MOOI PLAATS, WONDERHEUVEL, PAARDE VALLEY SOLAR POWER (PTY) LTD

PROPOSED UMSOBOMVU SOLAR PV ENERGY FACILITIES

Heritage Impact Report

Issue Date: 11 November 2019
Revision No.: 1
Project No.: 15324

Date:	11 11 2019
Document Title:	Heritage Impact Report
Author:	Wouter Fourie
Revision Number:	1
Checked by:	Stephan Jacobs
For:	SiVEST Environmental Division

The heritage impact assessment report has been compiled considering the NEMA Appendix 6 requirements for specialist reports as indicated in the table below.

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**
1.(1) (a) (i) Details of the specialist who prepared the report	Page 2 of Report – Contact details and company
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 – refer to **Appendix D**
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
(cA) An indication of the quality and age of base data used for the specialist report	Section 3.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 5.1
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.1
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3.1 and **Appendix B**
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 5
(g) An identification of any areas to be avoided, including buffers	Section 5
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 5
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 5 and 6
(k) Any mitigation measures for inclusion in the EMPr	Interim Section 7
(l) Any conditions for inclusion in the environmental authorisation	Interim Section 7
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Interim Section 7
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Interim Section 7
(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Interim Section 7
(o) A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. A public consultation process was handled as part of the EIA and EMP process.
(p) A summary and copies if any comments that were received during any consultation process	Not applicable. To date not comments regarding heritage resources that require input from a specialist have been raised.

(q) Any other information requested by the competent authority.	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	No protocols or minimum standards for HIAs or PIAs promulgated through a governmental notice.

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by SiVEST Environmental Division to undertake a Heritage Impact Assessment Report that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Umsombomvu Solar Energy Facilities close to Noupoort in the Northern Cape Province.

The HIA consisted of a scoping phase during which background information and landscape analysis was done to determine the heritage resources that can potentially occur within the study area. Thisi was followed up with fieldwork by a team of archaeologist and a palaeontologist with the aim of identifying heritage resources in the development footprint areas and t make recommendation on the management of these resources and the possible chance finds during construction activities.

The field work identified a total of 10 areas of heritage significance. Adjustments to the project layouts based on the various specialist input resulted in the total avoidance of 3 heritage areas that was excluded from the reporting. The remaining seven site consist of three large, low to medium density scatters of later stone age sites (**UMS005,008 and 009**). These three sites were avoided by slight adjustments in the PV array layouts in the Paarde Valley as well as Wonderheuvel PV facilities. **UMS004, 006 and 007** are all round stone packed enclosure. **UMS007** situated in the Mooi Plaats facility was excluded from direct impact by design changes. UMS004 and 006 will need to be avoided during construction of the power grid through the implementation of a 30-meter buffer.

UMS010 was identified as a fossil find spot and a 50-meter buffer around the fossil bearing material must be implemented. Any construction in the demarcated area must be monitored by a palaeontologist.

The impact rating on the heritage resources indicated that per-mitigation a negative high impact is projected but with the implementation of the recommended management measures this impact rating will be reduced to low negative.

A comparative assessment of the alternative provided for the PV and grid options is summarised in Table 18 and Table 19 below. The palaeontological sensitive area at UMS010 is the only heritage resources that influence the Options assessment, but those options affected is still favourable with the implementation of the recommended management measures.

Table E 1: Key for comparative assessment

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table E 2: PV infrastructure alternatives (laydown areas and O&M buildings)

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
WONDERHEUVEL SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 7	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 8	**NO PREFERENCE**	No heritage issue identified for this footprint
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 7	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 8	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 9	**NO PREFERENCE**	No heritage issue identified for this footprint

Table E 3: Grid connection infrastructure alternatives (power line corridors and associated substations)

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Grid Connection Option 1a	**NO PREFERENCE**	No heritage issue identified for this footprint
Grid Connection Option 1b	**NO PREFERENCE**	No heritage issue identified for this footprint
Grid Connection Option 2a	**NO PREFERENCE**	No heritage issue identified for this footprint
Grid Connection Option 2a	**NO PREFERENCE**	No heritage issue identified for this footprint
WONDERHEUVEL SOLAR PV FACILITY:		
Grid Connection Option 1a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
Grid Connection Option 1c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 3	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		substation 3a, but still a favourable option

It is my considered opinion, based on the current data available, that with the consideration of the position of heritage sensitivities during the layout design and the implementation of the proposed management measures, the project will have an acceptable low impact on heritage resources and can continue.

Contents Page

Appendices

1 INTRODUCTION

PGS Heritage (Pty) Ltd was appointed by SiVEST Environmental Division to undertake a Heritage Impact Assessment Report(HIA) that forms part of the respective Environmental Impact Assessments (EIAs) and Environmental Management Programmes (EMPrs) for the Umsombomvu Solar Energy Facilities close to Noupoort and Middelburg in the Northern and Eastern Cape Provinces.

1.1 Scope of the Study

The aim of the study is to identify possible heritage resources, finds and sensitive areas that may occur in the study area to be investigated in the EIA study. The HIA aims to inform the Environmental Impact Assessment (EIA) in the development of a comprehensive Environmental Management Programme (EMPr) 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 Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the development area. Various factors account for this, including the subterranean nature of some archaeological sites. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

The accuracy of Palaeontological Impact Assessments, that is included as part of the HIA, is reduced by several factors which may include the following: the databases of institutions are not always up to date and relevant locality and geological information was not accurately documented in the past. Various remote areas of South Africa have not been assessed by palaeontologists and data is based on aerial photographs alone. Geological maps concentre on the geology of an area and the sheet explanations were never intended to focus on palaeontological heritage.

Similar Assemblage Zones, but in different areas are used to provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations and Assemblage Zones generally assume that exposed fossil heritage is present within the development area. The accuracy of the Palaeontological Impact Assessment is thus improved considerably by conducting a field-assessment.

Due to the prohibitive size of the application area it was agreed that fieldwork related to the heritage assessment will only be done in the EIA phase when the footprint areas have been determined and significantly reduced, based on environmental sensitive areas determined by the other specialists. After the completion of the fieldwork the proposed grid corridors were

redefined based on the information from various specialist. The final power line corridor will then be walked down during the EMP implementation as required in the proposed management measures related to heritage resources.

1.3 Specialist Qualifications

PGS Heritage (PGS) compiled this HIA.

The staff at PGS has a combined experience of nearly 80 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, author and project manager for this project, holds a BA (Hon) in Archaeology and 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).

Marko Hutten, field archaeologist this project, holds a BA (Hon) in Archaeology and is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA) and has CRM accreditation within the said organisation.

Thomas Mulaudzi, archaeological field technician this project, is registered as an Archaeological Field technician with the Association of Southern African Professional Archaeologists (ASAPA).

Elize Butler has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 12 years. She has been conducting PIAs since 2014.

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:

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

National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Environmental Assessment (BEA) – Section (23)(2)(d)
- Environmental Scoping Report (ESR) – Section (29)(1)(d)
- Environmental Impact Assessment (EIA) – Section (32)(2)(d)
- Environmental Management Plan (EMP) – Section (34)(b)

National Heritage Resources Act (NHRA) Act 25 of 1999

- Protection of Heritage Resources – Sections 34 to 36; and
- Heritage Resources Management – Section 38

Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002

- 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. This study falls under s38(8) and requires comment from the relevant heritage resources authority.

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

Table 1: Terminology

Acronyms	**Description**
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CI	Cumulative Impacts
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Earlier Stone Age
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	Palaeontological Society of South Africa
ROD	Record of Decision

Acronyms	Description
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
WEF	Wind Energy Facility

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

Earlier 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.

Later Stone Age
The archaeology of the last 30 000 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 30 000-300 000 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.

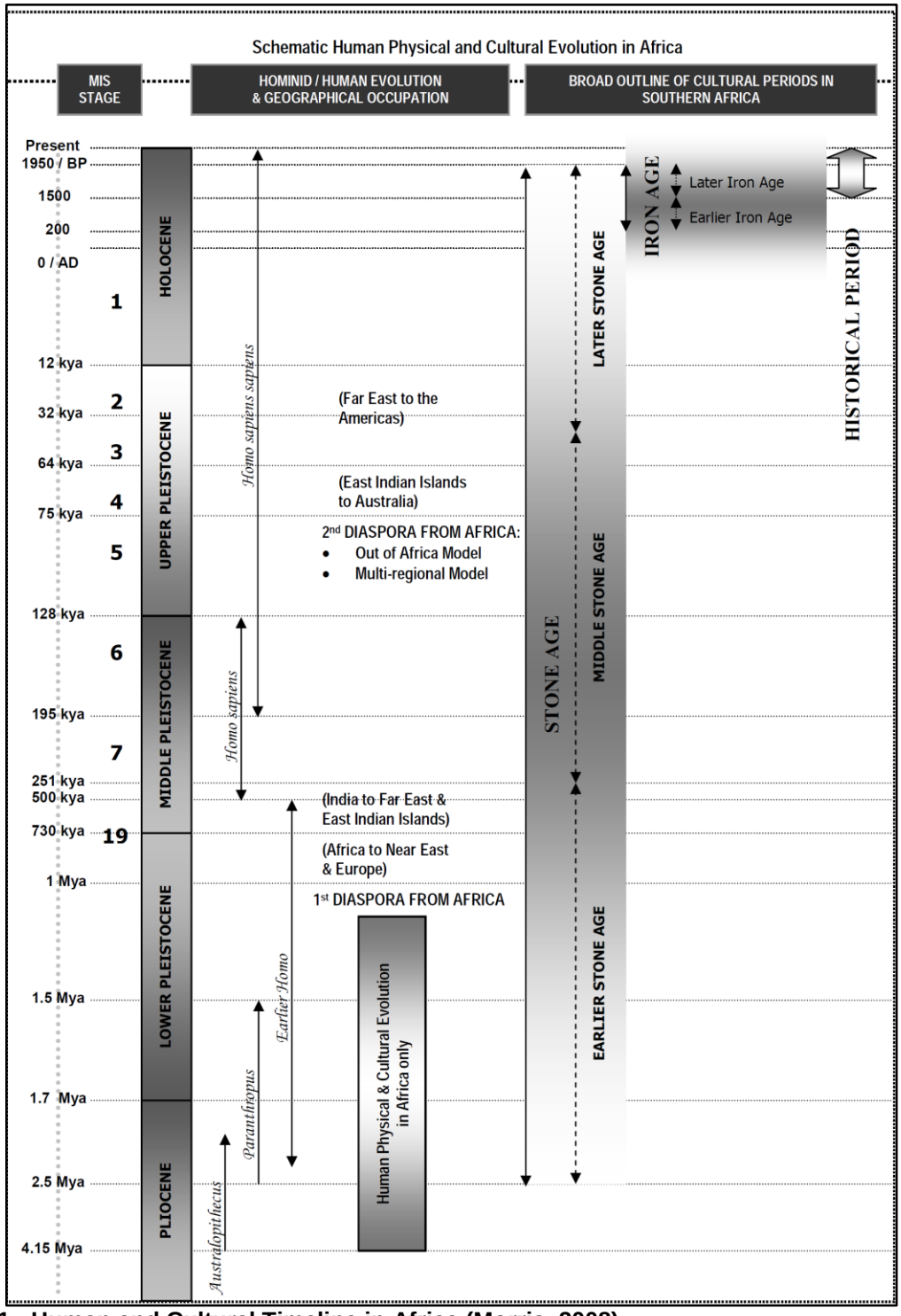

Figure 1: Human and Cultural Timeline in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

It is proposed that three (3) Solar Photovoltaic (PV) Energy Facilities, with associated grid connection infrastructure, will be developed, these being:

- ***Mooi Plaats Solar PV Facility***, on an application site of approximately 5 303ha, comprising the following farm portions:
  - Portion 1 of Leuwe Kop No 120
  - Remainder of Mooi Plaats No 121

- ***Wonderheuvel Solar PV Facility***, on an application site of approximately 5 652ha, comprising the following farm portions:
  - Remainder of Mooi Plaats No 121
  - Portion 3 of Wonder Heuvel No 140
  - Portion 5 of Holle Fountain No 133

- ***Paarde Valley Solar PV Facility***, on an application site of approximately 3 695ha, comprising the following farm portion:
  - Portion 2 of Paarde Valley No 62: and
  - Portion 7 of the Farm Leeuw Hoek No. 61.

2.1 SOLAR PV COMPONENTS

2.1.1 Mooi Plaats Solar PV Energy Facility

The proposed Mooi Plaats Solar PV Energy Facility will include the following components:

- Three (3) PV array areas, occupying a combined total area of approximately 777 hectares (ha).
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **400MW** and will comprise approximately **1 142 857** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to three (3) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of three (3) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

2.1.2 Wonderheuvel Solar PV Energy Facility

The proposed Wonderheuvel Solar PV Energy Facility will include the following components:

- Six (6) PV array areas, occupying a combined total area of approximately 864ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **480MW** and will comprise approximately **1 371 429** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to a maximum of four (4) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. However, certain PV array areas will share O&M buildings. Up to a maximum of four (4) O&M buildings will thus be constructed.
- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

2.1.3 Paarde Valley Solar PV Energy Facility

The proposed Paarde Valley Solar PV Energy Facility will include the following components:

- Five (5) PV array areas, occupying a combined total area of approximately 1 337ha.
- The proposed solar PV energy facility will have a maximum total generation capacity of approximately **700MW** and will comprise approximately **2 000 000** PV modules. The final number of modules as well as their configuration will only be determined in the detailed design phase.
- PV modules will be either fixed tilt mounting or single axis tracking mounting, and the modules will be either crystalline silicon or thin film technology. Each module will be approximately 2m wide and between 1m and 4m in height, depending on the mounting type.
- Internal roads, between 4m and 10m wide, will provide access to the PV arrays. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Up to five (5) temporary construction laydown / staging areas of approximately 4ha each.
- Operation and maintenance (O&M) buildings will be provided for each PV array area, occupying a site of approximately 1ha each. Up to a maximum of five (5) O&M buildings will thus be constructed.

- Medium voltage cabling will link the solar PV energy facility to the grid connection infrastructure. These cables will be laid underground wherever technically feasible.

2.2 Grid Connection Infrastructure

The proposed grid connection infrastructure will include the following components:

- New on-site substations and collector substations to serve each solar PV energy facility, each occupying an area of up to approximately 4ha.
- A new 132kV overhead power line connecting the on-site substations and/or collector substations to either the Hydra D Main Transmission Substation (MTS) or the proposed Coleskop Wind Energy Facility (WEF) substation, from where the electricity will be fed into the national grid. The type of power line towers being considered at this stage to include both lattice and monopole towers which will be up to 25m in height.

Grid connection infrastructure alternatives have been provided for each PV project. These alternatives essentially provide for different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. This is to allow for flexibility to route the power line on either side of the existing high voltage Eskom power lines. The respective alternatives are as follows:

2.2.1 Mooi Plaats Solar PV Grid Connection

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** - links Substation 2 and Substation 1a to the Hydra D MTS.
- **Corridor Option 1b** - links Substation 2 and Substation 1b to the Hydra D MTS.

OPTION 2:

- **Corridor Option 2a** - links Substation 2 and Substation 1a to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.
- **Corridor Option 2b** - links Substation 2 and Substation 1b to the Hydra D MTS via the proposed Central Collector substation located on the Wonderheuvel PV project application site.

2.2.2 Wonderheuvel Solar PV Grid Connection

The alternatives essentially provide for three (3) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- **Corridor Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern connection* links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern* connection links the Proposed Substation 3a to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern* connection links the Proposed Substation 3b to the Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4a to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

- **Corridor Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  a. The *northern connection* links the Proposed Substation 3b to Hydra D MTS via the proposed Northern Collector Substation located on the Mooi Plaats PV project application site.
  b. The *southern connection* links the proposed Substation 4b to the Coleskop WEF Substation via the proposed Southern Collector Substation located on the Paarde Valley PV Project application site.

OPTION 2:

- **Corridor Option 2a** - links Substation 3a to the Hydra D MTS via the proposed Central Collector Substation.

- **Corridor Option 2b** - Option 2b links Substation 3b to Hydra D MTS via the proposed Central Collector Substation.

OPTION 3:

- **Corridor Option 3** links Substation 4b to Hydra D MTS via the proposed Central Collector Substation.

2.2.3 Paarde Valley Solar PV Grid Connection

The alternatives essentially provide for two (2) different route alignments with associated substations contained within an assessment corridor between approximately 400m and 900m wide. The alternatives are as follows:

OPTION 1:

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Central Collector for this option).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7a to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

- Corridor **Option 1c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6a will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6a will act as Southern Collector for this option).

- Corridor **Option 1d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Coleskop Substation via the proposed Southern Collector Sub (Substation 6b will act as Southern Collector for this option).
  ii. The *southern connection* links Substation 7b to the Coleskop Substation via the proposed Southern Collector Substation (Substation 6b will act as Southern Collector for this option).

