BIOTHERM ENERGY (PTY) LTD

TLISITSENG PROJECT - TLISITSENG 1 SUBSTATION AND POWER LINE

Heritage Impact Assessment

Issue Date: 12 July 2016
Revision No.: 2
Project No.: 13303

Date:	12 07 2016
Document Title:	Heritage Impact Report
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Revision Number:	1
Checked by:	
For:	SiVEST Environmental Division

Executive Summary

PGS Heritage (Pty) Ltd (PGS) was appointed by SiVEST Environmental Division (SiVEST) to undertake a Heritage Impact assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed development of two 75MW solar photovoltaic (PV) energy facilities near Lichtenburg, North West Province. This report addresses the Tlisitseng Solar 1 132kV power line to connect the PV facilities to the proposed Tlisitseng substation.

The Heritage Impact Assessment has shown that the proposed Tlisitseng Solar projects does have heritage resources present on the property. This has been confirmed through archival research, evaluation of aerial photography of the sites and a field survey.

HERITAGE RESOURCES

No heritage resources related to the archaeological and historical time period were identified.

Palaeontology

The study area is underlain by Vaalian aged dolomite of the Monte Christo Formation, Chuniespoort Group. Stromatolites are known to occur within these deposits and more modern fossiliferous Caenozoic cave breccias have been recorded associated with carst formation in the dolomite.

During the fieldwork period several arbitrary finds of dolomite and chert with significantly well-defined stromatolites as well as a few potential sites with either associated sinkholes or cave breccias were recorded. Confirmation of the significance of these sites will only be possible after completion of the geotechnical surveys.

Palaeontology mititigation

During the fieldwork period several arbitrary finds of dolomite and chert with significantly well-defined stromatolites as well as a few potential sites with either associated sinkholes or cave breccias were recorded.

- Although no significant fossils were recorded in situ in both PV sites as well as the proposed alternative route corridors for the power lines, several well-defined micro-stromatolites and possible sites with cave breccia have been identified. Depending on the results of the geotechnical investigation and where potential excavations for foundations will exceed 1.5m, the ECO must investigate the possible presence of stromatolites and/or cave breccia and inform the HIA consultants immediately for appropriate action and appointment of a qualified palaeontologist to investigate the site before destruction of fossils occurs.
- Site visits as stipulated in the management tables will include an initial 2-day site visit and then fortnightly during construction.

- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Impact Summary

Table 1 provides a summary of the projected impact rating for this project on heritage resources.

Table 1 - Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	9	Negative Low Impact	9	Positive Low Impact
Palaeontology	Impact during construction	63	Negative	57	Positive

Comparative Assessment of Alternatives – Tlisitseng 1 Substation and Power Line

An assessment of the two Substation of Options indicates that none of the two will have an impact on heritage resources and thus no preference for either exists.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
SUBSTATION		
Alternative 1	**NO PREFERENCE**	No impact on heritage resources
Alternative 1	**NO PREFERENCE**	No impact on heritage resources

Cumulative impacts

An evaluation of the possible cumulative impacts from the combined solar projects in the area (Table 7 and **Figure 8**) on heritage resources has shown that the biggest envisaged impact could be on the palaeontological heritage of the area with the Watershed Solar Energy facility just northwest of this proposed development increasing the possibility of impacts on the breccias that could occur in the area.

Though with the implementation of mitigation measures these impacts could be transformed into a positive impact through the discovery of previously unknown fossils and the subsequent study of

such fossil finds adding to the academic knowledge of the palaeontological resources of the study area.

Conclusion

The overall impact on heritage resources is seen as acceptable and the proposed mitigation measures to be incorporated in the EMP will provided the necessary actions to address any impacts on heritage resources.

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HERITAGE SCOPING REPORT

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1 INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) was appointed by SiVEST Environmental Division (SiVEST) to undertake a Heritage Impact assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed development of two 75MW solar photovoltaic (PV) energy facilities near Lichtenburg, North West Province. This report addresses the Tlisitseng Solar 1 132kV power line to connect the PV facilities to the proposed Tlisitseng substation.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites, finds and sensitive areas that may occur in the study area for the EIA study. The Heritage Impact Assessment (HA) aims to inform the Environmental Impact Assessment in the development of a comprehensive Environmental Management Plan 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

PGS Heritage (PGS) compiled this Heritage Impact Report.

The staff at PGS has a combined experience of nearly 70 years in the heritage consulting industry. PGS and its staff have extensive experience in managing the HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Wouter Fourie, Project manager for this project, is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA) and has CRM accreditation within the said organisation, as well as being accredited as a Professional Heritage Practitioner with the Association of Professional Heritage Practitioners – Western Cape (APHP).

Jessica Angel, holds a Masters degree in Archaeology and is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA).

A palaeontological Impact Assessment was commissioned and completed bt Dr Gideon Groenewald (2016)

1.3 Assumptions and Limitations

Not detracting in any way from the fieldwork undertaken, it is necessary to realise that the heritage sites located during the fieldwork do not necessarily represent all the heritage sites present within the area. Should any heritage feature or objects not included in the inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way, until such time that the heritage specialist has been able to make

an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well.
The survey was conducted over 2 days over the extent of the total footprint area. It must be stressed that the extent of the fieldwork was based on the available field time and was aimed at determining the heritage character of the area.

The fieldwork that covered the Tlisitseng solar PV application site is an area of 10.3 square kilometres.

A total of 1 heritage site was marked within the application site over the extent of the fieldwork.

1.4 Legislative Context

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

i. National Environmental Management Act (NEMA), Act 107 of 1998
ii. National Heritage Resources Act (NHRA), Act 25 of 1999
iii. Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002

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

i. National Environmental Management Act (NEMA) Act 107 of 1998
    a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
    b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
    c. Environmental 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)

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, and MPRDA 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 Sections 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).

Refer to **Appendix A** for further discussions on heritage management and legislative frameworks

Table 2 Terminology

Acronyms	***Description***
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late 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	Palaeontological Society of South Africa
ROD	Record of Decision
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

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, such as the caves with archaeological deposits identified close to both development sites for this study.

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 20-300 000 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.

