 - This survey was undertaken on the farm Pering, which is located 17 km to the north-west of the present study area.
 - Only one site was identified, namely a Low Density Surface Scatter of Later Stone Age material.
- *Heritage Impact Assessment (HIA) for the Proposed Development of Photovoltaic Power Plants on Five Different Locations in North West and Northern Cape Province. Prepared for Subsolar. Compiled by J van Schalkwyk. December 2011.*
 - As indicated in the report title, this survey was undertaken on five different properties. Two of these properties are located in proximity to the study area, namely a section of the farm Bismark 908 HN (17.3 km to the west of the study area) and a portion of the farm Pering 787 HN (16 km north-west of the study area).
 - No archaeological or heritage sites were identified on these two properties.

5.2.4 Findings in terms of the Archaeological Overview

The following observations can be made from the archaeological overview provided above:

- A number of archaeological sites have been identified along the Harts River Valley. These sites range from rock art to Early Stone Age sites. The closest distance between the study area and the Harts River is roughly 23 km.
- The study area is located some distance away from the Harts River and based on previous heritage and archaeological reports undertaken in this area, archaeological sites appear to occur less frequently in the flat and dry areas found in proximity to the study area than what is the case closer to the Harts River (to the south-east) or further to the west (i.e. where the Wonderwerk Cave is located).

5.3 Historic Overview of the Study Area and Surrounding Landscape

5.3.1 Historic Overview

DATE	DESCRIPTION
2.5 million to 250,000 years ago	<p>The Earlier Stone Age (ESA) is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these technological phases is known as Oldowan which is associated with crude flakes and hammer stones and dates to approximately 2 million years ago. The second technological phase in the Earlier Stone Age of Southern Africa is known as the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial handaxe. The Acheulian phase dates back to approximately 1.5 million years ago.</p> <p>A total of 11 Early Stone Age sites with Acheulian lithics have been recorded in the Harts River valley, immediately east of the town of Taung and roughly 40 km east of the present study area (Kuman, 2001).</p>
250,000 to 40,000 years ago	<p>The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. It is associated with flakes, points and blades manufactured by means of the prepared core technique.</p>
40,000 years ago to the historic past	<p>The Later Stone Age is the third phase in South Africa's Stone Age history. It is associated with an abundance of very small stone artefacts (microliths). The Later Stone Age is also associated with rock engravings and rock paintings.</p> <p>Rock engravings are known from the wider vicinity of the study area (Bergh, 1998), with one known site located at Dinkweneng (roughly 43 km east of the study area). Furthermore, a Low Density Surface Scatter of Later Stone Age material was identified at the Pering Mine (approximately 17 km north-west of the study area) (Birkholtz, 2011).</p>
Early 1600s	<p>The Tswana groups known as the Thlaping and Thlaro moved southward into the area presently known as the Northern Cape. A century later they were settled in areas as far south as Majeng (Langeberg), Tsantsabane (Postmasburg) and Tlhaka le Tlou (Danielskuil) (Snyman, 1986).</p>

c. 1770	The Kora moved into the area. Due to their superior firearms they applied increasing pressure on the Thlaping and Thlaro groups. In the end the Thlaping moved into a north-eastern direction to settle in the general vicinity of Dithakong, north-east of present-day Kuruman. The Thlaro settled in areas to the west and north-west of the Thlaping (Snyman, 1986).
c. 1795	Legassick (2010) confirms the presence of the Thlaping, Thlaro and Kora in the general vicinity of the study area during this time.
Early 1800s	After the threat of the Kora became less intensive the Thlaping moved to the vicinity of present-day Kuruman. The Thlaro returned to the Langeberg, establishing them on a permanent basis there during the 1820s (Snyman, 1986). During this time German-born deserter Jan Bloem and his followers established themselves at Lekatlong, roughly 80km south of the present study area (Legassick, 2010).
1820s	Barend Barends and his followers moved from their settlement at Danielskuil to Boetsap. Boetsap is roughly 42.6 km south of the study area. During the same time Thlaping ruler Mothibi, the brother of Mahura, settled in the vicinity of Boetsap before moving to Griquatown (Legassick, 2010).
1833	Hurutshe refugees established themselves at Taungs (Legassick, 2010). The present-day town of Taung is roughly 33 km due-east of the study area.
1834	Mahura and his Thlaping followers moved from the vicinity of Kuruman to Taungs. Apart from the 1,500 individuals that followed Mahura to Taungs, the settlement of Taungs at the time also included some 2,000 Hurutshe, the Kora leader Mosweu Taaibosch and his followers as well as some 1,500 Maidi (Legassick, 2010).
November 1840	Gasibonwe, the son of Mothibi, attacked Mahura's cattle posts at Taungs and further afield. His aim was to degenerate Mahura's rule and to achieve supremacy over all the Thlaping (Legassick, 2010).
22 April 1842	A treaty was signed between Griqua leader Andries Waterboer and Thlaping leader Mahura at Mahura's settlement near Taungs. The agreement included a definition of the boundary between the two groups. The section of the agreed