OPTION 2:

- Corridor **Option 2a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderveuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2b** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2c** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6a and 7b to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

- Corridor **Option 2d** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  i. The *northern connection* links Substation 5 to Hydra D MTS via the proposed Central Collector Sub located on the Wonderheuvel PV Project application site.
  ii. The *southern connection* links Substation 6b and 7a to the Hydra D MTS via the proposed Central Collector Substation located on the Wonderheuvel PV Project application site.

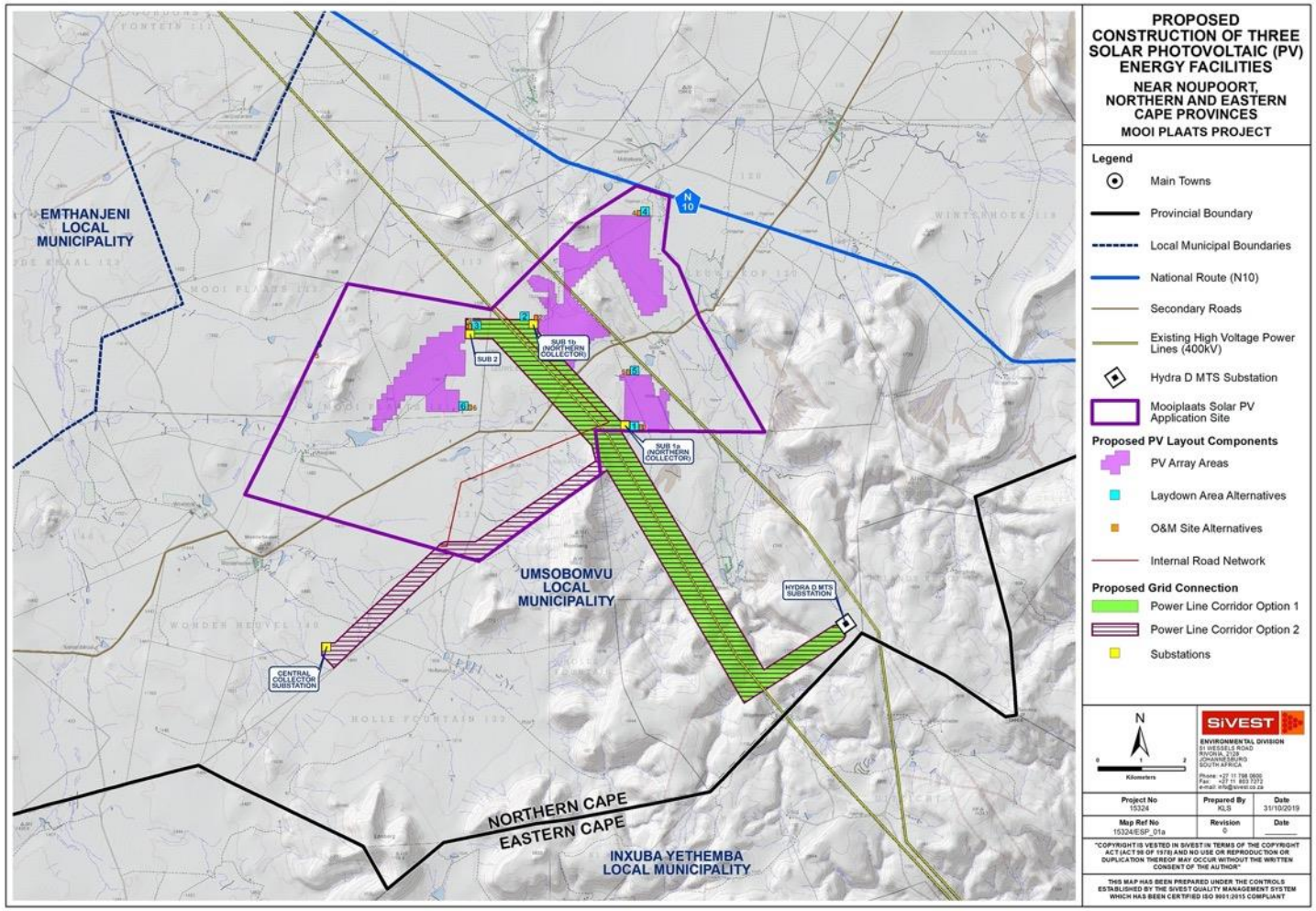

Figure 2: Mooi Plaats Solar PV Facility

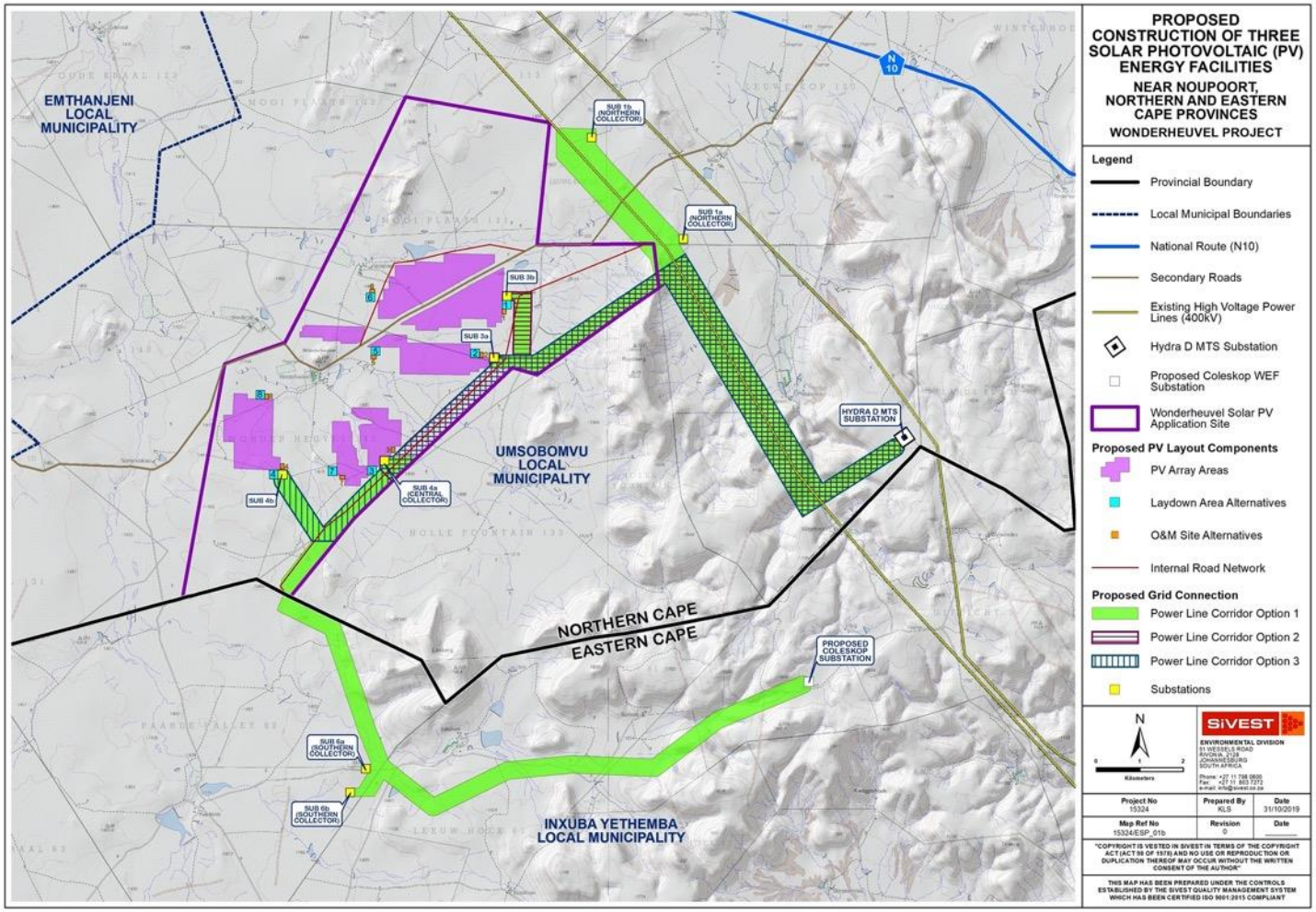

Figure 3: Wonderheuvel Solar PV Facility

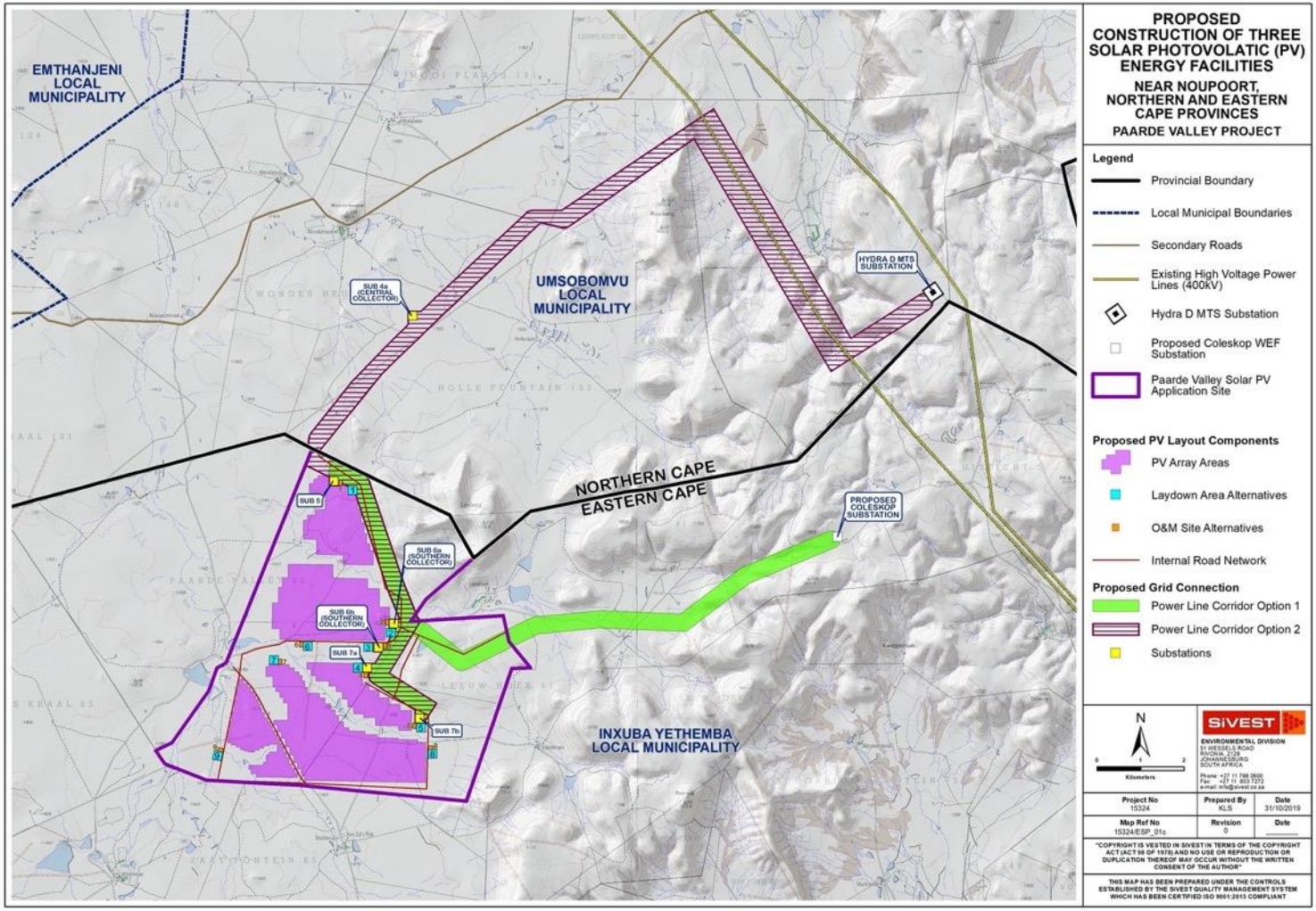

Figure 4: Paarde Valley Solar PV Energy Facility.

3 ASSESSMENT METHODOLOGY

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

3.1 Methodology for Assessing Heritage Site significance

This HIAreport was compiled by PGS for the Proposed Umsobomvu Solar PV Energy 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 and by vehicle through the proposed project area by two qualified archaeologists and two field assistants, which aimed at locating and documenting sites falling within and adjacent to the proposed development footprint. *Completed 26-29 August 2019*.

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 Heritage Impact Assessment methodology, while **Appendix C** provides the guidelines for the impact assessment evaluation that were utilised during this EIA phase of the project.

4 BACKGROUND RESEARCH

4.1 Previous Studies

Researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a number of other archaeological or historical studies have been performed within the wider vicinity of the study area. Previous studies listed for the area in the APM Report Mapping Project included a number of surveys within the area listed in chronological order below:

- Binneman, Booth & Higgitt (2010). A phase 1 Archaeological Impact Assessment (AIA) for the proposed Skietkuil quarries 1 and 2 on the farm Skietkuil no. 3,

Victoria West, central Karoo District, Western Cape Province ≈20 kms SW of study area. This study located stone artefacts as well as a lower grind stone, ceramics as well as kraals.

- Booth (2011) A phase 1 archaeological impact assessment (AIA) for the proposed Kleinfontein solar energy facility on the farm Kleinfontein, portion 4 of 167, situated near Noupoort, Northern Cape Province ≈130 kms E from study area. Isolated occurrences of very weathered and patinated Middle Stone Age (MSA) stone artefacts were observed within the proposed area.
- Booth, 2011 (b) A phase 1 Archaeological Impact Assessment (AIA) for the proposed solar facility on the farm Toitdale, portion 1 of 167, situated near Noupoort, Northern Cape Province ≈ 130 kms from the study area. MSA scatters.
- Fourie (2010) Phase 2 Heritage Impact Assessment for the Gamma-Kappa 765kV Transmission line. Various heritage resources were identified including rock engravings 5km south of the Kappa substation.
- Fourie (2016) Basic Assessment for the proposed construction of supporting electrical infrastructure for the Victoria West wind farm, Victoria West, Northern Cape Province ≈Kim form the study area. A MSA scatter was located as well as a colonial structure/farmstead
- Hart (2015) Heritage Impact Assessment for the proposed Umsinde Emoyeni wind energy facility. ≈40 kms from study area. This study located ESA, MSA and LSA scatters, ceramics, rock paintings and rock engravings pre-colonial kraals and historic buildings and graves.
- Halkett &Webley (2011) Heritage Impact Assessment: proposed Victoria West mini renewable energy facility on the farm Bultfontein 217, northern cape province. ≈30 kms W of the study area. The author found a wide scatter of stone artefactual material including some concentrations, which suggest spatial integrity. Most of the material observed can be ascribed to the Middle Stone Age (MSA).
- Morris (2012) Wildebeest Vlakte Karoo PV solar energy project. Specialist input for the Environmental Impact Assessment for the proposed Wildebeest Vakte Karoo PV solar energy project, Richmond registration division, Northern Cape Province ≈30 kms NW of the study area. Small scatter of MSA artefacts were located as well as two colonial structures of interest, a ruin of a stone dwelling with included ash heap containing porcelain and a small dry stone fortification, part of a blockhouse line developed to defend the railway during the Anglo Boer war.
- Murimbika (2014) Proposed Gamma-Kappa 2nd 765kv Eskom Transmission Powerline and Substations Upgrade Development in Western Cape, Phase 1 heritage impact assessment study. This study runs west of the study area through Victoria West. Findings include ESA, MSA and LSA scatters.
- Van Schalkwyk &Wahl (2007). Heritage Impact Assessment of the Gamma Grassridge Powerlines and substation, Eastern, Western, and Northern Cape Provinces South Africa. Numerous heritage resources were identified, including buildings and structures; an historical settlement; the landscape of the Camdeboo Karoo and the Springbokvlakte, archaeological sites, graves and traditional building techniques.

4.2 Findings from the studies

The aim of a desktop study is to create a compendium of the heritage resources in a selected area. These processes provide a good indication of the type of heritage sites to be expected in the area of concern. The area of concern in this case is between Victoria West and Richmond in the upper Karoo area of the Northern Cape, South Africa.

Sources of data include scientific literature on the topic, scientific journals and previous heritage reports that have been conducted in the surrounding area.

People have occupied the Karoo for hundreds of thousands of years (Hart, 2015). This information is borne out by solid scientific studies by researchers both local and international that have worked in the central interior of the country since the early years of the 20th century. Virtually the entire full range of material evidence of human evolution is manifested in the archaeological sites of this area (Hart, 2015).

The available data indicates that heritage resources are varied and widely distributed throughout the general vicinity. The heritage features include Stone Age sites, rock art sites, historical buildings associated with villages and farmsteads, cemeteries, and potential cultural landscapes (Prins, 2011).