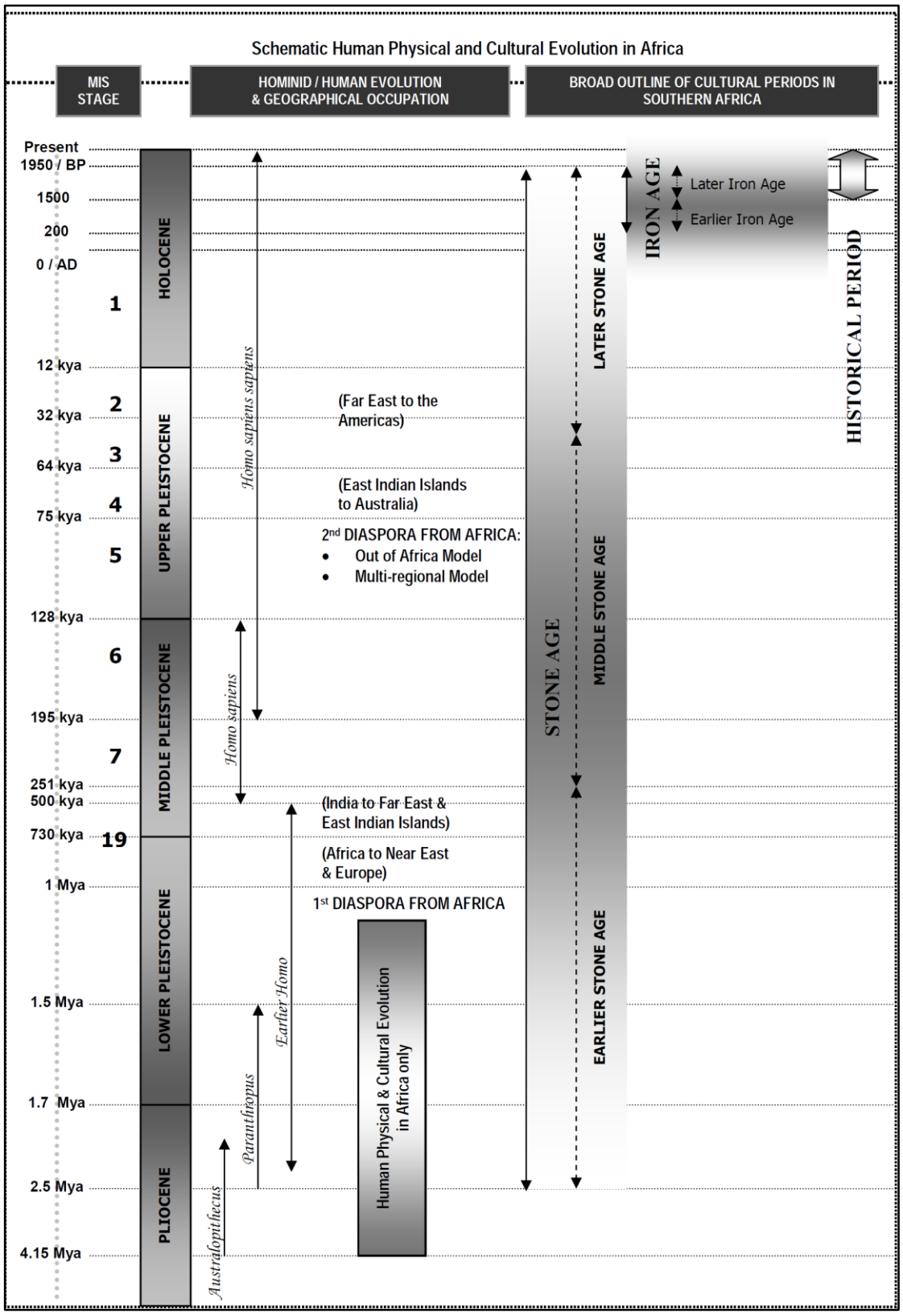

Figure 1 - Human and Cultural Timeline in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

The proposed project is located within the North West Province approximately 6km north of Lichtenburg. It falls within the Ngaka Modiri Molema District (Figure 2).

Figure 2 - Tlisitseng Solar 1 – Grid Locality

The application site is approximately 1000ha however the buildable area will be significantly smaller than this and will be determined by sensitive areas identified during the HIA of the EIA. Tlisitseng Solar will consist of two (2) 75MW solar PV facilities, namely Tlisitseng Solar 1 and Tlisitseng Solar 2. This report addresses the Tlisitseng Solar 1 132kV power line to connect the PV facilities to the proposed Tlisitseng substation.

Panels will be either fixed axis mounting or single axis tracking solutions, and will be either crystalline silicon or thin film technology. In addition to the PV panels each project will consist of:

- An onsite switching station, with the transformers for voltage step up from medium voltage to high voltage;
- The panels will be connected in strings to inverters and inverter stations will be required throughout the site. Inverter stations will house 2 x 1MW inverters and 1 x 2MVA transformers;
- DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22-33kV (medium voltage) in the transformers.
- The 22-33kV cables will be run underground in the facility to a common point before being fed to the onsite switching station where the voltage will be stepped up to 132kV.

- A power line with a voltage of 132kV to the proposed Tlisitseng substation;
- A laydown area for the temporary storage of materials during the construction activities;
- Access roads and internal roads;
- A car park and fencing; and
- Administration, control and warehouse buildings.

3 ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

3.1 Methodology for Assessing Heritage Site significance

PGS compiled this Heritage Assessment Document as part of the Heritage Impact Assessment (HIA) report for the proposed Tlisitseng Solar facilities. The applicable maps, tables and figures, are included as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998). The HIA process consisted of three steps:

3.1.1 Scoping Phase

Step I – Literature Review: The background information to the field survey relies greatly on the Heritage Background Research.

3.1.2 Impact Assessment Phase

Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by a qualified archaeologist, which aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

Step III – The final step involved the recording and documentation of relevant archaeological resources, the assessment of resources in terms of the HIA criteria and report writing, as well as mapping and constructive recommendations.

Appendix B, outlines the Plan of study for the Heritage Impact Assessment process, while **Appendix C** provides the guidelines for the impact assessment evaluation that will be done during the EIA phase of the project.

4 BACKGROUND RESEARCH

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore, an Internet literature search was conducted and relevant

archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

4.1 Previous Studies

A search of the SAHRIS (SA Heritage Resources Information System) database identified the following Heritage Impact Assessment (HIA) and Palaeontological Impact Assessment (PIA) reports for the study area and general surrounding region:

- Heritage Impact Assessment for the proposed rerouting of four existing 132kv power lines at the Eskom Watershed Substation, Lichtenburg, Ditsobotla Local Municipality, Ngaka Modiri Molema District Municipality, North-West Province. PGS Heritage (Pty) Ltd

- Cultural Heritage Resources Impact Assessment of Portion 151 Of Lichtenburg Town and Townlands 27 IP (Lichtenburg Extension 10), North West Province. Dr Udo Küsel. African Heritage Consultants CC. Prepared for Lockeport Projects (Pty) Ltd. July 2008

- Heritage Impact Report for the Proposed 88kv Power Line from Watershed Substation, Lichtenburg, to the Mmabatho Substation, North West Province. J van Schalkwyk. Prepared for Arcus Gibb. November 2008.

- Cultural Heritage Resources Impact Assessment of a Feedlot on the Farm Kalkfontein, Lichtenburg District, North West Province. Dr Udo Küsel. African Heritage Consultants CC. Prepared for EkoInfo CC. May 2011.

- Heritage Impact Assessment for the Proposed Lichtenburg Solar Park, North-West Province. Compiled for Africa Geo-Environmental Services (AGES) by Marko Hutten, Hutten Heritage Consultants. May 2012.

- Lichtenburg Solar Park, North West Province - Palaeontological Impact Assessment. Prof. Bruce Rubidge. Prepared for AGES (Pty) Ltd. July 2012.

The above-noted studies identified the following sites:

4.1.1 Archaeological and Historical Sites:

- No sites dating to the Stone Age were identified in the region of the study area
- No sites dating to the Iron Age were identified in the region of the study area.
- A number of features dating to the historic period were identified in the region surrounding the study area. This includes the remains of an old house in Bakerville, and a number of cemeteries. However, none of these sites is located within or adjacent to the study area.

4.1.2 Palaeontological sites:

The PIA for the Watershed Substation upgrade, which is located immediately southeast of the study area, noted the following:

> *"The study area is underlain by Vaalian aged Chert-rich Dolomites of the Monte Christo Formation, Malmani Subgroup, Chuniespoort Group, Transvaal Sequence. The Monte Christo Formation begins with an erosive breccia and continues with stromatolitic and oolitic platformal dolomites.*
>
> *Stromatolites are recorded from the dolomite layers. Highly fossiliferous Caenozoic cave breccias are also known to occur within the dolomite layers, but are not mapped individually. These fossiliferous deposits often contain more recent mammal and hominid fossils, e.g. in the Cradle of Humankind."*

Figure 3 - Geology of the study area (in purple)

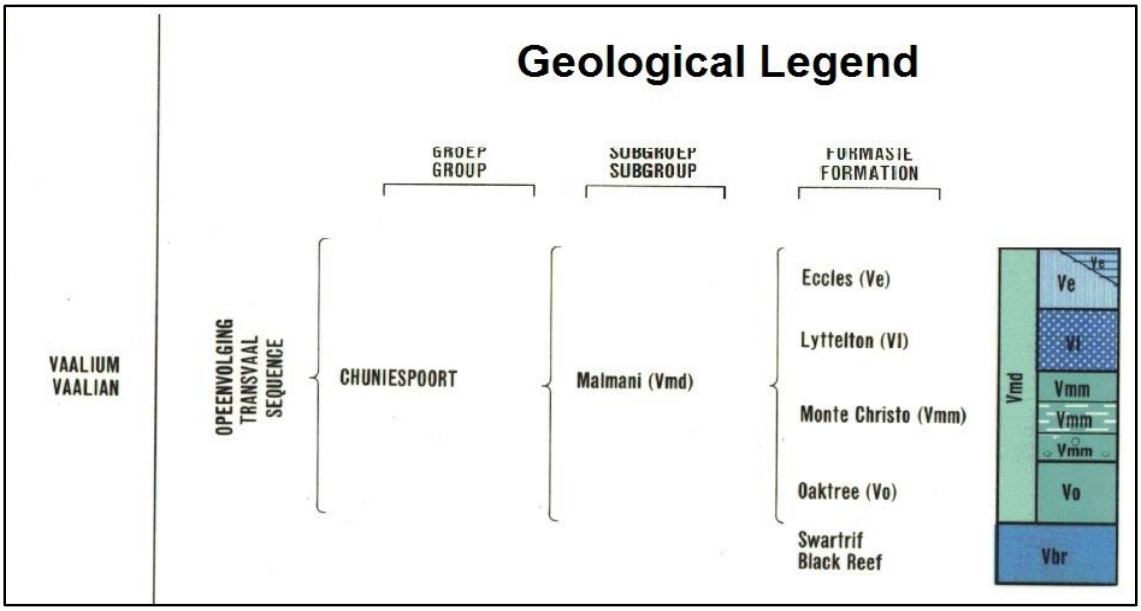

Figure 4 - Geological legend for Figure 3

4.2 Archival findings

The aim of the archival background research is to identify possible heritage resources that could be encountered during the fieldwork, as summarised in **Table 3**.