	upon boundary closest to the study area ran from Danielskuil to Boetsap, which meant that the study area was defined as part of this treaty as forming part of Thlaping land (Legassick, 2010). This boundary was very similar to an earlier one that was thought to have been agreed to during the 1820s as a boundary between the Griqua and the Thlaping (Legassick, 2010).
1867	Diamonds were discovered for the first time in South Africa near Hopetown. Alluvial diamonds were also discovered along both banks of the Orange River in the vicinity of the confluence of the Vaal and Harts Rivers (Van Staden, 1983). This resulted in large numbers of fortune seekers streaming into the area from overseas, which would have had a profound impact on the social-dynamics of the landscape.
27 October 1871	The area located in the triangle formed by the Orange and Vaal Rivers was proclaimed as British Territory and named Griqualand West. This proclamation came as a result of ownership disputes between the Griqua, the Boer Republic of the Orange Free State and the Boer Republic of the Zuid-Afrikaansche Republiek in terms of the newly discovered diamond diggings (www.wikipedia.com).
1879	After Barend Barends was defeated by the Khumalo Ndebele of Mzilikazi, Boetsap was occupied by two shopkeepers, Hunter and Tasker.
1882-1885	The Boer Republic of Stellaland existed during this time in the general area of the Vryburg district. Stellaland had its roots in the conflict between Mankurwane's Tlhaping and Mosweu's Kora over land. Both sides used white mercenaries who as part of their remuneration were to receive farms. Almost 300 Boers joined the side of Mosweu in this war and on 26 July 1882 Mankurwane sued for peace. As a result of the peace agreement a portion of land was set aside for the mercenaries. From September 1882 the capital of Stellaland was being laid out and named Vryburg. On 6 August 1883 the Republic of Stellaland was proclaimed. However, the republic ceased to exist when Sir Charles Warren proclaimed the Bechuanaland Protectorate on 30 September 1885 (Bergh, 1999). The Taungs area, including the farm Brakfontein, was located just outside the southern boundary of Stellaland.

2 June 1883	The Dutch Reformed Church of Cathcart West was established on this day. It was established on the farm Klein Boetsap, some 53 km south-west of the present study area. At the time Cathcart-West was the northernmost Dutch Reformed Church in the area presently known as the Northern Cape (Van Staden, 1983).
30 September 1885	Sir Charles Warren proclaims British Bechuanaland. This proclaimed area included the study area (www.wikipedia.com).
1888	The Church Council of Cathcart-West decided to change the name from Cathcart-West to Klein Boetsap (Van Staden, 1983).
1895	British Bechuanaland was incorporated into the Cape of Good Hope (www.wikipedia.com). The study area now fell within the Cape of Good Hope. In the same year the Kaukwe Native Reserve was established in accordance with British Bechuanaland Proclamation No. 220 (Breutz, 1986). This reserve is located 6.6 km north-west of the present study area
30 May 1917	<p>The decision was made by the Church Council of Klein Boetsap for the Dutch Reformed Church to buy the farm Bruintjiesfontein (Van Staden, 1983). This farm is located where Reivilo is today, and is some 20.8 km west of the present study area. A town was also established on the farm by the church.</p> <p>The present town of Reivilo is located 96 km south-west of Vryburg and 55 km west of Taung. It was proclaimed in 1941, and became a municipality in 1967. At first named Klein Boetsap after the Dutch Reformed parish, it was renamed Reivilo in 1927. The name is an inversion of the surname of the Reverend A J Olivier, local minister of the Dutch Reformed Church from 1914 to 1921 and 1922 to 1926 (Raper 1983).</p>
3 October 1919	The decision was made by the Church Council for the town that was in the process of being established on the farm Bruinjesfontein to be known as Reivilo. This name was chosen in honour of the church's Ds. A.J. Olivier (Van Staden, 1983).
1921	The farm Mahura Muthla, located approx. 33 km north-west of the present study area, was acquired in this year by a mining company to mine the alluvial

	diamonds located there.
19 February 1921	The decision was made by the Church Council of Klein Boetsap for the church to be moved from Klein Boetsap to Reivilo (Van Staden, 1983).
27 September 2003	The farms Kahukwe, Klipnes and Droogfontein, located roughly 6.6 km north-west of the study area, were handed back to original owners after a successful land restitution process was instituted (www.beeld.com). These farms originally comprised the Kaukwe Native Reserve which had been established in 1896. The land was dispossessed under the previous government's policy of Apartheid (www.info.gov.za).

5.3.2 Findings from Historic Overview

Although the historic overview of the study area and surroundings has revealed a long and significant history for the surroundings of the study area, almost none of the historical events highlighted in this report can be positively linked to the study area itself. This said, in a number of cases, mention is made to properties and localities located in the general vicinity of the present study area.