One of the most complete archaeological research surveys in South Africa was conducted by Professor Garth Sampson over a 30-year period, in the Agter Sneeuberg region (northern side of the Sneeuberg) in the central and upper Seacow River Area that covered an area of 734 square kilometers between Hanover, Richmond and Noupoort in the Northern Cape (Sampson, 1985; Booth, 2011). Sampson (1985) stated that one of the many reasons for him choosing to undertake archaeological research in to the Karoo was that it was that the heritage was intact and untouched by ploughing and recent intervention (Hart, 2015). The pre-colonial archaeology of the Karoo was not only visible, but also prolific and in exceptionally good condition.

The valley occurs north east to south east of the present study area and has revealed the presence of some 10 000 archaeological sites representing a history of human occupation that dates back at least 250 000 years (Hart, 2015). Since 1980 the headwaters of the Seacow River have been the focus of intensive archaeological survey where more than 16 000 Stone Age sites were recorded during this period (Sampson, 1985) and in depth ceramic distributional studies were conducted where later Stone Age Lithics and rare Khoekhoe pottery sherds were uncovered during systematic surveys of the area (Sadr & Sampson, 1999)

The Seacow River Valley covers an area of about 2000 sq. kms and was formerly known to its first trek-boer settlers as the Agter-Sneeuberg (Van der Merwe, 1937). Prior to the arrival of the trek-boers in the 1760's Bushman hunter-foragers who were believed to have been without livestock inhabited the area. Sampson (1989) describes the environment of the upper valley as large, flat, treeless basins on shale bedrock with thin topsoil. Dolerite ridges separate them and hill swarms supporting sparse bushes together with the typical Karoo scrub that also covers the flats (Sampson, 1989:3). It is believed that the carrying capacity of the area was high and was swarming with game

at the time of colonial contact with the Bushman. Key resources for hunter-forager survival, such as springs, firewood, hyrax colonies, plant foods, hornfels for stone tools and rare rock shelters were all concentrated on dolerites.

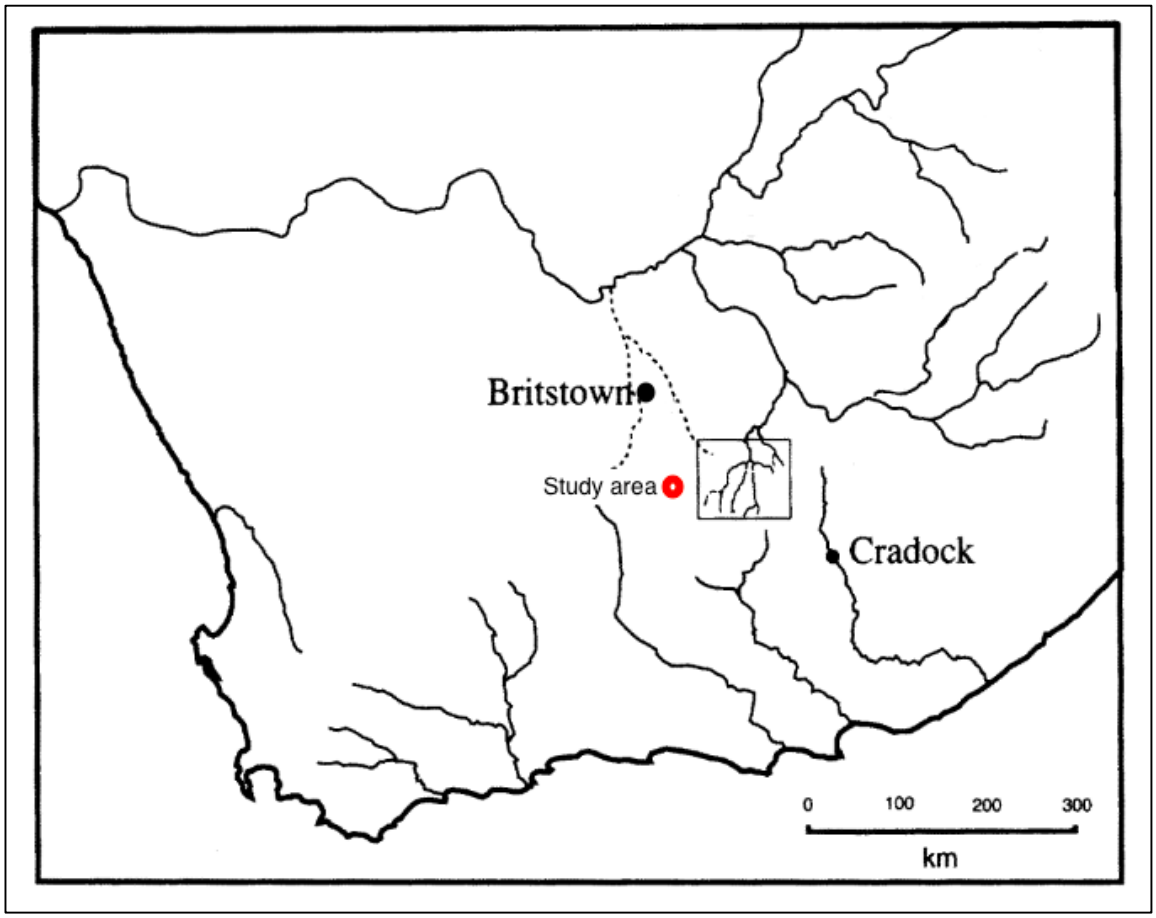

Figure 5: Position of the Seacow River Valley. Adapted from Close & Sampson, 1999

Prins (2011) and Sampson (1985) state that at about 1200 0 1400 AD, a global climatic fluctuation (The Little Ice Age) may well have caused an increase in rainfall in the central Karoo resulting in the area being more suitable than at present for the grazing by cattle and occupation by Khoekhoen pastoralists. It is further stated that archaeology of pastoralist occupation of vast areas in the Karoo are indicated by various stone kraal complexes of which several hundred have been recorded in the Seacow River Valley.

4.2.1 Pre-Colonial Past

- *Early Stone Age: 2.5 million to 250 000 years ago*

Early Stone Age stone artefacts endure for long periods and generally occur as open-air surface scatters either as isolated occurrences or in large quantities and very rarely in association with other archaeological heritage, plant and material remains (Booth, 2011).

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 is known as Oldowan and is

associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulean and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulean dates back to approximately 1.5 million years ago.

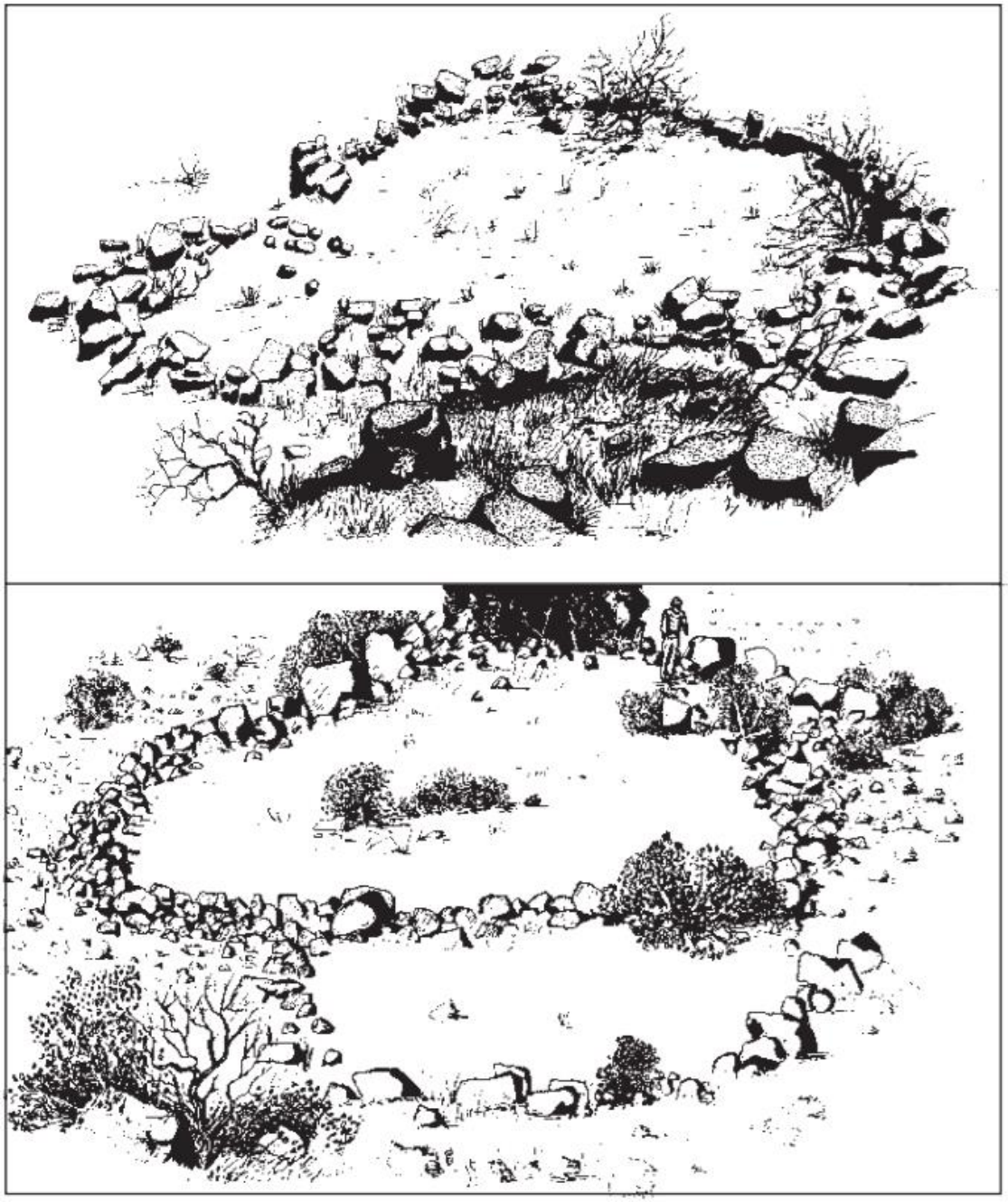

Figure 6: Field sketches from large, collapsed circles of low, dry-stone walling which is typical of the Seacow River Valley. (From Sampson unpublished article)

The Albany Museum database includes records of occurrences of Acheulean handaxes between Middelburg and the Kamdeboo National Park near Graaff Reinet, as well as a collection of stone

artefacts from the Cradock area. Sampson (1985) located a large number of sites within the Seacow River Valley (Booth, 2011).

Victoria West lent its name to the so-called Victoria West Industry, a component of the Early Stone Age period (ESA), of which distinctive prepared cores are the most recognizable element (Inskeep, 1978 in Mitchell, 2002), this is considered a transitional between the ESA and MSA. Binneman *et al* (2010) mentions that during the 1920's, A.H.J. Goodwin (1926, 1946) identified the Victoria West Industry which occurred in the Karoo and along the Vaal River, It is was thought that the Victoria West cores are the 'evolutionary step' before the Levallois or the prepared core industry, indicating an outward spread of this technological change (Lycett, 2009: 175).

- *Middle Stone Age: 250 000 to 40 000 years ago*

The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique.
The MSA focuses on the emergence of modern humans by the change in technology, behaviour, physical appearance, art, and symbolism (Booth, 2011). Surface scatters of these flake and blade industries occur widespread across southern Africa although rarely with any associated botanical and faunal remains (Booth, 2011). It is also common for these stone artefacts to be found between the surface and approximately 50-80cm below ground. Fossil bone may be associated with Middle Stone Age occurrences. According to Booth (2011), the Albany Museum database holds records of the occurrence of Middle Stone Age stone artefacts around the Cradock area. Sampson has reported many open-air MSA sites which he assigned to the Orangian Industry (dating between 128 000 - 75 000 years old), Florisbad and Zeekoegat Industries dating between 64 000 and 32 000 years old (Booth, 2011).

- *Late Stone Age: 40 000 years ago to the historic past*

The Later Stone Age is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths, and is associated with the archaeology of San hunter-gatherers. It is a very important layer on the Karoo landscape as this represents the heritage of the Khoekhoen (historically known as "Hottentot" by early writers) and San (popularly known as Bushman) people of South Africa (Hart, 2015). The direct descendants of these groups make up a significant proportion of the population today. This heritage is represented by two industries (phases). These are the Interior Wilton which is characterised by a microlithic stone artefact industry characterised by lightly patinated hornfels (indurated shale stone) and the later Smithfield industry characterised by specific classes of stone artefacts and the presence of grass tempered ceramics (Hart, 2015).

The majority of archaeological sites date from the past 10 000 years where San hunter-gatherers inhabited the landscape living in rock shelters and caves as well as on the open landscape, inland and along the coast (Booth, 2011). Booth (2011) mentions that the open sites are difficult to locate because they are in the open veld. The preservation of these sites is poor and it is not always possible to date them (Deacon & Deacon, 1999; Booth, 2011). Caves and rock shelters, however, in most cases, provide a more substantial preservation record of pre-colonial human occupation (Booth, 2011).

The Later Stone Age archaeology of the Karoo region is described as rich and varied. Various studies (Beaumont & Morris, 1990; Beaumont & Vogel, 1984, and Sampson, 1985) have shown that the general area has been relatively marginal regarding pre-colonial human settlement, but is in fact exceptionally rich in archaeological sites and rock art (Booth, 2011). Bifacial and tanged barbed arrowheads made on very fine-grained dark or black chalcedony are distributed over the Kimberly area in the west, Lesotho in the east and as far south as Britstown and Steynsburg (Humphreys, 1991).

About 2 000 years ago Khoekhoen pastoralists entered into the region and lived mainly in small settlements. They were the first food producers in South Africa and introduced domesticated animals (sheep, goats and cattle) and ceramic vessels to southern Africa (Booth, 2011). Often, these archaeological sites are found close to the banks of large streams and rivers and along the coast. Large piles of freshwater mussel shell (called freshwater middens) usually mark the large stream and river sites and large piles of marine shellfish middens mark the coastal sites.
According to Hart (2015), it was after 1000 years BP people who were herding sheep/goats and possibly cattle, made an incursion into Karoo and established a new economic order based on transhumant pastoralism (Hart, 1989; Sampson *et al,* 1989; Sampson, 2010). The presence of herding people is represented by stone walled structures that occur throughout the Karoo. They have been recorded within the Zeekoei River Valley, between De Aar and Victoria West and even in the inhospitable high Karoo near Sutherland (Hart, 2005) and on the West Coast (Sadr, 2007).
The spatial distribution of Late Stone Archaeological sites in the Karoo is quite patterned. People needed to be close to water so rivers, pans and springs played an important role in influencing where people lived. As previously mentioned the climate of the Karoo also played a key role. The winters can be extremely cold with temperatures dropping well below zero, made worse by freezing winds (Hart, 2015).

- *Ceramics*

A study done by Sampson *et al* (1989) discusses to importance of ceramic studies. Eight shallow rock shelters deposits were excavated in the headwaters of the Seacow River. In this case it is explained how depositional sequences can be reconstructed from rare, diagnostic potsherds used as fossil markers. The sherd contexts were examined on a case by case basis, revealing a valley-wide sequence.

Sampson *et al* (1989) discuss the findings; Grass-tempered plain wares first appear in the area at AD 900 together with rare Khoi vessels. The latter disappear from the record for c. 500 years, and then reappear in numbers. Various stamp-decorated wares, forming localized concentrations on the landscape, which suggest social groupings, then replace Khoi ceramics. Following this, these are replaced, apparently abruptly, by a single, valley wide ubiquitous rocker-stamp wares again rapidly replace motif of double puncture rows, and this. Sampson *et al* (1989) suggest that this final motif appears at the same time as the first European items, therefor suggesting that its arrival must date close to AD 1770. Rocker-stamp motifs continued to be made by the parahistoric Bushmen well into the post contact era. This research presents evidence of at least five stylistic upheavals in a single millennium.

Sadr & Sampson (1999) conducted a further study on the ceramics in the Upper Seacow Valley area, they stated that Khoekhoe pottery on surface sites in the upper Seacow River Valley is remarkably like the more abundant, well- stratified Later Stone Age ceramics found some 500-600 **km** away in the south-western Western Cape Province. They believe that pastoralists introduced both. Sadr and Sampson (1999) further state that there appears to have been a steadily expanding herder presence in the upper Seacow Valley with the expansion front moving from north-west to south-east across the study area. Whether this means that some later phases have their origins in the regions *between* the two areas compared here, remains to be seen.

- *Rock art*

Heritage resources such as rock art have been identified by Van Schalkwyk and Wahl (2007) in the Kamdeboo mountains, which occur near Graaff Reinet (≈ 115 Kms from the study area). Rock engravings are known to exist on dolerite koppies in the region, and occur in hills along the Ongers River (Morris, 2012). Such koppies occur as a major feature in the area (Morris, 2012)

The SARADA database of rock art indicates that rock paintings and engravings occur sporadically within the surrounding area. These include rock art found on four farms near Beafort West (≈118 kms SW from study area), sixteen localities in the Richmond area (≈35 kms NE from study area), two farms near Murraysburg (≈50 kms S from study area), two farms near Nieu Bethesda (≈100 kms SE from study area) and one near Victoria west (≈40 kms NW from study area)(Van Riet-Lowe, 1941). Some of the most well-known rock engraving site occurs at Nelspoort, at near Beaufort West (Prins, 2011).