Table 3 - Summary of History of Lichtenburg Town and Surrounding Area

DATE	DESCRIPTION
2.5 million to 250 000 years ago	**The Earlier Stone Age (ESA)**. The Earlier Stone Age 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 is known as the Acheulean and comprises more refined and better made stone artefacts such as the cleaver and bifacial handaxe. The Acheulean phase dates back to approximately 1.5 million years ago. The rock engraving site at Bosworth Farm, near Klerksdorp also contains many stone artefacts (lithics) which date to over one million years ago (http://www.nasmus.co.za/departments/rock-art/public-rock-art-sites). No sites are known in or near the study area.
250 000 to 40 000 years ago	**The Middle Stone Age (MSA)**. 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. No sites are known in the vicinity of the study area.
40 000 years ago to the historic past	The **Later Stone Age (LSA)** 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. Rock engravings are known from the wider vicinity of the study area (Bergh, 1998). See below for two well-known sites in the greater vicinity of the study area.
Rock Art	**Thaba Sione**: this site is located in the middle of Thaba Sione town, some 60km south-west of Mmabatho. The site contains over 559 engravings located on rocks and boulders. The engravings are dominated by depictions of rhinoceros – some have been rubbed smooth. There are also buffalo, eland, shamanic human figures, wildebeest and a rare lizard. The site is still important today to local Tswana people and is used by the Zion Christian Church as a rain-making centre. (http://www.nasmus.co.za/departments/rock-art/public-rock-art-sites) **Bosworth Farm**: this site is located some 22km north-west of Klerksdorp on the Bosworth Farm property. It is a large site with over 400 San and Khoe (herder) rock engravings. There many depictions of human figures as well as animals: a charging rhinoceros, a large elephant, a flight of birds. There are also many geometric motifs. The site also has many stone artefacts (lithics) which date to over one million years ago. Bosworth is one of South Africa's 12 Rock Art sites formally protected under the National Heritage Resources Act (25 of 1999). (http://www.nasmus.co.za/departments/rock-art/public-rock-art-sites)
AD 200 - 900	**Early Iron Age (EIA)**. Known sites in the region include Kruger Cave near Rustenburg and Broederstroom near Hartebeespoort Dam. Both sites are located to the east of the

DATE	DESCRIPTION
	study area and date to approximately 460 AD (Mason 1974). No recorded sites were located within the study area during the desktop study.
AD 900 - 1300	**Middle Iron Age (MIA)**. No recorded sites were located during the desktop study.
AD 900 - 1840	**Late Iron Age (LIA)**. Various well-known sites from this period are located in the greater North-West Province, including the stone walled complexes at Buispoort and Braklaagte, the Makgame megasite, the 18th century capital at Kaditshwene and the copper mines at Dwarsberg in the Madikwe Game Reserve. These sites date to between the 15th and 19th centuries and record the arrival and development of the early Moloto Sotho-Tswana speakers (Boeyens, 2003).
	Four groups are of importance in the study area. These are the Bakolobeng, Batloung, Banogeng, and the Barolong. The following information was derived from a study conducted by the Lichtenburg Museum under P. M. Ntamu, 1996. The origins of the tribes of the Lichtenburg area follows (Fourie, 2009). *The Bakolobeng*: Oral sources indicate that the Bakolobeng originated from Tsaong near Silverkrans. Chief Kelly Molete concurs with Breutz's informants that the Bakolobeng were led through the present Kwena-Reserve of Botswana by Chief VI Molete-wa-Modikwagae in about 1769 or 1770, and later moved to Tsaong. Around 1830, they experienced a difficult period, which began with the death of their Chief, Kgosi VIII Molete when the Ndebele Group attacked them. This period of Difagane was also characterised by the Bakolobeng's flight to Thaba 'Nchu (in the Free State) and to Dimawe (Klerksdorp District) were they joined other refugees like the Batloung and Banogeng. After 1837, the Thaba 'Nchu Group of the Bakolobeng returned and settled temporarily at Bodumatau (Lichtenburg District) until they came into contact with Hermannsburg Mission. *Batloung:* They are also known as Batlhako, because they were originally with the Batlhako when they departed from the present Pretoria District and migrated to the areas of Rustenburg in about 1650. Oupa Mogorosi, one of the oldest informants, stated that: "... (they) departed from Mabalstadt along with Baphiring ... who controlled a section of people who were later to settle at Putfontein." Breutz's informants hold that in about 1750, the Batloung became an independent chiefdom and went to settle at Dipakane, in the Klerksdorp area. The Batloung later went to stay in a farm at Gruisfontein, accompanied by Rev Schnell of the Hermannsburg Lutheran Mission. At that time the Tribe was so scattered that one section was at Bodibe (Polfontein) and other places in the district. The idea of buying a farm as their ultimate settlement brought them together. *Banogeng:* According to oral sources collected by Breutz, the Banogeng are believed to be an ancient branch of the Digoja, i.e. forerunners of the Batswana Tribes who passed the Mafikeng area in small clan units. They are believed to be related to the Bakubung,

DATE	DESCRIPTION
	Bataung and the Barolong Tribes, who originally shared the same totem; Tholo (Kudu) with them. For reasons better known to themselves; the Banogeng were destroyed and separated even before the period of Mzilikatzi attacks, except for remnants who stayed in the Lichtenburg District. The Ndebele continued to pose a threat to them so that they fled to Dimawe in the District of Klerksdorp. Here they merged with refugees from Baphiring, Batloung and Bakolobeng Tribes. Except for those who were assimilated into the already mentioned tribal groups, Ramosiane attempted to gather the remains of the Banogeng. They stayed at Kolong (Rietfontein) until 1960 when the tribe applied for its recognition and the re-establishment of the tribe. *The two Barolong tribes:* There are presently so many Barolong Tribes whose origin has been attributed to the first Chief Morolong, and the second Chief Noto. It is interesting to note that the totems, Tholo (Kudu) and Tshipi (Iron), were respectively taken from the names of the Chiefs mentioned. In his book, "History of the Batswana", Natal, 1989, Breutz indicate that "the first Tswana Tribe to come to South Africa under the rule of a Chief were the Barolong who arrived sometime between 1 200 and 1 300 or earlier". These migrations which continued even beyond the years 1450 and 1700 made the divisions of the Batswana Tribes like the Bahurutshe and the Bakwena more conspicuous. From 1823 - 1830, several Barolong Tribes fled from their Tribal land in the Transvaal as a result of Bataung raids and the Mzilikazi raids. Towards the end of the eighteenth century, the Barolong had divided into four groups, under Rratlou, Rrapulana, Seleka and Tshidi. The first two groups, namely the Barolong Boo-Ratlou and the Barolong Boo-Rapulana came to stay in the District of Lichtenburg. The Barolong Boo-Rapulana's residence was Lotlhakane (Rietfontein) in the Lichtenburg District. In 1882 moved to Bodibe (Polfontein) in the District of Lichtenburg. The last of the Barolong Boo-Ratloung, Chief Noto Moswete and his tribe were moved to Kopela.
AD 1873	**Historical period** The town of Lichtenburg: Hendrik Adriaan Greeff was born on the farm Lichtenburg close to Durbanville in the Cape Province. He became a hunter and started to frequent the then ZAR area. Greef settled in the late 1860 on the farms Doornfontein and Kaalplaats. Potchefstroom was the closest trading centre and approximately 150 km or "14 uur rijdens te paarde" away. A need for a town with a church and shops became stronger and Greeff and the Boers in the area saw Doornfontein with its abundant water, firewood and building material as the designated place. In 1865 the first application for town establishment was addressed to the House of Assembly, signed by 132 males in the area, and they started compiling a number of town regulations. Greeff wanted to name the town Lichtenburg, a name that he carried from his birth and because he wanted it to be a town whose light would shine over the area, not just with regard to hospitality and prosperity, but also in respect of religion. In 1868 the name "Lichtenberg", (a mistake still commonly made) appeared on the official map of the SAR, but the House of Assembly did not react yet. The men met again