- By at least c. 1795 groups such as the Thlaping, Thlaro and Kora were all present in the general vicinity of the study area.
- By 1834, the settlement of Taungs and surroundings included some 2,000 Hurutshe, the Kora leader Mosweu Taaibosch and his followers as well as some 1,500 Maidi.
- In 1895, British Bechuanaland was incorporated into the Cape of Good Hope (www.wikipedia.com). The study area now fell within the Cape of Good Hope. In the same year the Kaukwe Native Reserve was established in accordance with British Bechuanaland Proclamation No. 220 (Breutz, 1986). This reserve is located 6.6 km north-west of the present study area
- On 30 May 1917 the decision was taken by the Church Council of Klein Boetsap for the Dutch Reformed Church to buy the farm Bruintjiesfontein. Two years later the decision was made for the newly established town to be named Reivilo in honour of Ds. A.J. Olivier (Van Staden, 1983).
- On 17 September 2003 the farms Kahukwe, Klipnes and Droogfontein were handed back to their original owners after a successful land restitution process was instituted (www.beeld.com). These farms originally comprised the Kaukwe Native Reserve which had been established in 1896. The land was dispossessed under the previous government's policy of Apartheid (www.info.gov.za).

6. PALAEOLOGICAL DESKTOP STUDY AND FINDINGS

6.1 Introduction

Dr. Gideon Groenewald was commissioned to conduct a palaeontological desktop study for the proposed development. Refer Annexure A for the complete Palaeontological Report

6.2 Geology of the Study Area

The study area is underlain by rocks of the Reivilo Formation, Ghaap Group, Transvaal Supergroup.

6.2.1 The Reivilo Formation

The Reivilo Formation consists of chert-poor stromatolitic dolomites. The areas underlain by dolomites are also prone to have a very high possibility of Cenozoic-aged carbonaceous cave breccias.