4.2.2 Colonial Archaeology

Hart (2015) states that the indigenous people of Karoo waged a bitter war against colonial expansion as they gradually lost control of their traditional land. Penn (2005) notes the most determined indigenous resistance to trekboer expansion occurred when they entered the harsh environment of the escarpment of the interior plateau (namely Hantam, Roggeveld and Nieuweveld Mountains).

During the first quarter of the nineteenth century the Seacow River valley, between the Sneeuberg range and the Orange River, was on the far northeastern border of the Cape Colony. Dutch stock farmers (trekboers) were present in small numbers from the 1770s and rapidly filled up the valley between 1800-1820 (Neville *et al,* 1994).

The frontier history of the Upper Seacow Valley is one on changing interactions between resident Bushman, Hunter-Gatherers and Dutch trekboer pastoralists (Saitowitz & Sampson, 1992). The early direct contact phase spans from 1765-1770 and their direct contact phase is covered by the Bushman/Boer war for the Sneeuberg between 1770-1800. It was believed that the San launched an almost successful campaign to drive the trekboers out. Numerous place names throughout the Karoo such as Oorlogspoort and Oorlogskloof are testimony the skirmishes of the late 18th century (Hart, 2015). The situation became so desperate that the colonists fought back by establishing the “Kommando” system – the “hunting” of San was officially sanctioned in 1777 (Dooling, 2007) and in some instances bounties were obtainable from the local landrost (on presentation of body parts).

The Drosdy of Graaff Reinett played a significant role in this long and bitter war, which eventually saw the almost complete destruction of the Karoo San.

The settlement phase covers Earl Macartney's pacification programme of 1800-1825 (Saitowitz & Sampson, 1992; Thompson & Lamar, 1981). There was also an advanced settlement sub-phase during 1826-1850 where surviving pockets of 'wild' Bushmen suffered increasing ecological and social stress. During the Consolidation phase 1850-1890, the upper valley was surrounded by towns and entered the cash economy, with most remaining Bushman becoming servants (Sampson, 1993).

- *Glass beads*

Sampson (1993) discusses how surviving documents indicate that among the first European items acquired by the Seacow River Bushmen were glass beads, clay pipes and copper wire. During the pacification programme, Bushmen were encouraged to settle at the farmsteads, flint-and-steel sets, tinderboxes and knives were handed out during this time. Muskets were also given to Bushmen shepherds and farm guards. Other items such as household utensils and European clothing only became common among farm Bushmen in early Consolidation times (Saitowitz & Sampson, 1992). Increased use of building materials like window glass, nails, screws, box strapping and especially fencing wire by the Bushman occurred after 1880.

Saitowitz & Sampson (1992) excavated eight rock shelters in the upper Seacow valley, the superficial deposits contained fragments of nearly all the above-mentioned items among dwindling numbers of indigenous Smithfield artefacts. In six of these excavations, small assemblages of glass beads were found in association with other European items, many of which have can be dated to the nearest quarter century (Saitowitz & Sampson, 1992). Although very small samples, these bead assemblages, together with those from three shelters in the adjacent middle Orange River, offer rare insights into glass bead chronology for the semi-arid interior of South Africa.
Saitowitz & Sampson (1992) state that although all the upper Karoo rock shelters were still in use at the end of the nineteenth century, glass beads were not found reliably associated with any of these dated superficial deposits. Presumably the farm Bushmen responsible for such residues had by this time adopted European dress, and glass beads no longer played any part in the frontier exchange system.

- *Guns*

Westbury and Sampson (1993) conducted a study, which observed the acquisition of guns by Bushman in the Seacow Valley, the purpose being to provide a timetable of changes in firearm technology throughout the valley. They state that records suggest that Bushman began to use firearms as early as 1770, however material traces only appear from 1825. According to Westbury & Sampson (1993) the earliest that musketry could have been introduced to the upper Seacow Valley would have been the 1770s. During that decade firearms and ammunition were supplied heavily into what was to become the Graaff-Reinet region, and particularly into the Sneeuberg Mountains immediately to the south of the upper valley. The newly arrived Dutch farmers in the area were believed to be arming themselves and their Khoi servants against marauding Bushman, also mentioned above (Westbury & Sampson, 1993)

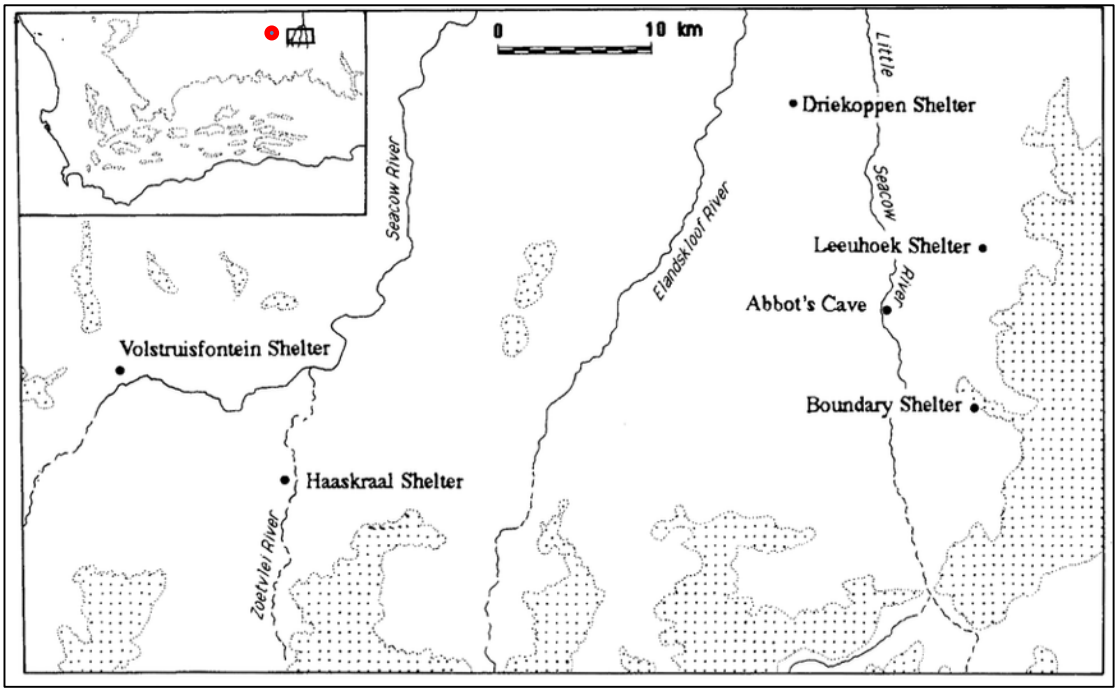

Figure 7: Map of the upper Seacow valley, showing mountains (stippled) main tributaries and locations of rock shelters containing glass trade beads. From Saitowitz & Sampson 1992:94. (red dot current study area)

The Dutch authorities at the Cape heavily supplemented Trekboer weaponry, as shown by a resolution of the Governor's Council dated 1774, in which an ammunition wagon was ordered to be sent to the Sneeuberg with "90 firelocks, 900 lbs of gunpowder, 1,800 lbs of lead, 3,000 flints" (Moodie, 1960). In 1977 the situation got more severe between farmers and Bushman, and more ammunition was requested. By 1779 a further request to the Cape authorities, this time for 1000 lbs gunpowder and 2000 lbs lead (Westbury & Sampson, 1993). During these years there were many opportunities for ammunition to be stolen from farmers or acquired by run-away servants.
By 1809 Strife had substantially subsided after the enforcement of Earl Macartney's pacification programme by the Landdrost, and guns had become common throughout the landscape. Farmers and herders were using the weapons at this stage alike, for protection against wild animals.

The introduction of weapons by expanding colonization had an impact on the archaeological record. Westbury & Sampson excavated nine rock shelters in the Upper Seacow valley of which all revealed shallow post-Contact horizons containing a wide variety of European items found among dwindling numbers of artefacts, fauna and indigenous pottery.

4.2.3 Findings from the studies

Palaeontology

The following is extracted from the Palaeontological Impact Assessment (PIA) completed by Butler (2019) – Refer to **Appendix E** for the full PIA.

*The proposed development includes three PV facilities as well as grid connections and infrastructure. These proposed developments are underlain by the continental sediments of the Latest Permian sediments of the Balfour Formation (Upper Beaufort Group, Adelaide Subgroup) and earliest Triassic sediments of the Katberg Formation (Upper Beaufort Group, Tarkastad Subgroup, Karoo Supergroup) as well as Jurassic Karoo Dolerite. These sediments are generally mantled by a thick layer of Quaternary to Recent colluvium and alluvium. The uppermost Balfour and Katberg Formations are of extraordinary interest in that they provide some of the best existing information on ecologically-complex terrestrial ecosystems during the catastrophic end-Permian mass extinction. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Tarkastad and Adelaide Subgroups has a Very High Palaeontological Sensitivity, while that of the Quaternary superficial deposits of the Central interior is high and the Karoo dolerite (igneous rocks) is insignificant and rated as zero (***Figure 8 *to* Figure 10***).*

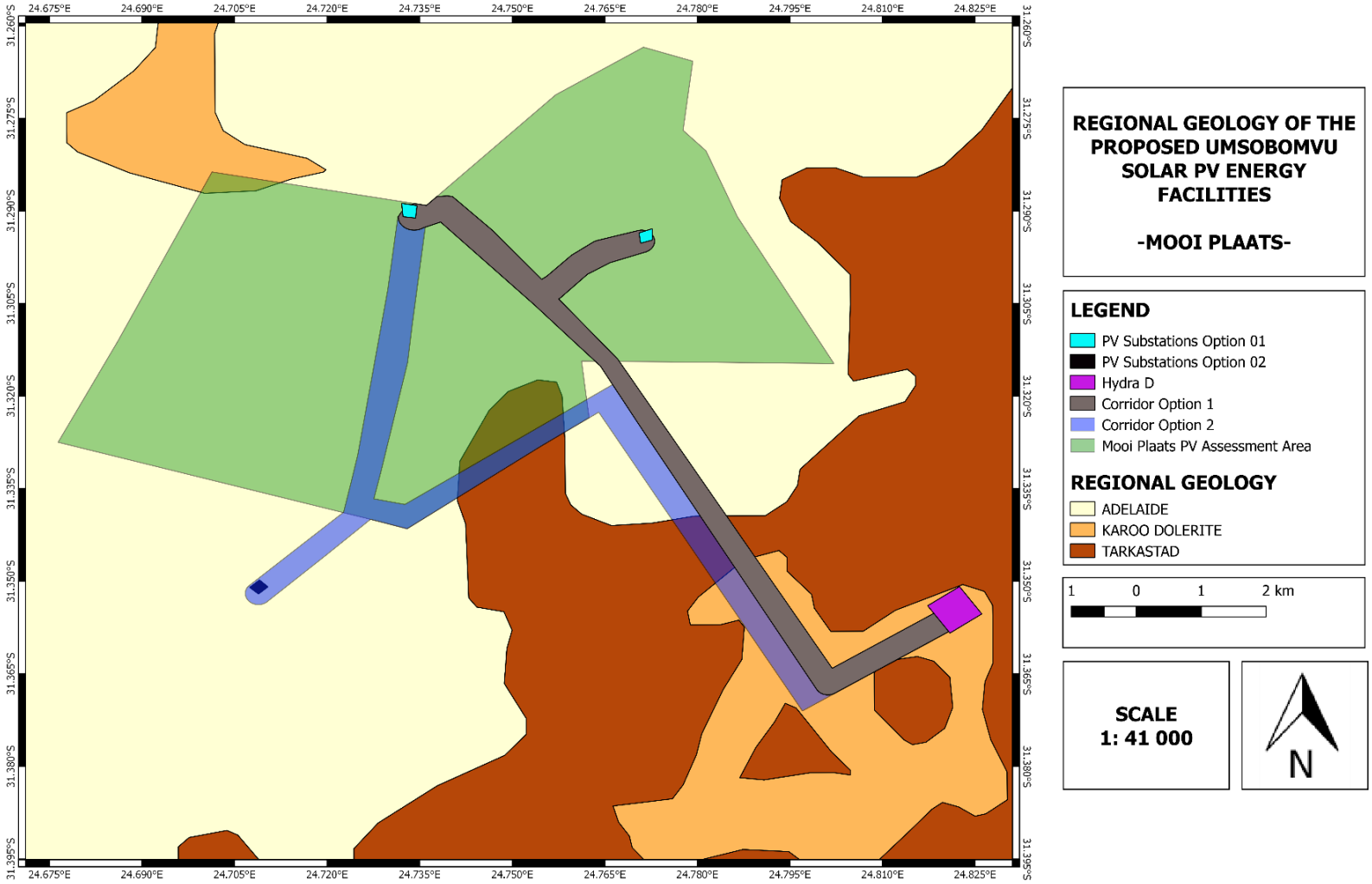

Figure 8: Surface geology of the proposed Umsobomvu Solar PV Energy Facilities: Mooi Plaats. The proposed development is underlain by the Adelaide and Tarkastad Subgroup, Beaufort Group, Karoo Supergroup) as well as Jurassic Karoo Dolerite. Map drawn QGIS Desktop 2.18.1. Map drawn QGIS Desktop 2.18.1

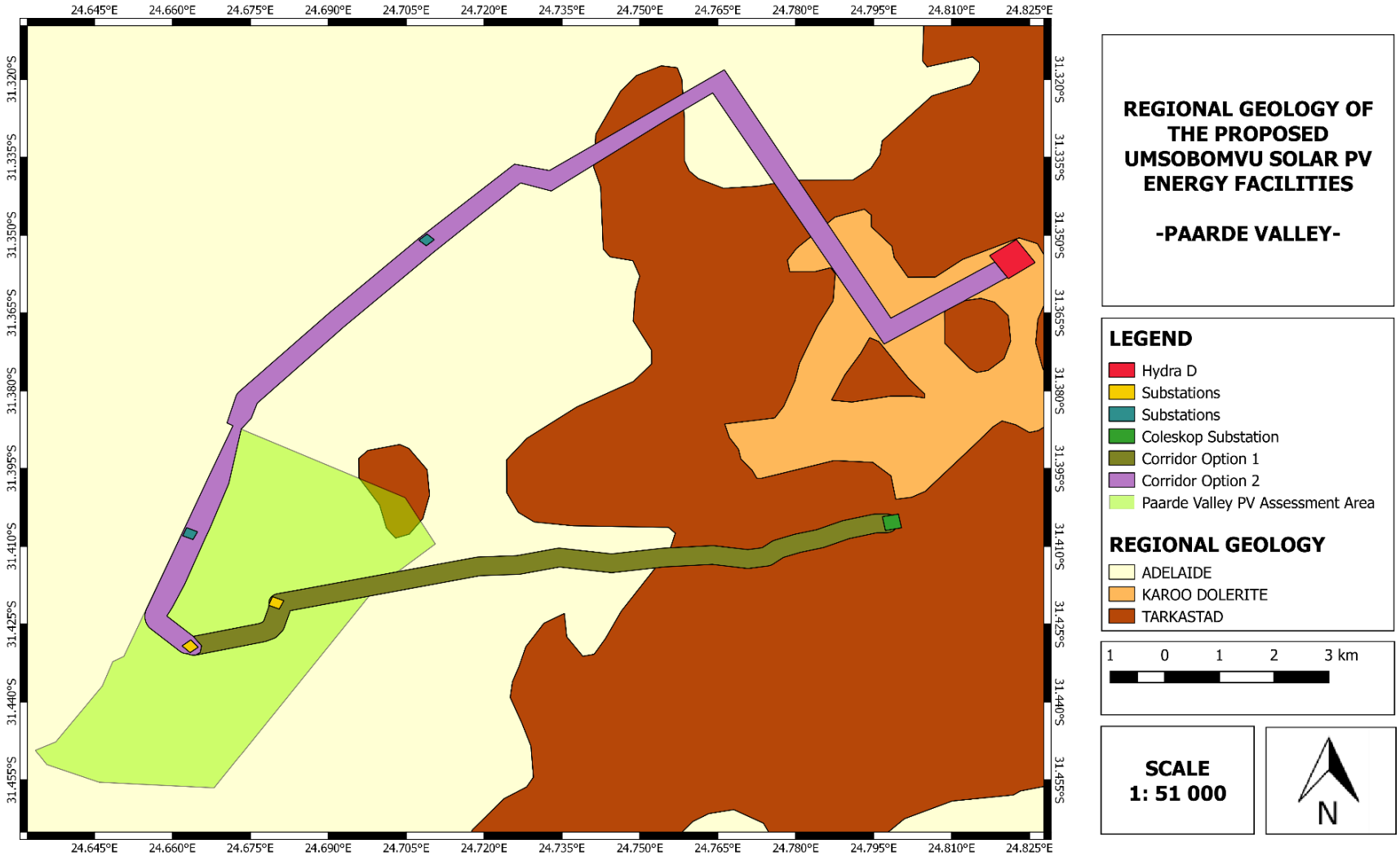

Figure 9: Surface geology of the proposed Umsobomvu Solar PV Energy Facilities: Paarde Valley. The proposed development is underlain by the Adelaide and Tarkastad Subgroup, Beaufort Group, Karoo Supergroup) as well as Jurassic Karoo Dolerite. Map drawn QGIS Desktop 2.18.1