DATE	DESCRIPTION
	to discuss the town regulations and to obtain an appeal on speedy proclamation from the House of Assembly. The well-known Voortrekker savant, JG Bantjes, also established himself in Lichtenburg and signed the regulation as witness. Eventually Lichtenburg was officially proclaimed as town in mid-winter on 25 July 1873 by Pres. TF Burgers. (Lichtenburg Museum, 2009; cited in Fourie 2009).
1900-1902	**Boer War** During the Boer War the town of Lichtenburg was occupied by a British garrison of 620 men under the command of Lieutenant-Colonel CGC Money. The market square was turned into a fortified redoubt and strong pickets and sangars on the outskirts of town. On 3 March 1901, General De la Rey planned to attack the town with the help of General Cilliers and Commandant Lemmer and their followers, amounting to 1200 men. An attacking force of between 300-400 men was to assault the town. Due to the marshy terrain and a premature charge by General Liebenberg, the attack was repulsed with equal loses on both sides (Cloete, 2000).
Diamond Rush 1927	**Diamond Rush 1927** The Lichtenburg area is known for the 1926-27 diamond rush. In December 1924, a diamond of 3 carats was discovered by the Voorendyk family on the farm Elandsputte. Initial prospecting in 1925 produced a high yield of diamonds and the area was proclaimed as a “diggings” in February 1926. By 1945 a total of 104 diggings were proclaimed on 13 farms. It was the richest public diggings in the world, with the biggest gathering of diggers in history. A shanty town rose within a year or two, which housed in the region of 150 000 people, about 5 times as big as Lichtenburg today. Bakers, called after the owner Albert Baker, and later known as Bakerville, was the "main town". Here the houses and shacks stood ‘cheek by jowl’ for several kilometers. In the business centre there were as many as 250 diamond buyers' offices, as well as about 60 cafes, shops, barbers, butcheries and other businesses (Lichtenburg Museum, 2009). Bakerville is situated 10 kilometers to the north of Houthaalboomen, the proposed development farm for this project.

5 IMPACT ASSESSMENT

5.1 Field work findings

5.1.1 Methodology

Fieldwork was conducted on the application site of the Tlisitseng Solar PP Project from 1-2 December 2015. The methodology focused of a tracked walkthrough of the foot print areas of proposed PV project application area. An accredited professional archaeologist, Miss Jessica Angel, completed the fieldwork. The fieldwork was done on foot and by vehicle.

It must be stressed that the extent of the fieldwork was based on the available field time and was aimed at determining the heritage character of the area.

The field work that covered the Tlisitseng Solar 1 grid and substation areas, application site is an area of 10.3 square kilometers.

A total of 1 heritage related site was marked within the application site over the extent of the fieldwork.

5.1.2 Description of area

The study area and surrounds is characterised by low vegetation growth dispersed over fairly flat terrain. Dominating the surface area are vast exposed pebble layers usually associated with low rises in the landscape. Drainage lines and flat surface are characterised by red sand cover in between the exposed pebble layers.

Figure 5 – View of general area

Figure 6 – General view of the area

5.1.3 Finds

No heritage finds were made in the corridor

5.1.4 PV footprint – Mitigation:

No further mitigation required

5.1.5 Palaeontological findings

During the fieldwork period of the Palaeontological Assessment (Groenewald, 2016) several arbitrary finds of dolomite and chert with significantly well-defined stromatolites as well as a few potential sites with either

associated sinkholes or cave breccias were recorded (Table 4). Confirmation of the significance of these sites will only be possible after completion of the geotechnical surveys.

Table 4 - Photographic observations during fieldwork session

Photo	GPS station no (Fig. 9) and coordinates	Description	Picture
1	(062) -26° 05' 21.9" 26° 08' 15.3"	Deep soils on dolomite. No outcrop. No fossils observed. Landscape indicate old river bed with river gravels and boulders of dolomite and chert.	
2	(062) -26° 05' 21.9" 26° 08' 15.3"	Micro-stromatolite structures in dolomite and chert layers. Boulders not in situ	
3	(072) -26° 05' 16.8" 26° 08' 24.8"	Micro-stromatolites in possible outcrop, covered in shallow soil. Geotechnical reports will indicate possible exposure of these fossils during excavation for foundations	
4	(032) -26° 05' 32.3" 26° 08' 28.5"	Aardvark. burrow into deep Hutton soils. No outcrop, no fossils observed	

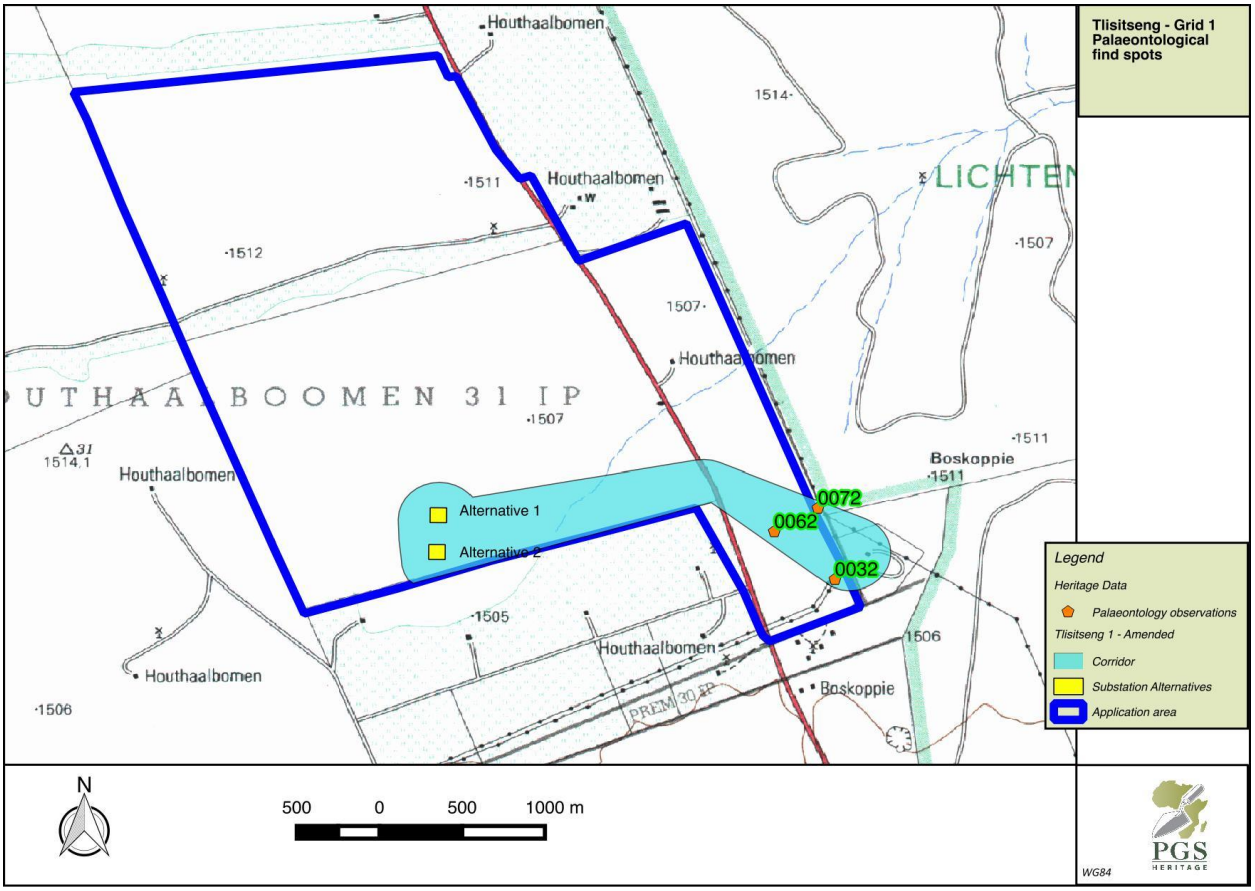

Figure 7 – Palaeontological find spots

5.2 Assessment

5.2.1 Heritage sites and finds

The fieldwork findings have shown that the study area is characterized by a background scatter of Stone Age artefacts, Several small structures and a cemetery.