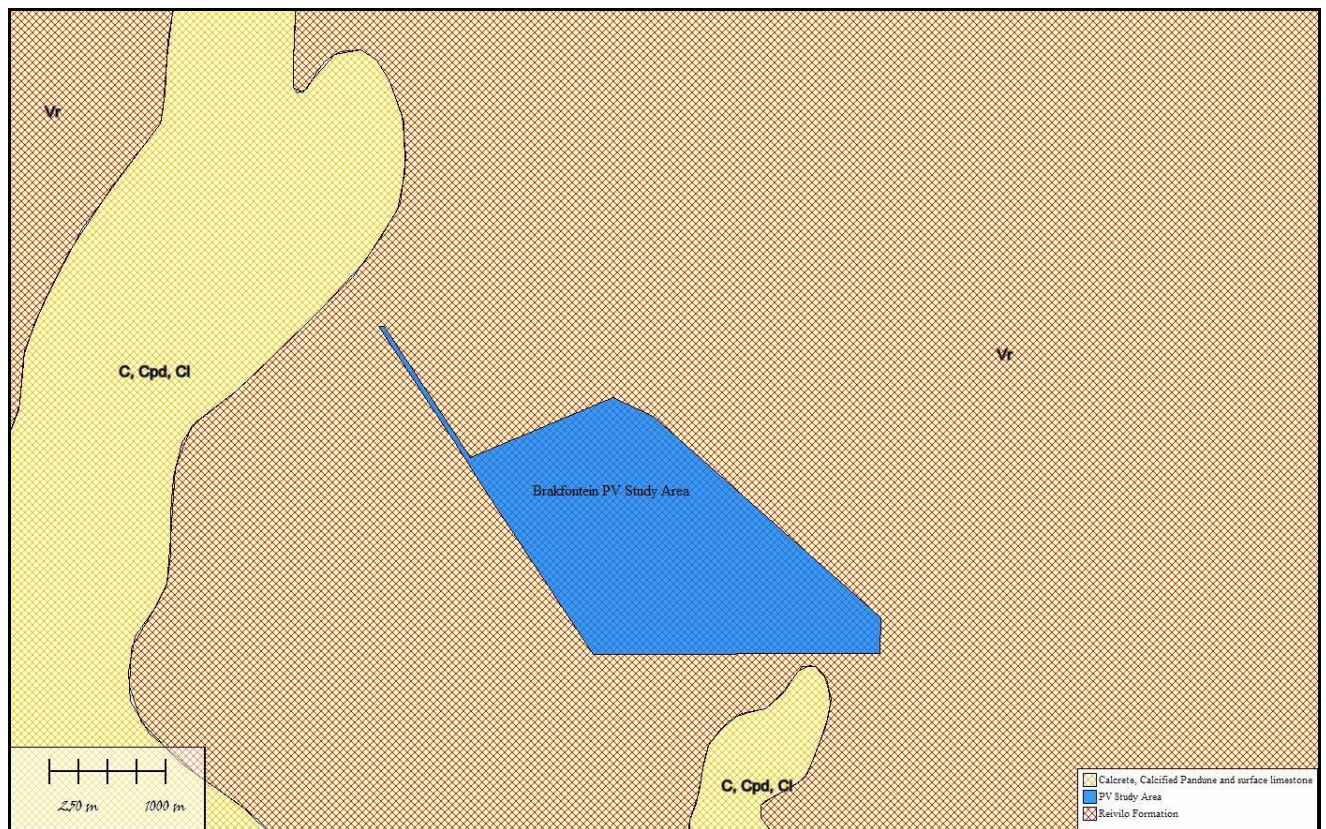


Figure 13 – Geology of the Study Area

6.3 Palaeontology of the Study Area

6.3.1 The Reivilo Formation

A range of shallow marine and lacustrine stromatolites (some very large), oolites, pisolites in carbonates, filamentous and coccoid organic walled microfossils (eg cyanobacteria) in siliciclastics / carbonates, as well as cherts of banded iron formations (BIF): Schmidtsdrift, Campbell Rand & Asbestos Hills Subgroups. The Cenozoic-aged cave breccias that can be associated with the dolomites of the Ghaap Group can contain extremely important fossil remains, including the remains of Hominins.

6.4 Palaeontological Sensitivity of the Study Area

The entire development area falls on highly sensitive dolomitic terrain, being both sensitive for dolomitic stromatolites and micro-fossils, as well as possible fossiliferous breccias.



Figure 14 – Palaeontological sensitivity of the Study Area (red = Very High)

6.5 Palaeontological Findings

The Brakfontein Study Area is underlain by Vaalian aged rocks of the Ghaap Group. The very high fossiliferous potential of the Ghaap Group strata warrants an allocation of a Very High palaeontological sensitivity to the areas underlain by the rocks of the Reivilo Formation. The potential carbonaceous breccias might contain very important early Hominin remains.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments contains significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages.
2. A qualified palaeontologist must be appointed to conduct a Phase 1 Palaeontological Impact Assessment to confirm the presence of significant fossils of stromatolites and possible cave breccia deposits on this site and to make the necessary recommendations regarding a possible Phase 2 PIA during the construction phase.
3. These recommendations should form part of the EMP of the project.

7. FIELDWORK FINDINGS

Refer **Annexure A** for the recorded GPS track logs.

A foot survey of the study area was undertaken over a period of three days from 23 to 25 October 2014. General landscape features, such as ridges, water courses and open areas were prioritised during the foot survey, since these are the most likely locations for past human activity. In addition the survey was logged and areas insufficiently covered by the first strategy were surveyed to ensure that the total area was covered appropriately. Since the area contains dolomite deposits with breccia inclusions, and given the relative proximity of Taung, specific attention was paid to breccia visible on the surface.

As no one lives within the study area, informal communications with local residents such as farm workers took place with the help of the farm manager. No one had any knowledge of previous habitation of the area or any heritage resources present.

No indications of any archaeological or historical heritage sites indicating past human activity were observed. None of the breccias visible on the surface contained any signs of fossils of any age.

8. IMPACT OF PROPOSED DEVELOPMENT ON HERITAGE RESOURCES

No archaeological or heritage sites were identified within the study area during the fieldwork and desktop study components. As a result no impact is expected on these two aspects. However, the palaeontological desktop has revealed that the study area has a Very High Palaeontological Sensitivity. As a result the potential exist for the development to have a significant impact on such resources. However, a Phase 1 Palaeontological Impact Assessment comprising a field assessment of the study area is recommended to establish the exact palaeontological characteristics of the study area.

9. MITIGATION MEASURES AND GENERAL RECOMMENDATIONS

9.1 Palaeontology

The following recommendations are made:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments contains significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages.
2. A Qualified palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment to confirm the presence if significant fossils of stromatolites and possible cave breccia deposits on this site and to make the necessary recommendations regarding a possible Phase 2 PIA during the construction phase.
3. These recommendations should form part of the EMP of the project.

9.2 General Mitigation Measures

1. Please note that while the study area was covered in detail during the physical survey, the subterranean nature of some heritage sites - such as archaeological deposits, graves and burials - means that one can never exclude the potential existence of any such resources within the study area. Therefore, should any heritage sites not included in this report be discovered during the construction phase of the project, construction should stop immediately in that area and a suitably qualified archaeologist or heritage practitioner be called to site to investigate the finds and make recommendations on the way forward.

10. CONCLUSIONS

PGS Heritage was appointed by the Centre for Environmental Management to undertake a Heritage Impact Assessment for the proposed construction of a photovoltaic power station and associated infrastructure on the farm Brakfontein 879 HN, situated between Taung and Reivilo in the Greater Taung Local Municipality, Dr Ruth Segomotsi Mompati District Municipality, North West Province.