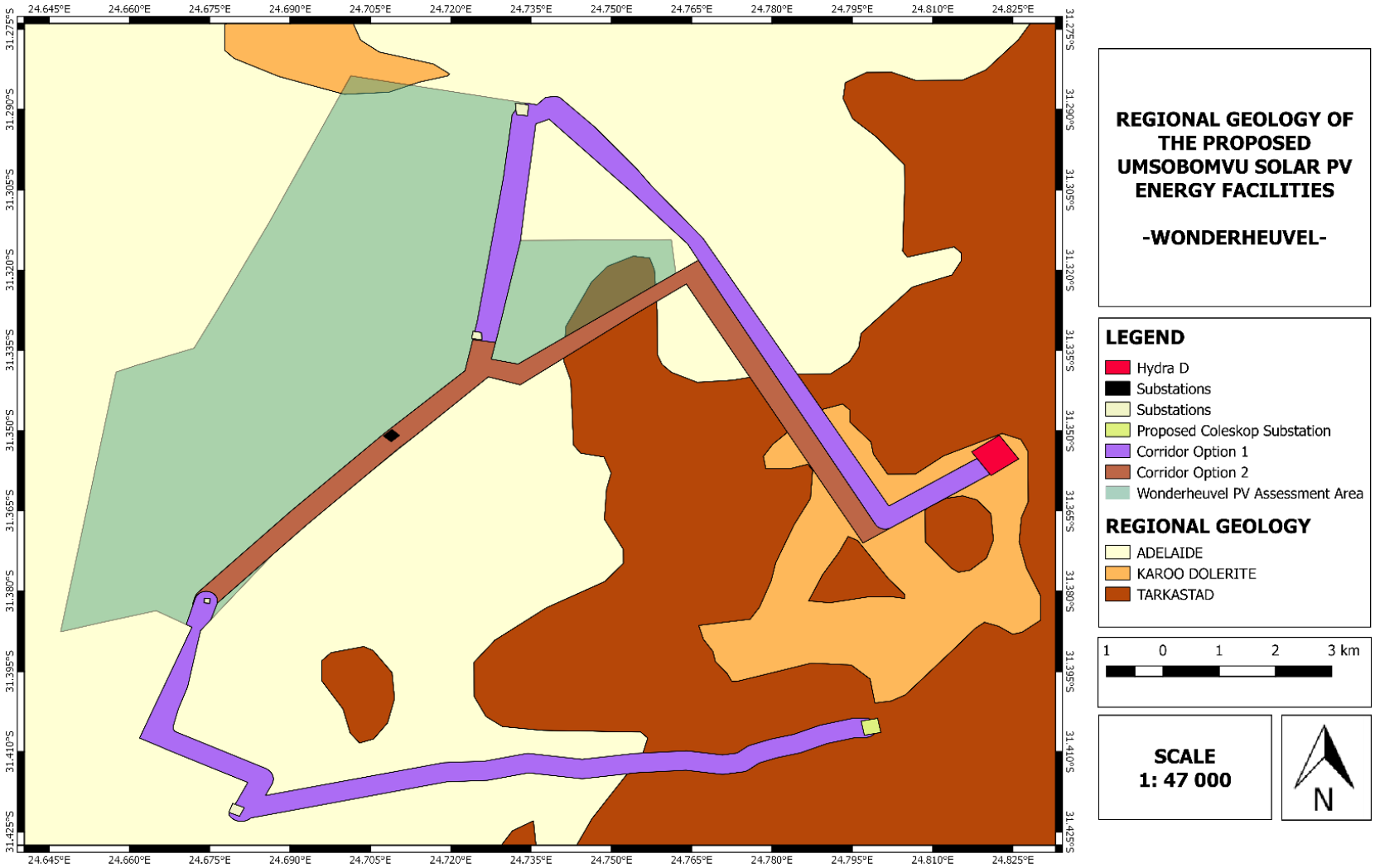

Figure 10: Surface geology of the proposed Umsobomvu Solar PV Energy Facilities: Wonderheuvel. The proposed development is underlain by the Adelaide and Tarkastad Subgroup, Beaufort Group, Karoo Supergroup) as well as Jurassic Karoo Dolerite. Map drawn QGIS Desktop 2.18.1

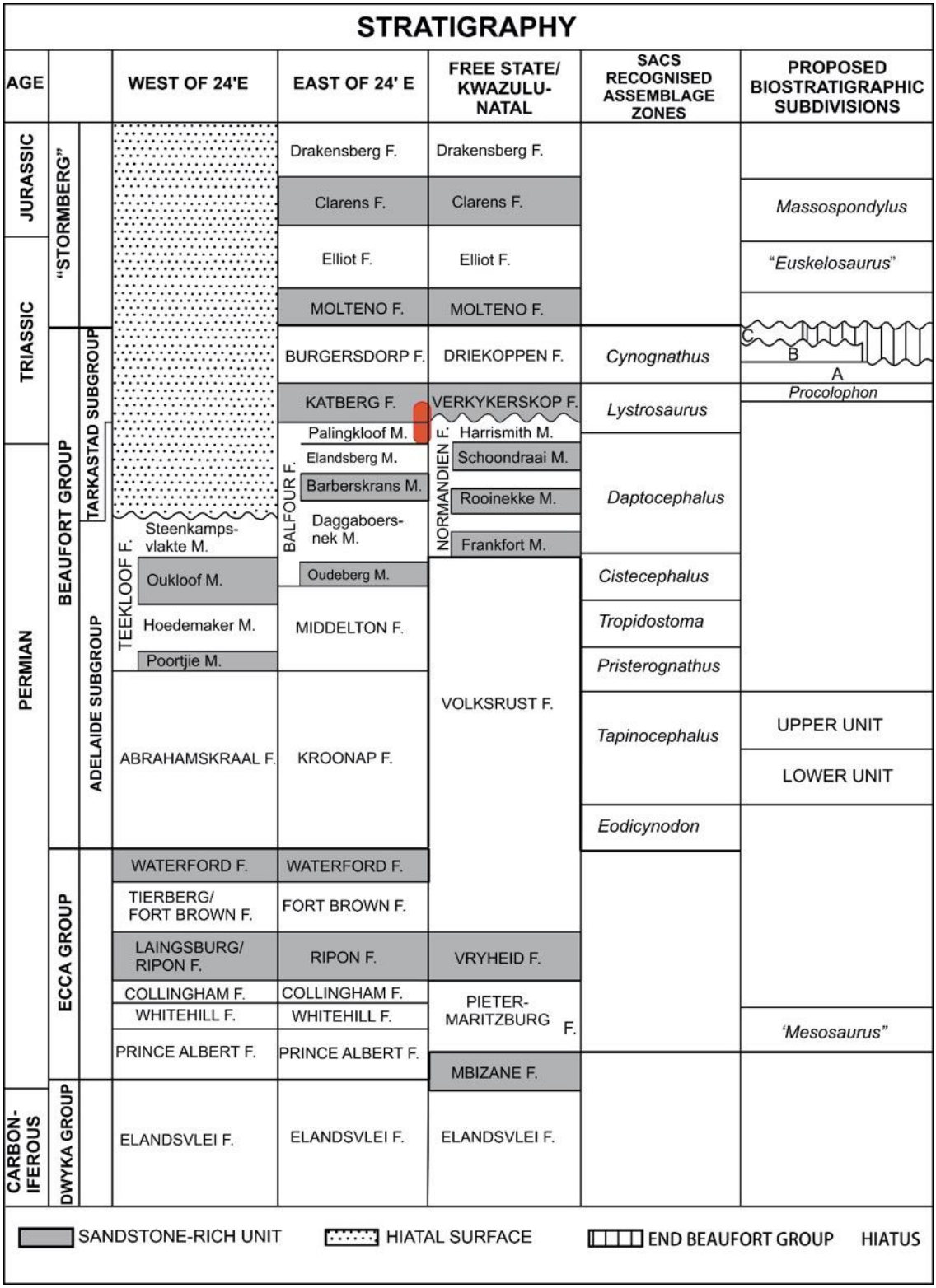

Figure 11: Lithostratigraphic (rock-based) and biostratigraphic (fossil-based) subdivisions Beaufort Group of the Karoo Supergroup with rock units and fossil assemblage zones relevant to the present study marked in red (Modified from Rubidge, 1995). Abbreviations: F. = Formation, M. = Member

The proposed development includes three PV facilities as well as grid connections and infrastructure. These proposed developments are underlain by the continental sediments of the Latest Permian sediments of the Balfour Formation (Upper Beaufort Group, Adelaide Subgroup) and earliest Triassic sediments of the Katberg Formation (Upper Beaufort Group, Tarkastad Subgroup, Karoo Supergroup) as well as Jurassic Karoo Dolerite. These sediments are generally mantled by a thick layer of Quaternary to Recent colluvium and alluvium. The uppermost Balfour and Katberg Formations are of extraordinary interest in that they provide some of the best existing information on ecologically-complex terrestrial ecosystems during the catastrophic end-Permian mass extinction. According to the PalaeoMap of South African Heritage Resources Information System the Palaeontological Sensitivity of the Tarkastad and Adelaide Subgroups has a Very High Palaeontological Sensitivity, while that of the Quaternary superficial deposits of the Central interior is high and the Karoo dolerite (igneous rocks) is insignificant and rated as zero.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle from the 24^{tht} – 28th January 2019. Elsewhere in the Karoo Basin numerous fossils have been uncovered in these geological sediments but only two sites on koppies with fossiliferous outcrops were identified. These fossiliferous sites have been identified as Highly Sensitive and No-go areas. It is recommended that a 50 m buffer will be placed around these areas. In the event that construction is necessary in these sensitive areas it is recommended that the fossils will be collected by a professional palaeontologist. Preceding excavation of any fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies suggested by SAHRA.

4.2.4 Heritage sensitivities

The evaluation of the possible heritage resource finds, and their heritage significance linked to mitigation requirements was linked to types of landscape. The heritage sensitivity rating does not indicate no-go areas but the possibility of finding heritage significant site that could require mitigation work.

4.2.5 Possible finds

Evaluation of aerial photography has indicated that certain areas may be sensitive from an archaeological perspective. The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in Table 2**.**

Table 2:Landform to heritage matrix

LAND FROM TYPE	HERITAGE TYPE
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites

LAND FROM TYPE	HERITAGE TYPE
Outcrops	Occupation sites dating to LSA
Farmsteads	Historical archaeological material

5 FIELWORK FINDINGS

Due to the nature of cultural remains, a systematic controlled-exclusive surface survey was conducted on foot and in a vehicle, over a period of four days by an archaeologist and archaeological technician from PGS. The fieldwork was conducted on the 26-29 August 2019.

The area is characterized by typical Karoo landscape with low vegetation cover and vast open spaces. The PV localities are situated in the flat low lying areas (**Figure 12** and **Figure 13**) while the southern power line corridors travers mountainous areas (**Figure 14** and **Figure 15**).

Figure 12: View of open Karoo veld in study area

Figure 13: Characteristic view of the study area

Figure 14: View of one of the power lien corridors

Figure 15: Mountainous areas within study area

The following section describes the heritage resource identified during the fieldwork and is divided per PV facility.

5.1 Mooi Plaats

The Mooi Plaats PV and corridor areas revealed a single heritage resource point (**UMS007**) within the development footprint (refer to **Table 3**). As noted in section 1.2 of this report the focus of the field work was on the PV footprints as well as the power line corridor centre lines. Track logs (in orange) for the survey and heritage resources in red are indicated in **Figure 18**.

Table 3 – Heritage Resources for Mooi Plaats

Site[1] number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS007	S 31,28607	E 24,74903°	A small, circular shaped, stone walled enclosure was identified at this location. The enclosure measures approximately 4m x 5m in size and the walls were approximately 1m high and approximately 0.75m wide. It was overgrown and collapsed in several places. The small enclosure was most probably used during the herding of sheep and goats on the farm.	Medium	IIIB

Figure 16: View of stone packed wall at site UMS007

Figure 17: View of stone packed wall at site UMS007

[1] *Site in this context refers to a place where a heritage resource is located and not a proclaimed heritage site as contemplated under s27 of the NHRA.*

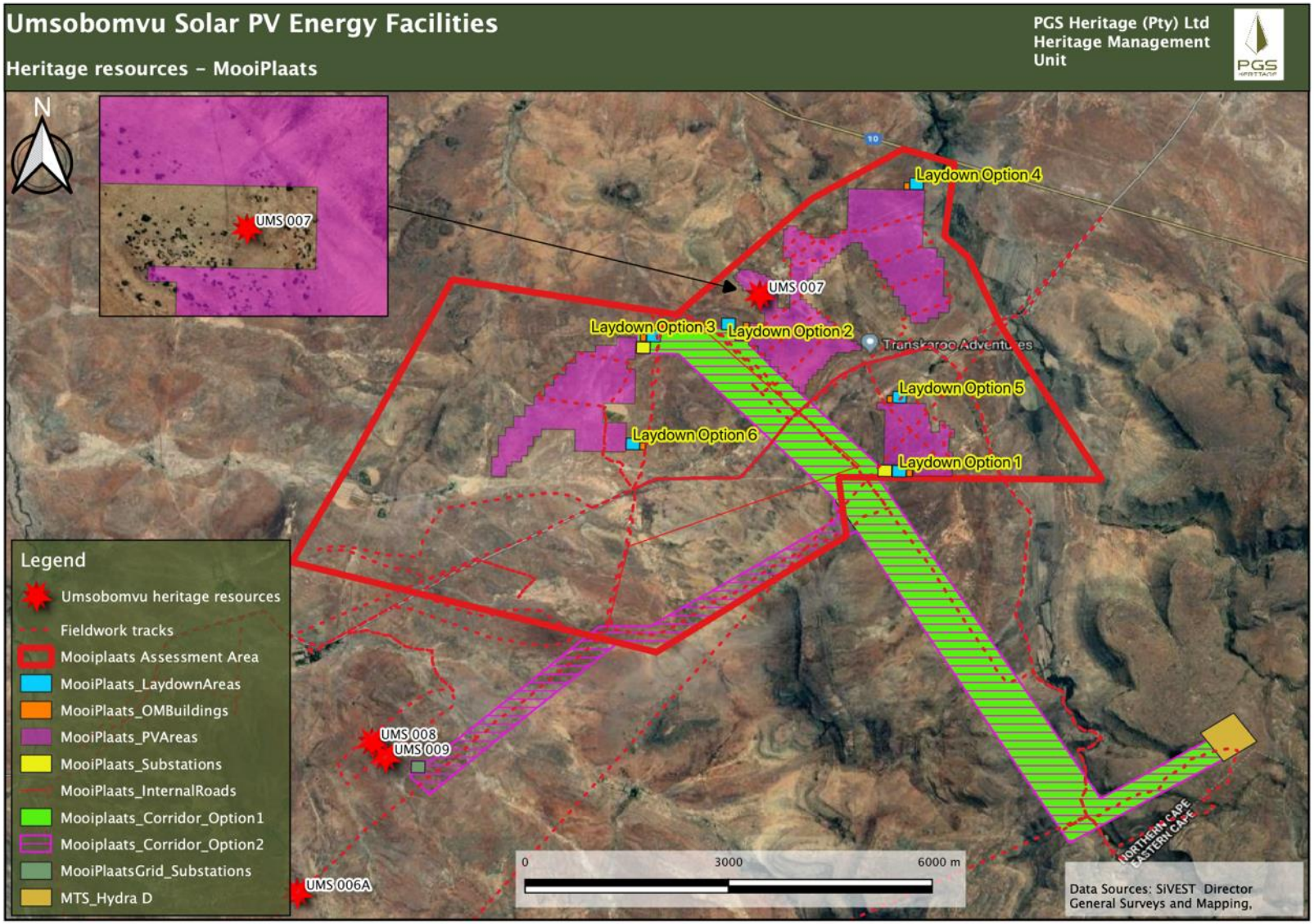

Figure 18: Heritage resources and tracklogs - Mooi Plaats

5.2 Paarde Valley

The Paarde Valley PV and corridor areas revealed tree heritage resource points (**UMS004, UMS005 & 005B and UMS006A**) within the development footprint (refer to **Table 4**). As noted in section 1.2 of this report the focus of the field work was on the PV footprints as well as the power line corridor centre lines. Track logs (in orange) for the survey and heritage resources in red are indicated in **Figure 25**.