It must be kept in mind that the fieldwork could in no way identify all archaeological sites within the development footprint and as such the fieldwork has shown that the possibility of encountering other Stone Age archaeological site is extremely high.

The following set of tables provide an assessment of the impact on heritage resources within the development footprint.

Table 5 - Rating of impacts – chance finds

IMPACT TABLE	
Environmental Parameter	*Heritage Resources*

Issue/Impact/Environmental Effect/Nature	*The possibility of encountering previously unidentified heritage resources and specifically Stone Age archaeological sites. As well as the impact on the identified archaeological sites*	
Extent	*Will impact on the footprint area of the development*	
Probability	*The fieldwork has shown that such a predicted impact will definitely occur*	
Reversibility	*Due to the nature of archaeological sites the impact is seen as irreversible, however mitigation could enable the collection of enough information to preserve the data from such a site*	
Irreplaceable loss of resources	*The development could lead to significant losses in unidentified and unmitigated site*	
Duration	*The impact on heritage resources such as archaeological sites will be permanent*	
Cumulative effect	*As the type of development impact on a large area, and other similar development in the area will also impact on archaeological sites the cumulative impact is seen as having a medium negative impact.*	
Intensity/magnitude	*The large scale impact on archaeological sites and will require mitigation work.*	
Significance Rating	*The overall significance rating for the impact on heritage resources is seen as high pre-mitigation. This can be attributed to the very definite possibility of encountering more archaeological sites as shown through fieldwork. The implementation of the recommended heritage mitigation measures will address the envisaged impacts and reduce the overall rating to a low impact rating.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	1	1
Reversibility	2	1
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-9 (negative low Impact)	-9 (negative low impact)

Mitigation measures	*General management guidelines to be implemented*

5.2.2 Palaeontology

The fieldwork findings have shown that the study area is characterised by a background scatter of Stromatolites in all the dolomite boulders on site and some areas have remains of cave breccia but no in situ outcrops were recorded.

It must be kept in mind that the fieldwork could in no way identify all palaeontological sites within the development footprint and as such the fieldwork has shown that the possibility of encountering possible cave breccias during geotechnical investigation is relatively high.

The following set of tables provide an assessment of the impact on palaeontological heritage resources within the development foot print

Table 6 - Rating of Impacts and Chance finds

IMPACT TABLE	
Environmental Parameter	*Palaeontological Resources*
Issue/Impact/Environmental Effect/Nature	*The possibility of encountering previously unidentified heritage resources and specifically Palaeontological sites. As well as the impact on the identified palaeontological sites*
Extent	*Will impact on the footprint area of the development*
Probability	*The fieldwork has shown that such a predicted impact will definitely occur*
Reversibility	*Due to the nature of palaeontological sites the impact is seen as irreversible, however mitigation could enable the collection of enough information to preserve the data from such a site*
Irreplaceable loss of resources	*The development could lead to significant losses in unidentified and unmitigated site*
Duration	*The impact on heritage resources such as palaeontological sites will be permanent*
Cumulative effect	*As the type of development impact on a large area, and other similar development in the area will also impact on palaeontological sites the cumulative impact is seen as having a medium negative impact.*
Intensity/magnitude	*The large scale impact on palaeontological sites might require mitigation work.*

Significance Rating	*The overall significance rating for the impact on heritage resources is seen as very high pre-mitigation. This can be attributed to the very high possibility of encountering more palaeontological sites during geotechnical investigations. The implementation of the recommended heritage mitigation measures will address the envisaged impacts and reduce the overall rating to a low impact rating.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	2
Reversibility	4	3
Irreplaceable loss	3	3
Duration	4	4
Cumulative effect	3	3
Intensity/magnitude	3	3
Significance rating	-63 (high negative)	57 (high positive)
Mitigation measures	*Mitigation through palaeontological excavations and collection if Geotechnical Survey indicates necessity for mitigation* *Monitoring during construction by palaeontologist if fossils are exposed during excavation of more than 1.5m of soil cover*	

5.3 Cumulative impacts

A large number of solar projects are proposed and some have been approved and is currently in construction around the study area (Table 9).

The need for the implementation of the recommended mitigation measures is of great importance and must be seen in the context of the large areas to be impacted by the construction activity. By implementing the mitigation measures the cumulative effect will be reducing from a High to a Medium negative impact rating.

Table 7 - Renewable energy developments proposed within a 20km radius from the proposed Tlisitseng PV application site

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Proposed Capacity	Farm Details
Matrigenix Renewable Energy Project	14/12/16/3/3/3/270	Scoping and EIA processes underway	Matrigenix (Pty) Ltd	70MW	A portion of portion 10 of the Farm Lichtenburg Town and Townlands 27
Watershed Solar Energy Facility	14/12/16/3/3/2/557	Scoping and EIA processes underway.	FVR Energy South Africa (Pty) Ltd	75MW	Portions 1, 9, 10 and 18 of the Farm Houthaalbomen 31
Hibernia PV Solar Energy Facility	14/12/16/3/3/2/1062	Project has received environmental authorisation	South Africa Mainstream Renewable Power Developments (Pty) Ltd	**UNKNOWN**	Portions 9 and 31 of the Farm Hibernia 52

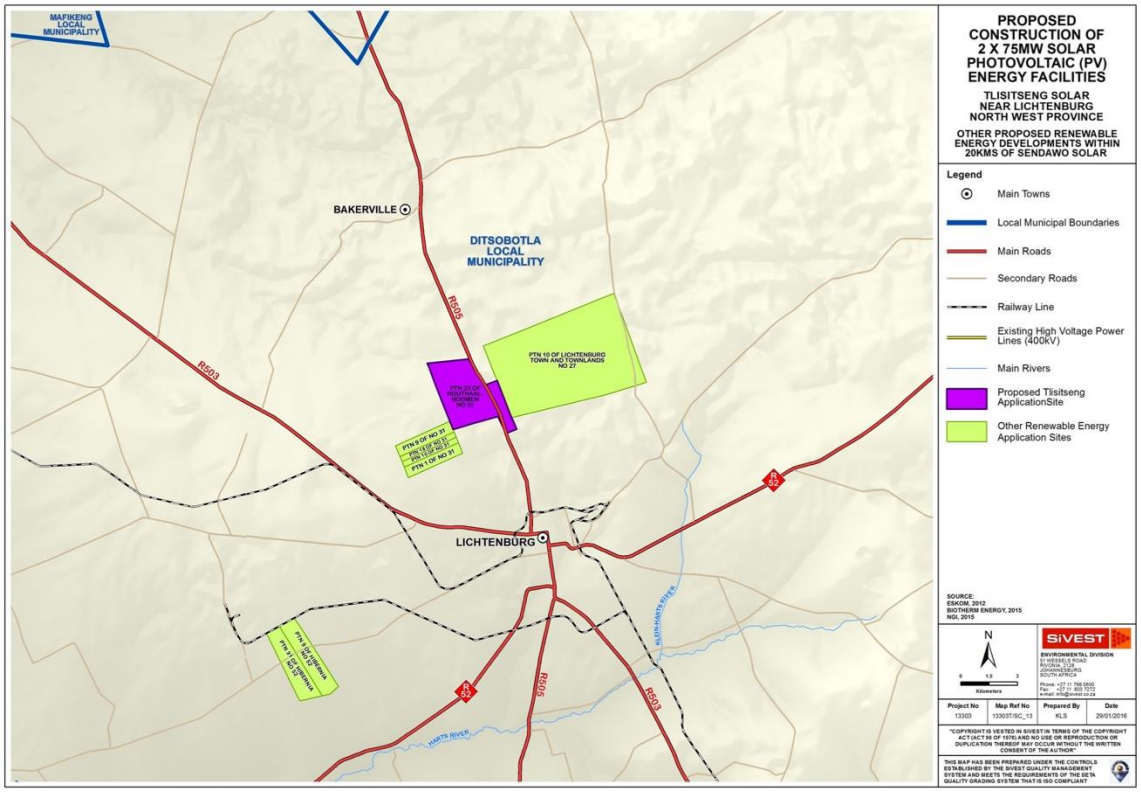

Figure 8 - Geographical position of renewable energy developments proposed within a 20km radius from the proposed Tlisitseng PV application site