1) Desktop Studies

- Archival and Historical Maps

Three historical maps covering the study area, and specifically the farm Brakfontein, were located. No obvious heritage sites are indicated on the two early maps depicting the study area.

- History

An archival and historical study was undertaken which has shown that the surroundings of the study area have a long and significant history. However, even though this historical study was quite intensive and detailed, very little historical data with regard to the study area itself could be located.

- Archaeology

An investigation was undertaken of previous heritage studies conducted in the surroundings of the study area by utilising the South African Heritage Resources Information System (SAHRIS). Three such reports were found. The combined archaeological sites identified by these studies comprise a single low density surface scatter of Later Stone Age material. This suggests that the surroundings of the study area have a low archaeological site frequency. Furthermore, a general literature study of published archaeological books and journals augments the SAHRIS data in that no archaeological academic research appears to have taken place in the direct surroundings of the study area. The closest known published site to the study area is the Taung Skull World Heritage Site, with a number of sites located in the Harts River Valley (roughly 40 km east of the study area) also written on. The Taung Skull World Heritage Site is located 18 km south-east of the present study area and is famous for the fact that in 1924 Dr. Raymond Dart identified the skull of an infant gracile australopithecine from a limestone quarry at this site. Taung is one of only three localities in South Africa where fossil

evidence for early hominins were ever recovered, the other two being the Cradle of Humankind (with sites such as Sterkfontein and Kromdraai) and Makapansgat (Mitchell, 2002).

- Palaeontology

Dr. Gideon Groenewald conducted a palaeontological desktop study of the study area. His findings are that the entire development area falls on a highly sensitive dolomitic terrain, being both sensitive for dolomitic stromatolites and micro-fossils, as well as possible fossiliferous breccias.

The following recommendations are made in his report:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments contains significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages.
2. A qualified palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment to confirm the presence if significant fossils of stromatolites and possible cave breccia deposits on this site and to make the necessary recommendations regarding a possible Phase 2 PIA during the construction phase.
3. These recommendations should form part of the EMP of the project.

2) Fieldwork Findings

An experienced archaeologist conducted a walkthrough of the study area. No indications of any archaeological or historical sites were observed.

3) Conclusions and Recommendations

The proposed development is not expected to have any impact on archaeological or heritage sites. However, the palaeontological significance of the site has been assessed as Very High. As a result, certain mitigation measures are recommended (see above). On the conditions that the recommendations made in this report are adhered to, the development may be allowed to continue.

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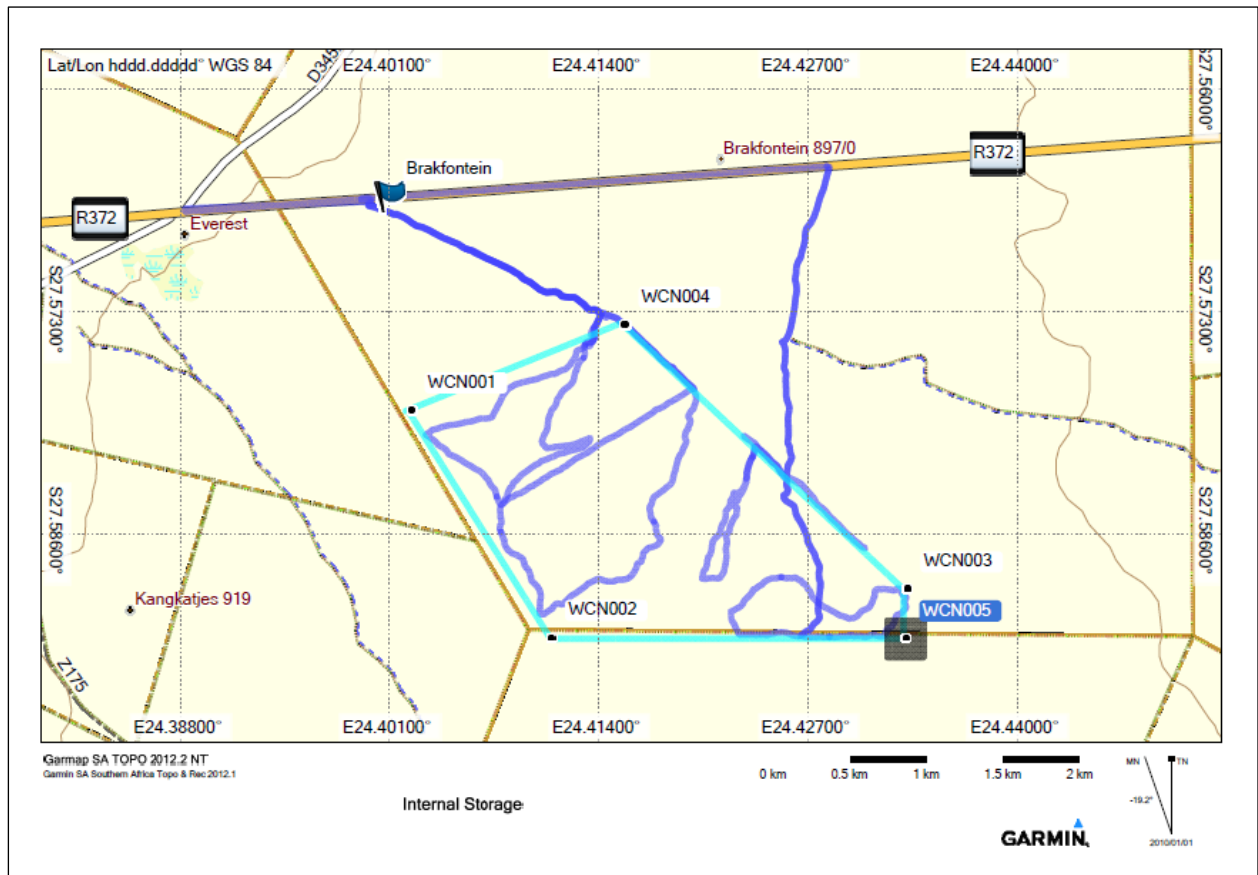
Historic Topographic Maps