Table 4 – Heritage Resources for Paarde Valley

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS004	S 31,41905°	E 24,69405°	A small, circular shaped, stone walled enclosure was identified at this location. The enclosure measures approximately 8m x 10m in size and the walls were approximately 1m high and approximately 0.75m wide. It was overgrown and collapsed in several places. The small enclosure was most probably used during the herding of sheep and goats on the farm. Three unknown stone mounds are situated approximately 15m to the south of the stone walled enclosure. The origin or function of these stone mounds is not known as yet. **Site extent**: 20x20m.	Medium	IIIB

Figure 19: Stone circle at UMS004

Figure 20: One of the stone mounds at UMS004

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS005 &005B	S 31,41926°	E 24,69005°	A low/medium density scatter (5-10 artefacts/10m²) of Late Stone Age artefacts was identified at this location. The scatter is situated on the northern slopes of an elongated rise which overlooks a water course approximately 80m further to the north. The scatter of artefacts follows the slope of the rise all along the water course to the north. It extents for approximately 400m along this water course further to the north and measures approximately 200m wide across the slope of the rise. The artefacts are exposed due to some sheet erosion which occurs across the slope. The artefacts occur in concentrations along this eroded or exposed area. The artefacts consist mostly of debitage (waste material such as flakes, chips and chunks) which were produced from fine- grained and weathered dolerite, quarts and rare CCS (Crypto-crystalline silicates). Some cores and blade fragments were also recognized.	Low	IIIC

Figure 21: View of site UMS005 and 005B

Figure 22: Dolerite core (left), some side and end scrapers collected on the site

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS006A	S 31,37868°	E 24,67732°	A small, circular shaped, stone walled enclosure was identified at this location. The enclosure measures approximately 5m x 6m in size and the walls were approximately 1m high and approximately 0.75m wide. It was overgrown and collapsed in several places. The small enclosure was most probably used during the herding of sheep and goats on the farm.	Medium	IIIB

Figure 23: Stone circle at UMS006A

Figure 24: Low stone walling

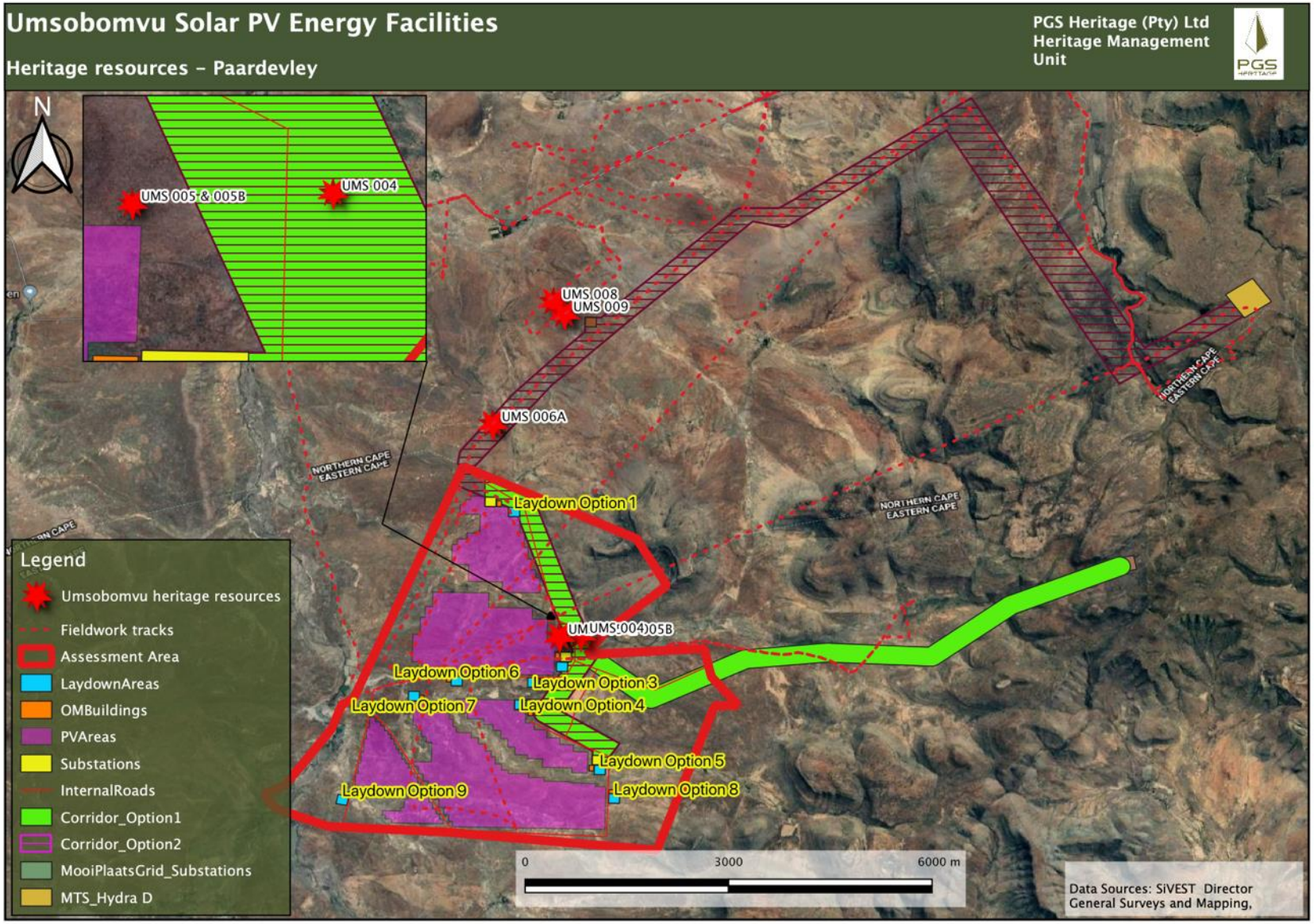

Figure 25: Heritage resources and tracklogs – Paarde Valley

5.3 Wonderheuvel

The Wonderheuvel PV and corridor areas revealed tree heritage resource points (**UMS004, UMS005 & 005B, UMS006A, UMS007-010**) within the development footprint (refer to **Table 5**). As noted in section 1.2 of this report the focus of the field work was on the PV footprints as well as the power line corridor centre lines. Track logs (in orange) for the survey and heritage resources in red are indicated in **Figure 37**.

Table 5: List of heritage finds in the Wonderheuvel PV footprint

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS004	S 31,41905°	E 24,69405°	A small, circular shaped, stone walled enclosure was identified at this location. The enclosure measures approximately 8m x 10m in size and the walls were approximately 1m high and approximately 0.75m wide. It was overgrown and collapsed in several places. The small enclosure was most probably used during the herding of sheep and goats on the farm. Three unknown stone mounds are situated approximately 15m to the south of the stone walled enclosure. The origin or function of these stone mounds is not known as yet. **Site extent**: 20x20m.	Medium	IIIB

Figure 26 – Stone circle at UMS004

Figure 27 – One of the stone mounds at UMS004

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS005 &005B	S 31,41926°	E 24,69005°	A low/medium density scatter (5-10 artefacts/10m²) of Late Stone Age artefacts was identified at this location. The scatter is situated on the northern slopes of an elongated rise which overlooks a water course approximately 80m further to the north. The scatter of artefacts follows the slope of the rise all along the water course to the north. It extents for approximately 400m along this water course further to the north and measures approximately 200m wide across the slope of the rise. The artefacts are exposed due to some sheet erosion which occurs across the slope. The artefacts occur in concentrations along this eroded or exposed area. The artefacts consist mostly of debitage (waste material such as flakes, chips and chunks) which were produced from fine- grained and weathered dolerite, quarts and rare CCS (Crypto-crystalline silicates). Some cores and blade fragments were also recognized.	Low	IIIC

Figure 28 – View of site UMS005 and 005B

Figure 29 – Dolerite core (left), some side and end scrapers collected on the site

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS006A	S 31,37868°	E 24,67732°	A small, circular shaped, stone walled enclosure was identified at this location. The enclosure measures approximately 5m x 6m in size and the walls were approximately 1m high and approximately 0.75m wide. It was overgrown and collapsed in several places. The small enclosure was most probably used during the herding of sheep and goats on the farm.	Medium	IIIB

Figure 30 – Stone circle at UMS006A

Figure 31 – Low stone walling

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS008	S 31,35536°	E 24,68892°	Another low density scatter (2-5 artefacts/10m²) of Late Stone Age artefacts was identified at this location. The scatter is situated on the northern slopes of a shallow valley or gully which overlooks a water course approximately 40m further to the north. The scatter of artefacts follows the slope of the valley/gully all along the water course to the north. It extents for approximately 100m along this water course further to the north and measures approximately 50m wide across the slope of the valley. The artefacts are exposed due to some sheet erosion which occurs across the slope. The artefacts occur in concentrations along this eroded or exposed area. The artefacts consist mostly of debitage (waste material such as flakes, chips and chunks) which were produced from fine- grained and weathered dolerite, quarts and rare CCS (Crypto-crystalline silicates). Some cores and blade fragments were also recognized.	Low	IIIC

Figure 32 – Low density scatter visible in grass

Figure 33 – Various blades and side scrapers collected in the area of UMS008

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS009	S 31,35536°	E 24,68892°	Another low density scatter (2-5 artefacts/10m²) of Late Stone Age artefacts was identified at this location. The scatter is situated on the slopes of a shallow valley or gully which overlooks a water course approximately 40m further to the south. The scatter of artefacts follows the slope of the valley/gully all along the water course to the south. It also extends across the water course and more artefacts are found on the other side of the water course. The area with artefacts covers approximately 80m x 120m and is situated on both sides of the water course. The artefacts are exposed due to some sheet erosion which occurs across the slopes. The artefacts occur in concentrations along this eroded or exposed area. The artefacts consist mostly of debitage (waste material such as flakes, chips and chunks) which were produced from fine- grained and weathered dolerite, quarts and rare CCS (Crypto-crystalline silicates). Some cores and blade fragments were also recognized.	Low	IIIC

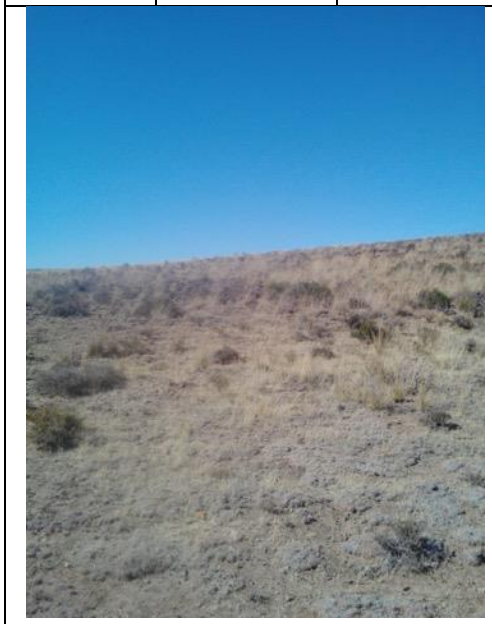

Figure 34 – View of site UMS009

Figure 35 – Various scrapers and roughout flakes found on slope

Site number	Lat	Lon	Description	Heritage Significance	Heritage Rating
UMS010A UMS10B	S31.32807° S31.32813°	24.745946° 24.745929°E	Only two sites with fossiliferous outcrops were identified on the proposed development footprint. As the fossiliferous outcrops was located on a koppies it and should not have an effect on the PV solar plants. Thus, although fossiliferous outcrops have been identified no, No-go areas or highly sensitive fossil sites have been identified as the uncovered fossils were poorly preserved and fragmentary.	Low	IIIC

Figure 36 – In situ Lystrosaurus skull

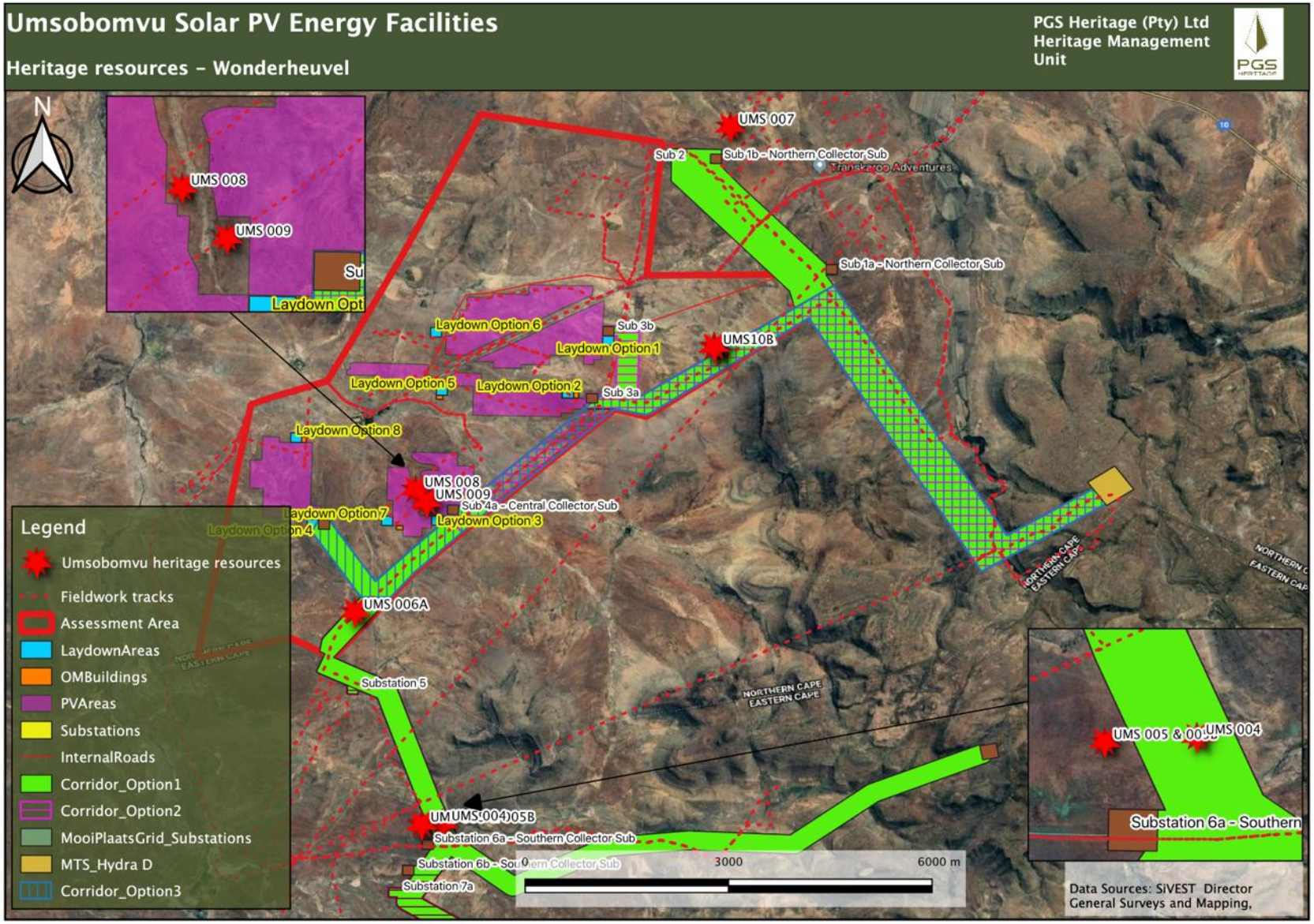

Figure 37: Heritage resources and tracklogs - Wonderheuvel

6 IMPACT RATINGS

After consideration of the proposed layout in relation to the heritage resource the following table provide findings for each of the PV projects inclusive of their corridors. The impact assessment rating is based on the rating scale as contained in **Appendix B** and **Appendix C**.