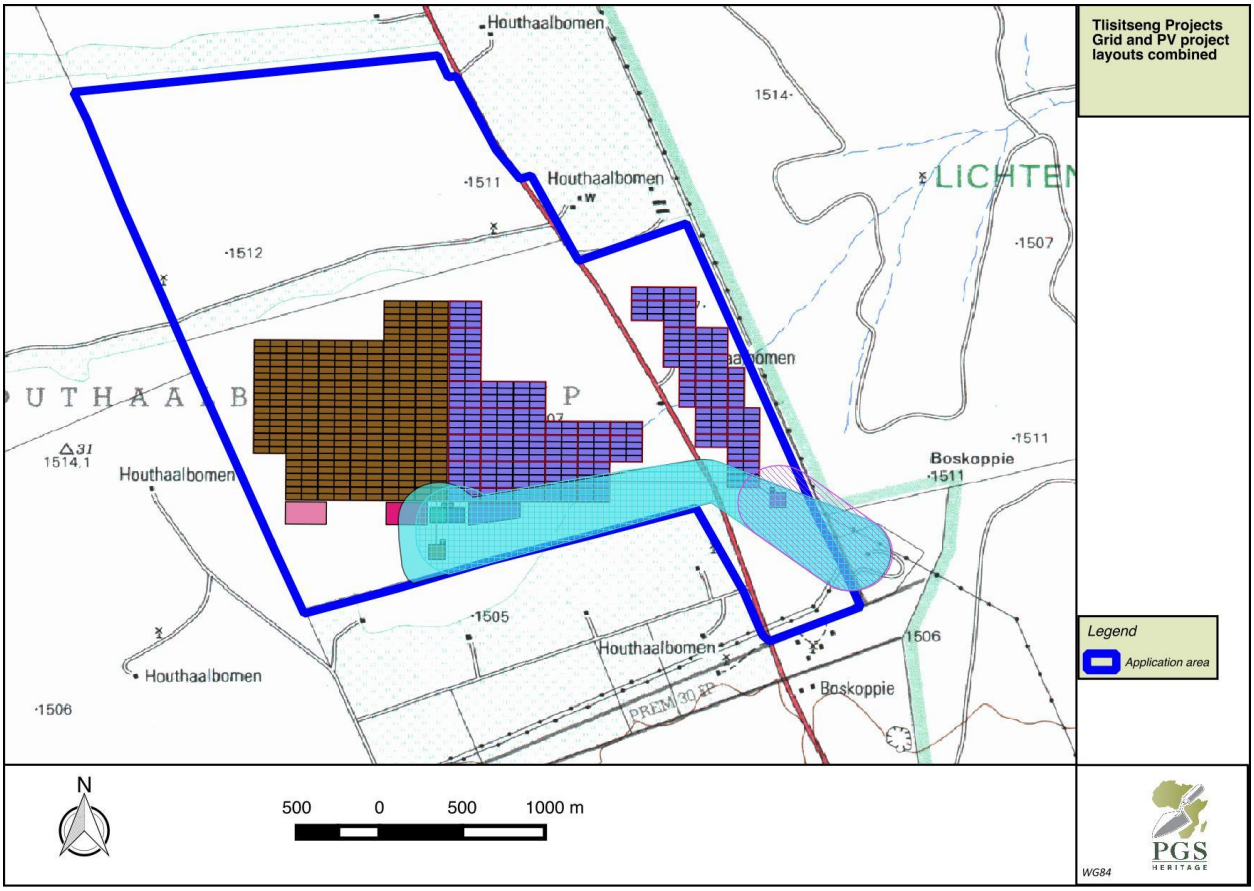

Figure 9 - Combined project options for the Tlisitseng PV facilities

5.4 Impact Summary

Table 8 provides a summary of the projected impact rating for this project on heritage resources.

Table 8 - Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	9	Negative Low Impact	9	Positive Low Impact
Palaeontology	Impact during construction	63	Negative	57	Positive

5.5 Comparative Assessment of Alternatives – Tlisitseng 1 Substation and Power Line

An assessment of the two Substation of Options indicates that none of the two will have an impact on heritage resources and thus no preference for either exists.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
SUBSTATION		
Alternative 1	**NO PREFERENCE**	No impact on heritage resources
Alterative 2	**NO PREFERENCE**	No impact on heritage resources

6 MANAGEMENT GUIDELINE

6.1 Heritage Management Plan for EMP implementation

No.	Mitigation Measures	Phase	Timeframe	Responsible Party For Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)	Cost
A	Include section on possible heritage finds in induction prior to construction activities take place – Refer to Section 9 of this report	Planning /Pre-Construction	Prior to construction	Applicant ECO Heritage Specialist	ECO (Monthly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 36 and 38 of NHRA	No legal directives Legal compliance audit scores (Legal register) (ECO Monthly Checklist/Report)	**R5 000**
B	Implement chance find procedures in case where possible heritage finds area made	Construction	During construction	Applicant ECO Heritage Specialist	ECO (weekly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 and 38 of NHRA	ECO Monthly Checklist/Report	**Possibly R10 000**
C	Implement mitigation for identified sites	Pre-construction	Pre-Construction	Applicant ECO Archaeologist	Once off	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 and 38 of NHRA	Completion of mitigation measures and obtain destruction permit	**Approximately R300 000**

6.2 Palaeontological Management Plan for EMP implementation

No.	Mitigation Measures	Phase	Timeframe	Responsible Party For Implementation	Monitoring Party (Frequency)	Target	Performance Indicators (Monitoring Tool)	Cost
A	Include section on possible [palaeontological heritage finds in induction prior to construction activities take place – Refer to Section 5 of this report referring to geotechnical reports	Planning /Pre-Construction	Prior to construction	Applicant ECO Heritage Specialist	ECO (Monthly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 36 and 38 of NHRA	No legal directives Legal compliance audit scores (Legal register) (ECO Monthly Checklist/Report)	**R5 000**
B	Implement chance find procedures in case where possible palaeontological heritage finds area made	Construction	During construction	Applicant ECO Heritage Specialist	ECO (weekly)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35and 38 of NHRA	ECO Monthly Checklist/Report	**Possibly R10 000**
C	Monitoring of construction activities by palaeontologist if indicated after completion of geotechnical report	Construction	During construction	Applicant ECO Palaeontologist	Palaeontologist (Initial 2-day site visit. Then Fortnightly during construction)	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 35 and 38 of NHRA	Palaeontologist Monthly Checklist/Report	**Monthly R40-50 000**

7 HERITAGE MANAGEMENT GUIDELINES

7.1 General Management Guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-
   (a) the construction of a road, wall, transmission line, 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.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the SAHRA needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).

   This survey and evaluation must include:
   (a) The identification and mapping of all heritage resources in the area affected;
   (b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Heritage Resources Act;
   (c) An assessment of the impact of the development on such heritage resources;
   (d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
   (e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

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

(g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:
   a. Heritage;
   b. Graves;
   c. Archaeological finds; and
   d. Historical Structures.

   This module must be tailor made to include all possible finds that could be expected in that area of construction.

   Possible finds include:
   a. Open air Stone Age scatters, disturbed during vegetation clearing. This will include stone tools.
   b. Palaeontological deposits such as bone, and teeth in fluvial riverbank deposits.
4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
5. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.
6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.
7. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
8. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.
9. In the event that human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation of the finds made.
10. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process.