One of the historic topographic maps used in this report was obtained from the National Archives and the other from the digital resources of the William Cullen Library, Historical Papers, Early Maps collection.

Google Earth

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

MAP DEPICTING THE RECORDED GPS TRACK LOGS



PALAEONTOLOGICAL DESKTOP STUDY

**PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE
PROPOSED CONSTRUCTION OF A PHOTOVOLTAIC
POWER STATION AND ASSOCIATED INFRASTRUCTURE
ON THE FARM BRAKFORTEIN 879 HN BETWEEN TAUNG
AND REIVILLO IN THE NORTH WEST
PROVINCE**

For:

HIA CONSULTANTS



DATE: 28 October 2014

By

**Gideon Groenewald
082 339 9202**

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PGS Heritage Consultants to undertake a desktop survey, assessing the potential palaeontological impact of the proposed construction of the Brakfontein PV Facility on the farm Brakfontein 897 HN between Taung and Reivillo in the North West Province.

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

The applicant, Brakfontein Solar Plant (Pty) Ltd., proposes to develop a 75MW PV solar power plant covering approximately 275 ha, with associated infrastructure, on the farm Brakfontein 879 HN, south of the R372 between Taung and Reivillo in the North West Province.

The Brakfontein Study Area is mainly underlain by Valian-aged rocks of the Ghaap Group. The Reivillo Formation consists of chert-poor stromatolitic dolomites. The areas underlain by dolomites are also prone to have a very high possibility of Cenozoic-aged carbonaceous cave breccias. The very high fossiliferous potential of the Ghaap Group strata warrants an allocation of a Very High palaeontological sensitivity to the areas underlain by the rocks of the Reivillo Formation. The potential carbonaceous breccias might contain very important early Hominin remains.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments contain significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages.
2. A Qualified palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment to confirm the presence of significant fossils of stromatolites and possible cave breccia deposits on this site and to make the necessary recommendations regarding a possible Phase 2 PIA during the construction phase.
3. These recommendations should form part of the EMP of the project.

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1. INTRODUCTION

1.1 Background

Gideon Groenewald was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontological impact of the proposed construction of the Brakfontein PV Facility on the farm Brakfontein 897 HN between the towns of Taung and Reivilo in the North West Province.

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

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

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

1.2 Aims and Methodology

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

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

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

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1 below.

Table 1. Palaeontological Sensitivity Analysis Outcome Classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al 2008.	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, Phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction), as well as application for collection and destruction permit compulsory.
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and Phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example, areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and Phase I PIA (ground proofing of desktop survey) recommended.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of, for example, small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Developer and HIA consultant must take note of possible fossils and make professional recommendations on the impact of development on significant palaeontological finds recorded in the literature. SAHRA must be notified if new fossils are recorded and collection of a representative sample of potential fossiliferous material is recommended.

GREY	<p>Very Low Palaeontological sensitivity/vulnerability. Very low to no possibility that fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during emplacement of the rocks. It is however, essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic-aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Developer and HIA consultant must note archaeological reports for possible descriptions of palaeontological finds in Cenozoic aged surface deposits.</p>
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1.3 Scope and Limitations of the Desktop Study

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

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

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

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

2. DESCRIPTION OF THE PROPOSED DEVELOPMENT

The applicant, Brakfontein Solar Plant (Pty) Ltd., proposes to develop a 75MW PV solar power plant covering approximately 275 ha, with associated infrastructure, on the farm Brakfontein 879 HN, south of the R372 between Taung and Reivilo in the North West Province.