Table 6: Impact table for the Mooi Plaats PV options

MOOI PLAATS SOLAR PV FACILITY																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																				
Impact on known Stone Age resources	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	** Review PV layout to avoid the site **Implementation 30-meter buffer	1	1	3	2	1	2	16	-	Low impact
Impact on chance finds	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	1	3	4	4	4	52	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	3	4	3	2	24	-	Medium impact

MOOI PLAATS SOLAR PV FACILITY																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Impact on palaeontological resources	Impact on palaeontological resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	**Implement chance finds procedures **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	2	4	4	2	24	-	Medium impact
Operational Phase																				
Impact on heritage resources	Impact on heritage resources during general maintenance	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Decommissioning Phase																				
Impact on heritage resources	Impact on heritage resources during rehabilitation work associated with decommissioning - grading trench filling etc	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request	1	1	4	4	4	1	14	-	Low impact

MOOI PLAATS SOLAR PV FACILITY																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
											destruction permits from SAHRA									
Cumulative																				
Impact on heritage resources	Additional impact of the development on heritage resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Impact on palaeontological resources	Additional impact of the development on palaeontological resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact

Table 7: Impact table for the Mooi Plaats grid options

MOOI PLAATS ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Impact on known Stone Age resources	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	** Review PV layout to avoid the site **Implementation 30-meter buffer	1	1	3	2	1	2	16	-	Low impact
Impact on chance finds	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	1	3	4	4	4	52	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	3	4	3	2	24	-	Medium impact

MOOI PLAATS ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Impact on palaeontological resources	Impact on palaeontological resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	**Implement chance finds procedures **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	2	4	4	2	24	-	Medium impact
Operational Phase																				
Impact on heritage resources	Impact on heritage resources during general maintenance	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Decommissioning Phase																				
Impact on heritage resources	Impact on heritage resources during rehabilitation work associated with decommissioning - grading trench filling etc	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request	1	1	4	4	4	1	14	-	Low impact

MOOI PLAATS ALIGNMENT																				
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
											destruction permits from SAHRA									
Cumulative																				
Impact on heritage resources	Additional impact of the development on heritage resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Impact on palaeontological resources	Additional impact of the development on palaeontological resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact

Table 8: Impact table for the Paarde Valley PV options

PAARDE VALLEY SOLAR PV FACILITY																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Impact on known Stone Age resources	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	** Review PV layout to avoid the site **Implementation 30-meter buffer	1	1	3	2	1	2	16	-	Low impact
Impact on chance finds	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	1	3	4	4	4	52	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	3	4	3	2	24	-	Medium impact
Impact on palaeontological resources	Impact on palaeontological resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	**Implement chance finds procedures **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	2	4	4	2	24	-	Medium impact

PAARDE VALLEY SOLAR PV FACILITY																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operational Phase																				
Impact on heritage resources	Impact on heritage resources during general maintenance	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Decommissioning Phase																				
Impact on heritage resources	Impact on heritage resources during rehabilitation work associated with decommissioning - grading trench filling etc	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Cumulative																				

PAARDE VALLEY SOLAR PV FACILITY																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Impact on heritage resources	Additional impact of the development on heritage resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Impact on palaeontological resources	Additional impact of the development on palaeontological resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact

Table 9: Impact table for the Paarde Valley grid options

PAARDE VALLEY GRID ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Impact on known Stone Age resources	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	** Review PV layout to avoid the site **Implementation 30-meter buffer	1	1	3	2	1	2	16	-	Low impact
Impact on chance finds	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	1	3	4	4	4	52	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	3	4	3	2	24	-	Medium impact

PAARDE VALLEY GRID ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Impact on palaeontological resources	Impact on palaeontological resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	**Implement chance finds procedures **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	2	4	4	2	24	-	Medium impact
Operational Phase																				
Impact on heritage resources	Impact on heritage resources during general maintenance	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Decommissioning Phase																				
Impact on heritage resources	Impact on heritage resources during rehabilitation work associated with decommissioning - grading trench filling etc	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request	1	1	4	4	4	1	14	-	Low impact

PAARDE VALLEY GRID ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											destruction permits from SAHRA									
Cumulative																				
Impact on heritage resources	Additional impact of the development on heritage resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Impact on palaeontological resources	Additional impact of the development on palaeontological resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact

Table 10: Impact table for the Wonderheuvel PV options

WONDERHEUVEL PV FACILITY																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Impact on known Stone Age resources	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	** Review PV layout to avoid the site **Implementation 30-meter buffer	1	1	3	2	1	2	16	-	Low impact
Impact on chance finds	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	1	3	4	4	4	52	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	3	4	3	2	24	-	Medium impact
Impact on palaeontological resources	Impact on palaeontological resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	**Implement chance finds procedures **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	2	4	4	2	24	-	Medium impact

WONDERHEUVEL PV FACILITY																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operational Phase																				
Impact on heritage resources	Impact on heritage resources during general maintenance	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Decommissioning Phase																				
Impact on heritage resources	Impact on heritage resources during rehabilitation work associated with decommissioning - grading trench filling etc	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Cumulative																				

WONDERHEUVEL PV FACILITY																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Impact on heritage resources	Additional impact of the development on heritage resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Impact on palaeontological resources	Additional impact of the development on palaeontological resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact

Table 11: Impact table for the Wonderheuvel grid options

WONDERHEUVEL GRID ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Impact on known Stone Age resources	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	** Review PV layout to avoid the site **Implementation 30-meter buffer	1	1	3	2	1	2	16	-	Low impact
Impact on chance finds	Impact on stone age resources during earth moving - including trenching, road making, foundation digging	1	1	3	4	4	4	52	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	3	4	3	2	24	-	Medium impact
Impact on palaeontological resources	Impact on palaeontological resources during earth moving - including trenching, road making, foundation digging	1	2	3	4	4	2	28	-	Medium impact	**Implement chance finds procedures **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	2	4	4	2	24	-	Medium impact

WONDERHEUVEL GRID ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Operational Phase																				
Impact on heritage resources	Impact on heritage resources during general maintenance	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Decommissioning Phase																				
Impact on heritage resources	Impact on heritage resources during rehabilitation work associated with decommissioning - grading trench filling etc	1	1	4	4	4	4	56	-	High impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Cumulative																				

WONDERHEUVEL GRID ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Impact on heritage resources	Additional impact of the development on heritage resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Impact on palaeontological resources	Additional impact of the development on palaeontological resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact

The projected impact significance for the development on heritage resources is MEDIUM to HIGH before mitigation and management and will reduce MEDIUM to LOW.

6.1 Cumulative Impacts (CI)

This section evaluates the Umsombombvu PV Projects. The CI on heritage resources evaluated a 35-kilometer radius (**Figure 38**). It must further be noted that the evaluation is based on available heritage studies (**Table 12**) and cannot take the findings of outstanding studies on current ongoing EIA's in consideration.

The following must be considered in the analysis of the cumulative effect of development on heritage resources:

- **Fixed datum or dataset:** There is no comprehensive heritage data set for the region and thus we cannot quantify how much of a specific cultural heritage element is present in the region. The region has never been covered by a heritage resources study that can account for all heritage resources. Further to this none of the heritage studies conducted can with certainty state that all heritage resources within the study area has been identified and evaluated;
- **Defined thresholds**: The value judgement on the significance of a heritage site will vary from individual to individual and between interest groups. Thus, implicating that heritage resources' significance can and does change over time. And so, will the tipping threshold for impacts on a certain type of heritage resource;
- **Threshold crossing**: In the absence of a comprehensive dataset or heritage inventory of the entire region we will never be able to quantify or set a threshold to determine at what stage the impact from developments on heritage resources has reached or is reaching the danger level or excludes the new development on this basis. (Godwin, 2011)

Keeping the above short comings in mind, the methodology in evaluating cumulative impacts on heritage resources has been as follows.

The analysis of the competed studies as listed in **Table 12**, took in to account the findings and recommendation of each of the seventeen evaluated HIA's. The cumulative impact on the cultural landscape was discounted as the HIA's, in most cases, did not address this and the Visual Impact Assessment covers such analysis in detail.

The overall findings of the 17 studies all concur that the area is characterised by numerous Stone Age findspots and archaeological resources. Many these concentrated around outcrops in a landscape where water, food and shelter came at a premium. The sites around the outcrops where in most cases given a medium to high heritage significance on a local scale and in the majority of the cases were recommended as being no-go areas or extensive mitigation is required.

This cumulative assessment has also not addressed the possible cumulative impacts on the heritage landscape. The evaluated studies have in most cases not addressed or quantified the possible impact on the cultural landscape.

Table 12 provides an analysis of the projected cumulative impact this project will add to impact on heritage resources.

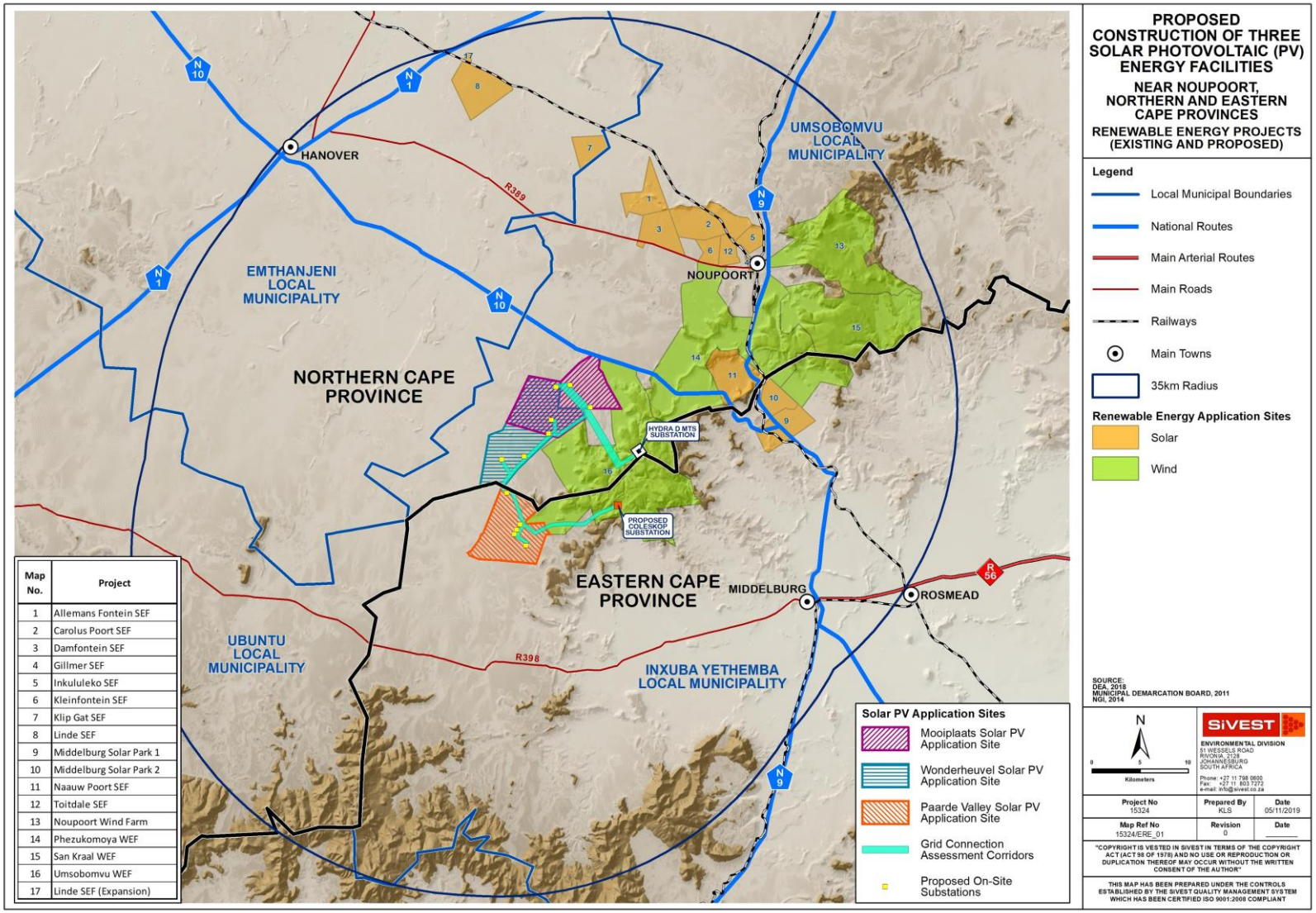

Figure 38: Other Renewable Energy developments in relation to the Umsombombvu PV Projects (SiVEST 2019)

Table 12: Heritage Impact Assessments conducted within 35km from the Umsombombvu PV Projects

Project	DEA Reference No	Findings	Recommendations
Allemans Fontein SEF	14/12/16/3/3/1/730	Surface scatters of middle stone age artefacts occurred over the extent of the area. Most were however disturbed and of low heritage value. No although the area was underlain by fossiliferous mudstone and sandstone no palaeontological significant finds were made.	General management measures such as informing SAHRA and chance finds procedure to be put in place.
Carolus Poort SEF	14/12/16/3/3/1/729	Surface scatters of middle stone age and later stone age artefacts occurred over the extent of the area. Most were however disturbed and of low heritage value Although the area was underlain by fossiliferous mudstone and sandstone no palaeontological significant finds were made.	General management measures such as informing SAHRA and chance finds procedure to be put in place.
Damfontein SEF	14/12/16/3/3/1/728	Surface scatters of middle stone age and later stone age artefacts occurred over the extent of the area. Most were however disturbed and of low heritage value.	General management measures such as informing SAHRA and chance finds procedure to be put in place.
Gillmer SEF	14/12/16/3/3/1/735	Surface scatters of middle stone age and later stone age artefacts occurred over the extent of the area. One single collapsed stone structure was discovered. Most were however disturbed and of low heritage value. Although the area was underlain by fossiliferous mudstone and sandstone no palaeontological significant finds were made.	General management measures such as informing SAHRA and chance finds procedure to be put in place.
Inkululeko SEF	14/12/16/3/3/1/553	Surface scatters of middle stone age and later stone age artefacts occurred over the extent of the area.	General management measures such as informing SAHRA and chance finds procedure to be put in place.
Kleinfontein SEF	12/12/20/2654	Surface scatters of middle stone age artefacts occurred over the extent of the area.	General management measures such as informing SAHRA and chance finds procedure to be put in place.
Klip Gat SEF	14/12/16/3/3/2/354	Surface scatters of middle stone age and later stone age artefacts occurred over the extent of the area. One single collapsed stone structure was discovered. One area of high significance was demarcated. Although the area was underlain by fossiliferous mudstone and sandstone no palaeontological significant finds were made.	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended.
Linde SEF	12/12/20/2258	One site was identified with a cultural heritage resource, a stone redoubt emanating from the Second Boer War together with a portion of low gauge railway line. The resource has been excluded from the development footprint on site H, Taaibos.	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Buffering of the site was recommended.
Linde SEF (Expansion)	14/12/16/3/3/1/1122	One site was identified with a cultural heritage resource, a stone redoubt emanating from the Second Boer War together with a portion of low gauge railway line. The resource has been excluded from the development footprint on site H, Taaibos.	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Buffering of the site was recommended.
Middelburg Solar Park 1	12/12/20/2465/2	Surface scatters of middle stone age and later stone age artefacts occurred over the extent of the area. A few stone outcrops showed higher concentrations of lithics and required buffering.	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Buffering some sites were recommended.

Project	DEA Reference No	Findings	Recommendations
Middelburg Solar Park 2	12/12/20/2465/1	Surface scatters of middle stone age and later stone age artefacts occurred over the extent of the area. A few stone outcrops showed higher concentrations of lithics and required buffering.	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Buffering some sites were recommended.
Naauw Poort SEF	14/12/16/3/3/2/355	Surface scatters of middle stone age and later stone age artefacts occurred over the extent of the area. A few dry pack stone walls were identified as having a medium heritage significance. One area of high significance was demarcated. Various fossil finds were mad in the Katberg formation during field work.	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Further ground truthing of footprint areas were recommended.
Toitdale SEF	12/12/20/2653	Surface scatters of middle stone age artefacts occurred over the extent of the area.	General management measures such as informing SAHRA and chance finds procedure to be put in place.
Noupoort Wind Farm	12/12/20/2319	A rock shelter with rock art was identified. Numerous dry stone walled enclosures were identified. A farmstead and cemetery was also identified during the fieldwork. Various fossil finds were mad in the Katberg formation during field work.	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Further ground truthing of footprint areas were recommended
Phezukomoya WEF	14/12/16/3/3/1/1028	Stone Age archaeological sites are sparse in the high suurveld areas and that not very many sites will be physically impacted. Two archaeological sites will require mitigation through avoidance or alternatively systematic collection. Only a few fossil remains were recorded during a four-day field assessment	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Buffering some sites were recommended.
San Kraal WEF	14/12/16/3/3/1/1069	The comprehensive survey of the project area, associated infrastructure and power lines has revealed that Stone Age archaeological sites are sparse in the high suurveld areas and that not very many sites will be physically impacted. Fossil finds on site are confined to mostly fragmented river-washed bone fragments. The presence of a number of fossilised vertebrate burrows in a river bed was also noted	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Buffering some sites were recommended.
Umsobomvu WEF	14/12/16/3/3/2/730	A total of 41 heritage sites were noted in the study area from in the desktop and field survey. These sites varied from open stone tool scatters, rock art sites in small overhangs, and built structures such as farm buildings and kraals. The historical buildings were the most frequently occurring heritage sites. Three of these early farmsteads have associated cemeteries. There are no fatal flaws in the Umsobomvu WEF development proposal as far as fossil heritage is concerned.	General management measures such as informing SAHRA and chance finds procedure to be put in place. A detailed survey of the demarcated area was recommended. Buffering some sites were recommended.

As the projected impact on heritage resources is seen as the same on all the alternatives, a single impact rating table is provided (**Table 13**) for all three (3) proposed Solar PV Energy Facilities and grid options. The impact assessment rating is based on the rating scale as contained in **Appendix B** and **Appendix C**.

Table 13: Cumulative impact assessment table for all three facilities and grid connections

MOOI PLAATS ALIGNMENT																				
ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Cumulative																				
Impact on heritage resources	Additional impact of the development on heritage resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact
Impact on palaeontological resources	Additional impact of the development on palaeontological resources adding to the current cumulative impact of existing or proposed developments in the region	2	2	4	4	4	2	32	-	Medium impact	** development of chance finds procedures to be included in the EMP **Implementation of mitigation measures such as buffering, documentation and excavations and request destruction permits from SAHRA	1	1	4	4	4	1	14	-	Low impact

The projected impact significance for the development on heritage resources is MEDIUM before mitigation and management and will reduce to LOW.