Table 9 - Roles and responsibilities of archaeological and heritage management when heritage resources are discovered during operations

ROLE	RESPONSIBILITY	IMPLEMENTATION
A responsible specialist needs to be allocated and should attend all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA.	The client	Archaeologist and a competent archaeology support team
If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation.	The client	Archaeologist and a competent archaeology support team
Comply with defined national and local cultural heritage regulations on management plans for identified sites.	The client	Environmental Consultancy and the Archaeologist
Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites, when discovered.	The client	Environmental Consultancy and the Archaeologist
Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into the employee induction course).	The client	Environmental Consultancy and the Archaeologist,
If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation.	The client	Archaeologist, and/or competent authority for relocation services
Ensure that recommendations made in the Heritage Report are adhered to.	The client	The client
Provision of services and activities related to the management and monitoring of significant archaeological sites (when discovered). The client with the specialist needs to agree on the scope and activities to be performed	The client	Environmental Consultancy and the Archaeologist
When a specialist/archaeologist has been appointed for mitigation work on discovered heritage resources, comprehensive feedback reports should be submitted to relevant authorities during each phase of development.	Client and Archaeologist	Archaeologist

7.2 All phases of the project

7.2.1 Archaeology

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to during the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the prospecting phase, it is important to recognise any significant material being unearthed, and to make the correct judgment on which actions should be taken. In the event that possible heritage resources are identified a qualified archaeologist/palaeontologist must be contacted to evaluate the finds and make recommendations on the mitigation required.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Plan (EMP) of the project. Should an archaeological/palaeontological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological monitoring programme.

In the case where archaeological material is identified during construction the following measures must be taken:

- Upon the accidental discovery of archaeological material, a buffer of at least 20 meters should be implemented.
- If archaeological material is accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the material permit must be applied for from SAHRA under Section 35 of the NHRA.

7.2.2 Palaeontology

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area. It is essential that the information gathered during the Geotechnical investigations for developments be made available to the Heritage Practitioner and Palaeontologist to assess the possibility of exposing bedrock with fossils where excavations will exceed 1.5m or where gravity surveys indicate possible karst topography in dolomitic terrains.

It is possible that cultural material, including palaeontological finds, will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to during the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the prospecting phase, it is important to recognise any significant material being unearthed, and to make the correct judgment on which actions should be taken. In the event that possible heritage resources are identified a qualified archaeologist/palaeontologist must be contacted to evaluate the finds and make recommendations on the mitigation required.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological and palaeontological monitoring and feedback strategy should be incorporated into the Environmental Management Plan (EMP) of the project. Should an archaeological/palaeontological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological and palaeontological monitoring programme.

In the case where archaeological or palaeontological material is identified during construction the following measures must be taken:

- Upon the accidental discovery of archaeological or palaeontological material, a buffer of at least 20 meters should be implemented.
- If archaeological and palaeontological material is accidentally discovered during construction, activities must cease in the area and a qualified archaeologist or

palaeontologist be contacted to evaluate the find. To remove the material a permit must be applied for from SAHRA under Section 35 of the NHRA.

7.2.3 Graves

In the case where a grave is identified during construction the following measures must be taken:

- Upon the accidental discovery of graves, a buffer of at least 50 meters should be implemented.
- If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a permit must be applied for from SAHRA (Section 36 of the NHRA) and other relevant authorities (National Health Act and its regulations). The local South African Police Services must immediately be notified of the find.
- Where it is recommended that the graves be relocated, a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

i. A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
ii. Site notices indicating the intent of the relocation;
iii. Newspaper notices indicating the intent of the relocation;
iv. A permit from the local authority;
v. A permit from the Provincial Department of Health;
vi. A permit from the South African Heritage Resources Agency, if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
vii. An exhumation process that keeps the dignity of the remains intact;
viii. The whole process must be done by a reputable company that is well versed in relocations;
ix. The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the developing company.

8 CONCLUSIONS AND RECOMMENDATIONS

PGS Heritage (Pty) Ltd (PGS) was appointed by SiVEST Environmental Division (SiVEST) to undertake a Heritage Impact assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed development of two 75MW solar photovoltaic (PV) energy facilities near Lichtenburg, North West Province. This report addresses the Tlisitseng Solar 1 132kV power line to connect the PV facilities to the proposed Tlisitseng substation.

The Heritage Impact Assessment has shown that the proposed Tlisitseng Solar projects does have heritage resources present on the property. This has been confirmed through archival research, evaluation of aerial photography of the sites and a field survey.

8.1 Heritage resources

No heritage resources related to the archaeological and historical time period were identified.

Palaeontology

The study area is underlain by Vaalian aged dolomite of the Monte Christo Formation, Chuniespoort Group. Stromatolites are known to occur within these deposits and more modern fossiliferous Caenozoic cave breccias have been recorded associated with carst formation in the dolomite.

During the fieldwork period several arbitrary finds of dolomite and chert with significantly well-defined stromatolites as well as a few potential sites with either associated sinkholes or cave breccias were recorded. Confirmation of the significance of these sites will only be possible after completion of the geotechnical surveys.

8.1.1 Palaeontology mititigation

During the fieldwork period several arbitrary finds of dolomite and chert with significantly well-defined stromatolites as well as a few potential sites with either associated sinkholes or cave breccias were recorded.

- Although no significant fossils were recorded in situ in both PV sites as well as the proposed alternative route corridors for the power lines, several well-defined micro-stromatolites and possible sites with cave breccia have been identified. Depending on the results of the geotechnical investigation and where potential excavations for foundations will exceed 1.5m, the ECO must investigate the possible presence of stromatolites and/or cave breccia and inform the HIA consultants immediately for appropriate action and appointment of a qualified palaeontologist to investigate the site before destruction of fossils occurs.
- Site visits as stipulated in the management tables will include an initial 2-day site visit and then fortnightly during construction.
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

8.2 Impact Summary

Table 8 provides a summary of the projected impact rating for this project on heritage resources.

Table 10 - Comparison of summarised impacts on environmental parameters

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Heritage resources	Impact during construction	9	Negative Low Impact	9	Positive Low Impact
Palaeontology	Impact during construction	63	Negative	57	Positive

8.3 Comparative Assessment of Alternatives – Tlisitseng 1 Substation and Power Line

An assessment of the two Substation of Options indicates that none of the two will have an impact on heritage resources and thus no preference for either exists.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Alternative	Preference	Reasons
SUBSTATION		
Alternative 1	**NO PREFERENCE**	No impact on heritage resources
Alternative 1	**NO PREFERENCE**	No impact on heritage resources

Cumulative impacts

An evaluation of the possible cumulative impacts from the combined solar projects in the area (Table 7 and **Figure 8**) on heritage resources has shown that the biggest envisaged impact could be on the palaeontological heritage of the area with the Watershed Solar Energy facility just northwest of this proposed development increasing the possibility of impacts on the breccias that could occur in the area.

Though with the implementation of mitigation measures these impacts could be transformed into a positive impact through the discovery of previously unknown fossils and the subsequent study of such fossil finds adding to the academic knowledge of the palaeontological resources of the study area.

8.4 Conclusion

The overall impact on heritage resources is seen as acceptable and the proposed mitigation measures to be incorporated in the EMP will provided the necessary actions to address any impacts on heritage resources.

9 REFERENCES

9.1 Archival Resources

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Appendix A

LEGISLATIVE PRINCIPLES

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

3.1 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 done and identified heritage resources are formally protected.

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

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have interest in the graves: they may be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle will 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 developer's cost. Thus, developers 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 pre-historic cultural remains, including graves and human remains.

3.2 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 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 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.

Appendix C

Heritage Assessment Methodology

The section below outlines the assessment methodologies utilised in the study.

The Heritage Impact Assessment (HIA) report to be compiled by PGS Heritage (PGS) for the proposed Tlisitseng Solar projects will assess the heritage resources found on site. This report will contain the applicable maps, tables and figures as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998) and the Minerals and Petroleum Resources Development Act (MPRDA) (28 of 2002). The HIA process consists of three steps:

- Step I – Literature Review: The background information to the field survey leans greatly on the Heritage Scoping Report completed by PGS for this site.

- Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by qualified archaeologists, aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

- Step III – The final step involved the recording and documentation of relevant archaeological resources, as well as the assessment of resources in terms of the heritage impact assessment criteria and report writing, as well as mapping and constructive recommendations

The significance of heritage sites was based on four 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 - <10/50m^2
        - Medium - 10-50/50m^2
        - High - >50/50m^2
- **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 pylon 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.

Table 11: 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 Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium Significance	Recording before destruction
Generally Protected C (GP.A)	Grade 4C	Low Significance	Destruction

Appendix C

Impact Assessment Methodology to be utilised during EIA phase

Methodology for Impact Assessment

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

Determination of Significance of Impacts

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

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

Impact Rating System

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

- planning
- construction
- operation
- decommissioning

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

Rating System Used To Classify Impacts

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

Table 12: Description

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).

CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect, which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY/ MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

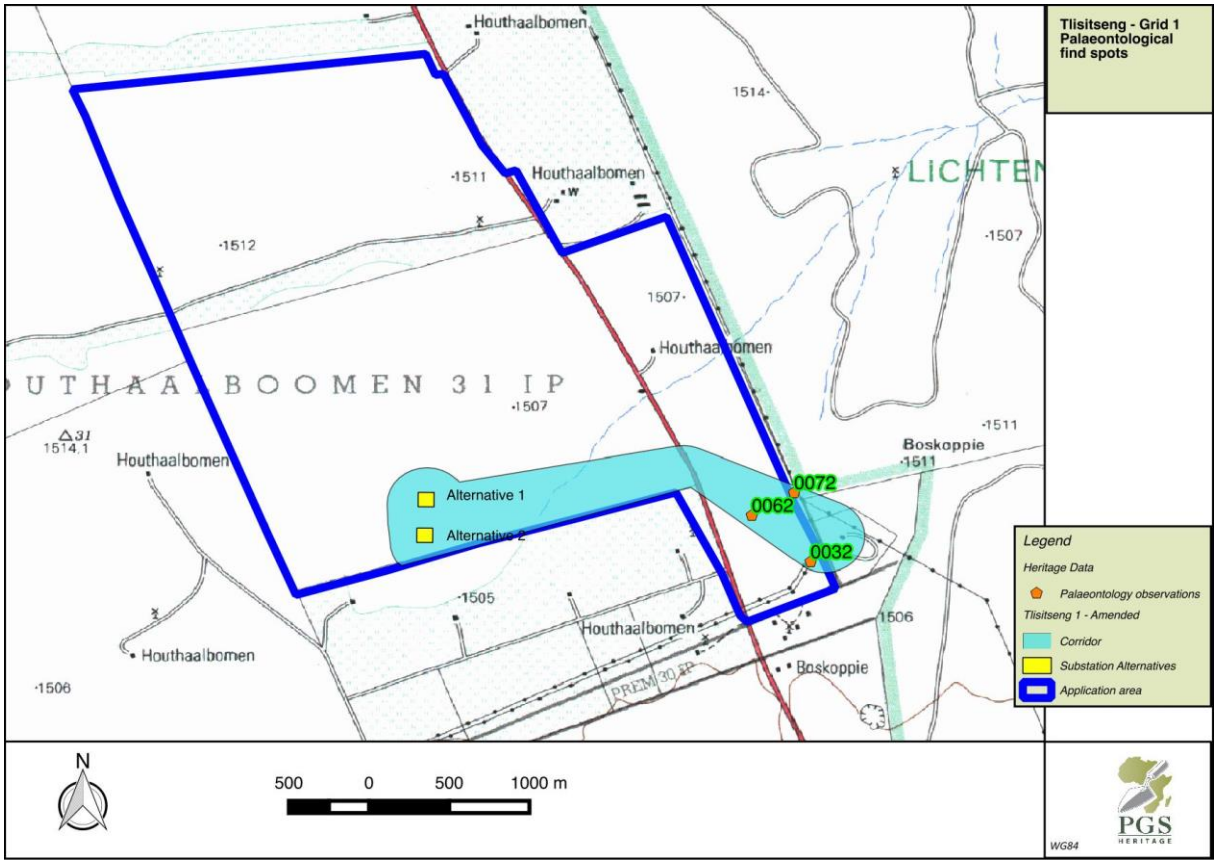
The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic, which can be measured and assigned a significance rating.

Points	**Impact Significance Rating**	**Description**
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The 2010 regulations also specify that alternatives must be compared in terms of impact assessment.

Appendix D

Heritage Maps


Tlisitseng - Grid 1
Palaeontological find spots
Houthaalbomen
1514
1511
Houthaalbomen
LICHTEN
1512
1507
1507
Houthaalbomen
UTHAA BOOMEN 31 IP
1507
△31
1514.1
Houthaalbomen
Boskoppie
1511
Alternative 1
Alternative 2
0072
0062
0032
1505
Houthaalbomen
1506
Houthaalbomen
Boskoppie
1506
PREM 30 SP
Legend
Heritage Data
Palaeontology observations
Tlisitseng 1 - Amended
Corridor
Substation Alternatives
Application area
N
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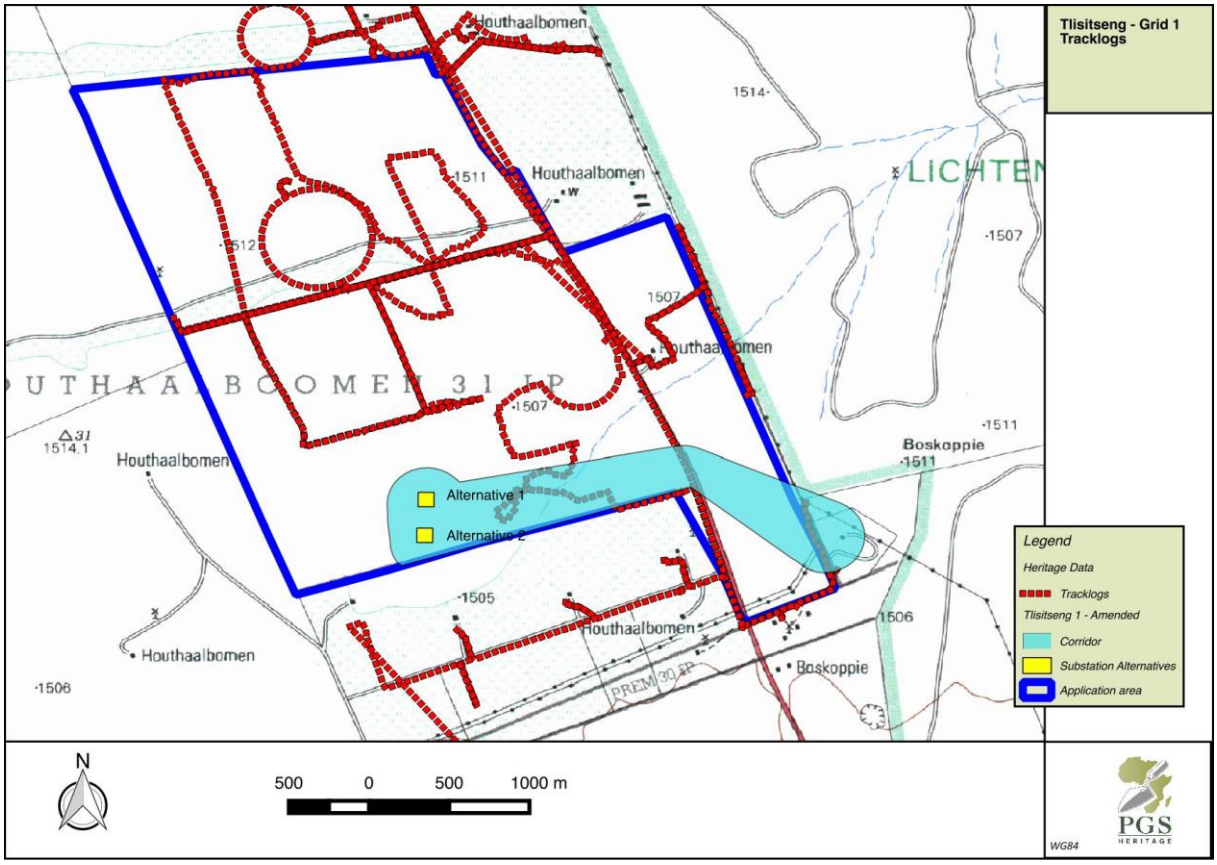
WG84
PGS
HERITAGE


Tlisitseng - Grid 1
Tracklogs
Houthaalbomen
1514
1511
Houthaalbomen
LICHTEN
1512
1507
1507
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UTHAA BOOMEN 31 IP
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Houthaalbomen
Boskoppie
1511
Alternative 1
Alternative 2
1505
Houthaalbomen
1506
Houthaalbomen
Boskoppie
1506
PREM 30 SP
Legend
Heritage Data
Tracklogs
Tlisitseng 1 - Amended
Corridor
Substation Alternatives
Application area
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WG84
PGS
HERITAGE