The project will include the following:

- One 75 MW solar PV plant, developed on a single 275 ha site;
- A new substation next to the existing 132 kV Eskom power line;
- A new 1.8 km long main gravel access road of 10 m reserve width from the R372 road to the solar PV plant development, which will be constructed along the western boundary of the farm.

The PV plant will also include the following related infrastructure:

- Buildings and Services (Control room, small office and workshop)
- Parking Area
- Perimeter Fencing
- Security System
- Internal and perimeter service roads of 3m surface width and 5 m reserve width
- Meteorological Stations
- Drainage Systems
- Inverters and Concentrator Boxes
- Transformation Centre
- Electrical Reticulation
- Evacuation Line
- Lightning Protection System
- Auxiliary Supply
- Emergency power Supply
- Monitoring and Control systems
- Trenches

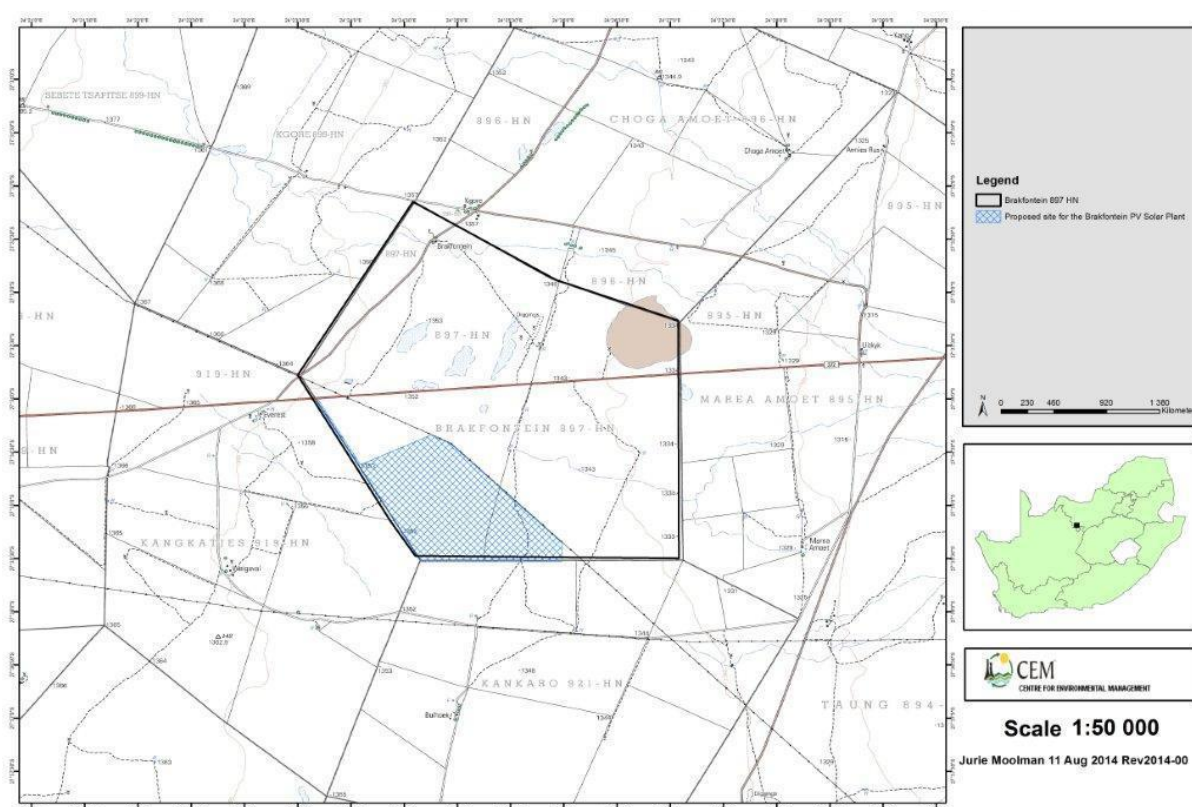


Figure.15 Site Location of the proposed Brakfontein PV Solar Plant



Figure.16 Locality of the proposed Brakfontein PV solar farm

3. GEOLOGY

The study area is underlain by rocks of the Reivilo Formation, Ghaap Group, Transvaal Supergroup.

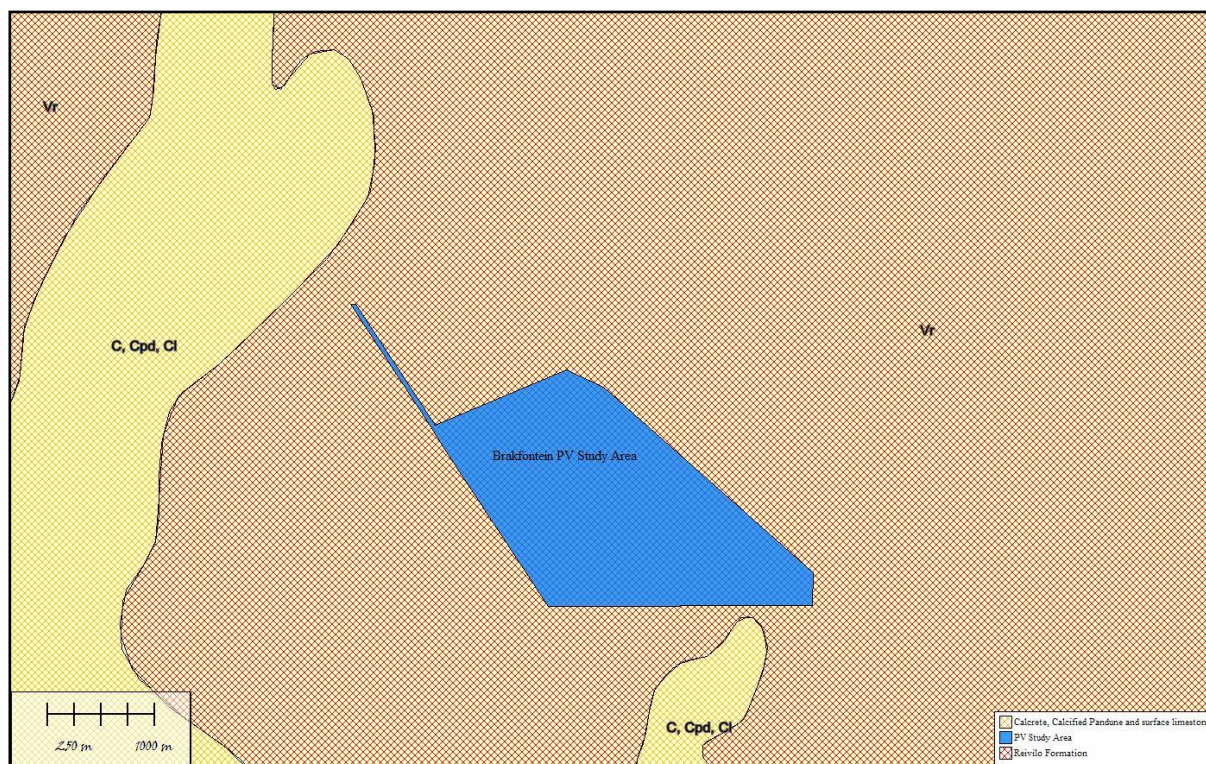


Figure.17 Geology of the study area

3.1 The Reivilo Formation

The Reivilo Formation consists of chert-poor stromatolitic dolomites.

The areas underlain by dolomites are also prone to have a very high possibility of Cenozoic-aged carbonaceous cave breccias.

4. PALAEOONTOLOGY OF THE AREA

4.1 Reivilo Formation

Range of shallow marine and lacustrine stromatolites (some very large), oolites, pisolites in carbonates, filamentous and coccoid organic walled microfossils (eg cyanobacteria) in siliciclastics / carbonates, as well as cherts of banded iron formations (BIF): Schmidtsdrift, Campbell Rand & Asbestos Hills Subgroups. The Cenozoic-aged cave breccias that can be associated with the dolomites of the Ghaap Group can contain extremely important fossil remains, including the remains of Hominins.

5. PALAEOONTOLOGICAL SENSITIVITY

The entire development area falls on highly sensitive dolomitic terrain, being both sensitive for dolomitic stromatolites and micro-fossils, as well as possible fossiliferous breccias (Figure 5.1). The different sensitivity classes used are explained in Table 1 above.



Figure.18 Paleontological sensitivity of the geological formations in the study area. Colours are explained in Table 1 above.

6. CONCLUSION AND RECOMMENDATIONS

The Brakfontein Study Area is underlain by Vaalian aged rocks of the Ghaap Group.

The very high fossiliferous potential of the Ghaap Group strata warrants an allocation of a Very High palaeontological sensitivity to the areas underlain by the rocks of the Reivilo Formation. The potential carbonaceous breccias might contain very important early Hominin remains.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that the Ghaap Group sediments contains significant fossil remains, albeit mostly stromatolites and micro-fossil assemblages.
2. A Qualified palaeontologist must be appointed to do a Phase 1 Palaeontological Impact Assessment to confirm the presence if significant fossils of stromatolites and possible cave breccia deposits on this site and to make the necessary recommendations regarding a possible Phase 2 PIA during the construction phase.
3. These recommendations should form part of the EMP of the project.

7. REFERENCES

Johnson MR, Anhausser CR and Thomas RJ. 2006. The Geology of South Africa. Geological Society of South Africa.

8. QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

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

9. DECLARATION OF INDEPENDENCE

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



Dr Gideon Groenewald
Geologist

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

1. GENERAL PRINCIPLES

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

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

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

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

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

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

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;

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

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

2. GRAVES AND CEMETERIES

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and National Health Act (Act 61 Of 2003) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

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

authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

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