6.2 Comparative Assessment of Layout Alternatives

Table 14: Key for comparative assessment

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 15: PV infrastructure alternatives (laydown areas and O&M buildings)

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
WONDERHEUVEL SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 7	**NO PREFERENCE**	No heritage issue identified for this footprint

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 8	**NO PREFERENCE**	No heritage issue identified for this footprint
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 7	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 8	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 9	**NO PREFERENCE**	No heritage issue identified for this footprint

Table 16: Grid connection infrastructure alternatives (power line corridors and associated substations)

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Grid Connection Option 1a	**NO PREFERENCE**	No heritage issue identified for this footprint
Grid Connection Option 1b	**NO PREFERENCE**	No heritage issue identified for this footprint
Grid Connection Option 2a	**NO PREFERENCE**	No heritage issue identified for this footprint
Grid Connection Option 2a	**NO PREFERENCE**	No heritage issue identified for this footprint
WONDERHEUVEL SOLAR PV FACILITY:		
Grid Connection Option 1a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 3	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option

7 CONCLUSIONS AND RECOMMENDATIONS

PGS was appointed by SiVEST to undertake a HIA that forms part of the respective EIAs and EMPr for the Umsombomvu Solar Energy Facilities close to Noupoort and Middelburg in the Northern and Eastern Cape Provinces.

The HIA consisted of a scoping phase during which background information and landscape analysis was done to determine the heritage resources that can potentially occur within the study area. This was followed up with fieldwork by a team of archaeologist and a palaeontologist with the aim of identifying heritage resources in the development footprint areas and t make recommendation on the management of these resources and the possible chance finds during construction activities.

The field work identified a total of 10 areas of heritage significance. Adjustments to the project layouts based on the various specialist input resulted in the total avoidance of 3 heritage areas that was excluded from the reporting. The remaining seven site consist of three large, low to medium density scatters of later stone age sites (**UMS005,008 and 009**). These three sites were avoided by slight adjustments in the PV array layouts in the Paarde Valley as well as Wonderheuvel PV facilities. **UMS004, 006 and 007** are all round stone packed enclosure. **UMS007** situated in the Mooi Plaats facility was excluded from direct impact by design changes. UMS004 and 006 will need to be avoided during construction of the power grid through the implementation of a 30-meter buffer.

UMS010 was identified as a fossil find spot and a 50-meter buffer around the fossil bearing material must be implemented. Any construction in the demarcated area must be monitored by a palaeontologist.

The impact rating on the heritage resources indicated that per-mitigation a negative high impact is projected but with the implementation of the recommended management measures this impact rating will be reduced to low negative.

A comparative assessment of the alternative provided for the PV and grid options is summarised in **Table 18** and **Table 19** below. The palaeontological sensitive area at UMS010 is the only heritage resources that influence the Options assessment, but those options affected is still favourable with the implementation of the recommended management measures.

Table 17: Key for comparative assessment

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
LEAST PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 18: PV infrastructure alternatives (laydown areas and O&M buildings)

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	**Preference**	**Reasons (incl. potential issues)**
MOOI PLAATS SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
WONDERHEUVEL SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 7	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 8	**NO PREFERENCE**	No heritage issue identified for this footprint
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 2	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 3	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 4	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 5	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 6	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 7	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 8	**NO PREFERENCE**	No heritage issue identified for this footprint
Laydown Area and O&M Building Site Option 9	**NO PREFERENCE**	No heritage issue identified for this footprint

Table 19: Grid connection infrastructure alternatives (power line corridors and associated substations)

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
MOOI PLAATS SOLAR PV FACILITY:		
Grid Connection Option 1a	**NO PREFERENCE**	No heritage issue identified for this footprint
Grid Connection Option 1b	**NO PREFERENCE**	No heritage issue identified for this footprint

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
Grid Connection Option 2a	**NO PREFERENCE**	No heritage issue identified for this footprint
Grid Connection Option 2a	**NO PREFERENCE**	No heritage issue identified for this footprint
WONDERHEUVEL SOLAR PV FACILITY:		
Grid Connection Option 1a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
		substation 3a, but still a favourable option
Grid Connection Option 3	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 1d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2a	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option

GRID CONNECTION INFRASTRUCTURE ALTERNATIVES (POWER LINE CORRIDORS AND ASSOCIATED SUBSTATIONS)	Preference	Reasons (incl. potential issues)
Grid Connection Option 2b	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2c	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option
Grid Connection Option 2d	**FAVOURABLE**	A paleontological sensitive area that will require monitoring during construction is situated on the northern corridor towards substation 3a, but still a favourable option

It is my considered opinion, based on the current data available, that with the consideration of the position of heritage sensitivities during the layout design and the implementation of the proposed management measures, the project will have an acceptable low impact on heritage resources and can continue.

8 REFERENCES

Beaumont, P. B. & Morris, D. 1990. Guide to archaeological sites in the Northern Cape. Kimberly: McGregor Museum.

Beaumont, P.B. & Vogel, J.C. 1984. Spatial patterning of the Ceramic Later Stone Age in the Northern Cape Province, South Africa. In: Hall, M.; Avery, G.; Avery, D. M.; Wilson, M. L. & Humphreys, A. J. B. Frontiers: southern African archaeology today. Oxford: BAR International Series 207.

Beaumont, P. B., Smith, A.B., & Vogel, J.C. 1995. Before the Einiqua: the archaeology of the frontier zone. In A. B. Smith (ed.). Einiqualand: studies of the Orange River frontier, Cape Town: UCT Press.

Binneman, J., Booth, C. & Higgitt, N. 2010. A phase 1 Archaeological Impact Assessment (AIA) for the proposed Skietkuil quarries 1 and 2 on the farm Skietkuil no. 3, Victoria West, central Karoo District, Western Cape Province for Acer (Africa) Environmental Management Consultants by The Albany Museum. Unpublished Report

Booth, C .2011. A phase 1 archaeological impact assessment (AIA) for the proposed Kleinfontein solar energy facility on the farm Kleinfontein, portion 4 of 167, situated near Noupoort, Northern Cape Province. For Savanna Environmental (Pty) Ltd by the Albany Museum. Unpublished Report

Booth, C. 2011 (b) A phase 1 Archaeological Impact Assessment (AIA) for the proposed solar facility on the farm Toitdale, portion 1 of 167, situated near Noupoort, Northern Cape Province for Savanna Environmental (Pty) Ltd by the Albany Museum. Unpublished Report

Close, A. E. & Sampson, C. G. 1999. Tanged Arrowheads form Later Stone Age Sites in the Seacow River Valley. The South African Archaeological Bulletin, 54: 81-89.

Butler, E. 2019. Palaeontological Impact Assessment for the proposed Umsobomvu Solar PV Energy Facilities near Noupoort, Northern and Eastern Cape Provinces

Deacon, H.J. & Deacon, J. 1999. Human beginnings in South Africa. Cape Town: David Phillips Publishers.

Dooling, W. 2007. Slavery, Emancipation And Colonial Rule In South Africa. University of KwaZulu-Natal Press

Fock, G.J. & Fock, D.M.L. 1989. Felsbilder in Südafrika: Vaal-Oranje Becken. Köln: Böhlau Verlag.

Fourie, W. 2010. Phase 2 Heritage Impact Assessment for the Gamma-Kappa 765kV Transmission line. Various heritage resources were identified including rock engravings 5km south of the Kappa substation.

Fourie, W. 2016. Basic Assessment for the proposed construction of supporting electrical infrastructure for the Victoria West wind farm, Victoria West, Northern Cape Province ≈Kim form the study area. A MSA scatter was located as well as a colonial structure/farmstead

Goodwin, A. J. H. 1926. The Victoria West Industry. In: Goodwin, A. J. H. & Lowe, V. R. (Eds). The South African Cultures of South Africa. Annals of the South African Museum. Cape Town, pp 53-69.

Goodwin, A. J. H. 1946. Earlier, Middle and Later. The South African Archaeological Bulletin, 3: 74-76.

Halkett, D., & Webley, L. 2011. Heritage Impact Assessment: proposed Victoria West mini renewable energy facility on the farm Bultfontein 217, Northern Cape Province. For Mainstream Renewable Power South Africa by ACO Associates. Unpublished Report

Hart, T 1989 Haaskraal and Volstruisfontein, Later Stone Age events at two rock shelters in the Zeekoe Valley, Great Karoo, South Africa. MA thesis, University of Cape Town.

Hart, T. 2005. Heritage Impact Assessment of a proposed Sutherland Golf Estate, Sutherland, Northern Cape Province. Unpublished Report

Hart, T. (2015) Heritage Impact Assessment for the proposed Umsinde Emoyeni wind energy facility, For Arcus Consulting PTY Ltd by ACO Associates cc. Unpublished Report

Humphreys, A.J.B. 1991. On the distribution and dating of bifacial and tanged arrowheads in the interior of South Africa. The South African Archaeological Bulletin, 46: 41-43.

Inskeep, R.R. 1978. The peopling of southern Africa. Cape Town: David Phillip

Lycett, S. J. 2009. Are Victoria West cores ‘‘proto-Levallois’’? A phylogenetic assessment. Journal of Human Evolution 56: 175-199.

Kaplan, J. 2011. Recommended exemption from having to conduct an archaeological study: the proposed Wildebeest Karoo Photo-voltaic Solar Power Plant on Portion 6 of the farm Kraanvogelvlei No 174, Victoria West, Northern Cape. Unpublished report.

Mitchell, P. 2002. The archaeology of southern Africa. Cambridge University Press.

Morris, D. 2012. Wildebeest Vlakte Karoo PV solar energy project. Specialist input for the Environmental Impact Assessment for the proposed Wildebeest Vakte Karoo PV solar energy project, Richmond registration division, Northern Cape Province. For Green Sky Solar (pty) Ltd by the McGregor Museum. Unpublished Report

Murimbika, M. C. E. 2014. Proposed Gamma-Kappa 2nd 765kv Eskom Transmission Powerline and Substations Upgrade Development in Western Cape, Phase 1 heritage impact assessment study for Nzumbululo Heritage Solutions. Unpublished Report

Neville, D., Sampson, B. E. & Sampson, C. G. 1994. The Frontier Wagon Track System in the Seacow River Valley, North-Eastern Cape. South African Archaeological Bulletin. 49: 65-72.

Moodie, D. 1960. The Record, or a series of official papers relative to the condition and treatment of the native tribes of South Africa. Part III (1769-1795) & Part V (1808-1819). Cape Town and Amsterdam: A. A. Balkema.

Noble, J. 1875. Descriptive Handbook of the Cape Colony: Its Condition and Resources: With Map and Illustrations. Juta

Penn, N. 2005. The Forgotten Frontier: Colonist and Khoisan on the Cape’s Northern Frontier in the 18th century. Ohio University Press: Athens.

Prins, F. 2011. Shell International Exploration and Production B.V. Technical report in support of the EMP for the South Western Karoo Basin Gas Exploration Application Project. Cultural Heritage Central Precinct. For Golder Associates Africa by Active Heritage cc. Unpublished Report

Sadr, K & Sampson, G. 1999. Khoekhoe ceramics of the upper Seacow Valley. South Africa Archaeological Bulletin, 54:3-15.

Saitowitz, S. J. & Sampson, C. G. 1992. Glass trade beads from rock shelters in the Upper Karoo. South African Archaeological Bulletin. 47: 94-103.

Sampson, C. G. 1985. Atlas of Stone Age settlement in the central and upper Seacow River valley. Memoirs van die Nasionale Museum Bloemfontein. No 20. 1-116.

Sampson, C. G., Hart, T. J. G., Wallsmith, D. L. & Blagg, J. D. 1989. The ceramic sequence in the upper Seacow Valley: problems and implications. South African Archaeological Bulletin 44: 3-16.
Sampson, C.G. 1993. Bushman (Oesjswana) survival and acculturation on the colonial frontier of South Africa, 1770-1890. Historical Archaeology: in press.
Sampson, C. G. 2010. Chronology and dynamics of Later Stone Age herders in the upper Seacow River valley, South Africa. Department of Anthropology, Texas State University, San
Sampson, C., G (Unpublished) http://nieu-bethesda.com/wp-content/uploads/2009/04/prehistoricherders.pdf (Accessed 19 May 2016)
Sampson, C.G. & Vogel, J.C. 1995. Radiocarbon chronology of Later Stone Age pottery decorations in the upper Seacow valley. Southern African Field Archaeology 4:84-94.
Thompson, L. & Lamar, H. 1981. Comparative frontier history. In: Lamar, H & Thompson, L. (eds.) The frontier in history: North America and southern Africa compared: 3-13. New Haven: Yale University Press.
Van der Merwe, P. J. 1937. Die noordwaartse beweging van die boere voor die trek (1700-1842), Pretoria. Nasionale Press.
Van Riet-Lowe, C. 1941. Prehistoric Art in South Africa. Bureau of Archaeology: Archaeological Series no. v. Government Printers: Pretoria.
Van Schalkwyk, L & Wahl, E. 2007. Heritage Impact Assessment of the Gamma Grassridge Powerlines and substation, Eastern, Western, and Northern Cape Provinces South Africa. For ACER (Africa) by e Thembeni Cultural Heritage. Unpublished Report.
Westbury, W. & Sampson, C. G. 1993. To strike the necessary fire: Acquisition of guns by the Seacow Valley Bushman. The South African Archaeological Bulletin 48: 26-31.

Heritage Impact assessments for the following projects:

Project	**DEA Reference No**
Allemans Fontein SEF	14/12/16/3/3/1/730
Carolus Poort SEF	14/12/16/3/3/1/729
Damfontein SEF	14/12/16/3/3/1/728
Gillmer SEF	14/12/16/3/3/1/735
Inkululeko SEF	14/12/16/3/3/1/553
Kleinfontein SEF	12/12/20/2654
Klip Gat SEF	14/12/16/3/3/2/354
Linde SEF	12/12/20/2258
Linde SEF (Expansion)	14/12/16/3/3/1/1122
Middelburg Solar Park 1	12/12/20/2465/2
Middelburg Solar Park 2	12/12/20/2465/1
Naauw Poort SEF	14/12/16/3/3/2/355
Toitdale SEF	12/12/20/2653
Noupoort Wind Farm	12/12/20/2319
Phezukomoya WEF	14/12/16/3/3/1/1028

Project	DEA Reference No
San Kraal WEF	14/12/16/3/3/1/1069
Umsobomvu WEF	14/12/16/3/3/2/730

Appendix A

LEGISLATIVE PRINCIPLES

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 B

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 Umsombombvu PV 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 and by vehicle 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 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 Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)		High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)		Medium Significance	Recording before destruction
Generally Protected C (GP.A)		Low Significance	Destruction

Appendix C

Impact Assessment Methodology to be utilised during EIA phase

1 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

The Environmental Impact Assessment (EIA) Methodology assists in evaluating the overall effect of a proposed activity on the environment. Determining of the significance of an environmental impact on an environmental parameter is determined through a systematic analysis.

1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global), whereas intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 1.

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.

1.2 Impact Rating System

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

- Planning;
- Construction;
- Operation; and
- 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.

The significance of Cumulative Impacts should also be rated (As per the Excel Spreadsheet Template).

1.2.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 20: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / 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 (e.g. oil spill in surface water).		
EXTENT (E)		
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 (P)		
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 (R)		
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 (L)		
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 (D)		
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).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
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 (S)

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:

Significance = (Extent + probability + reversibility + irreplaceability + duration) 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
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	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".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

The table below is to be represented in the Impact Assessment section of the report. The excel spreadsheet template can be used to complete the Impact Assessment.

Table 21: Rating of impacts template and example

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S
Construction Phase																				
Vegetation and protected plant species	Vegetation clearing for access roads, turbines and their service areas and other infrastructure will impact on vegetation and protected plant species.	2	4	2	2	3	3	39	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	4	2	1	3	2	24	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S
Operational Phase																				
Fauna	Fauna will be negatively affected by the operation of the wind farm due to the human disturbance, the presence of vehicles on the site and possibly by noise generated	2	3	2	1	4	3	36	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will**	2	2	2	1	4	2	22	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S
	by the wind turbines as well.										**be detailed in the EMPr.**									
Decommissioning Phase																				
Fauna	Fauna will be negatively affected by the decommissioning of the wind farm due to the human disturbance, the presence and operation of vehicles and	2	3	2	1	2	3	30	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These**	2	2	2	1	2	2	18	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S
	heavy machinery on the site and the noise generated.										**measures will be detailed in the EMPr.**									
Cumulative																				
Broad-scale ecological processes	Transformation and presence of the facility will contribute to cumulative habitat loss and impacts on broad-scale ecological processes such as fragmentation.	2	4	2	2	3	2	26	-	Medium	**Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. These measures will be detailed in the EMPr.**	2	3	2	1	3	2	22	-	Low

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR	S

Appendix D

Project team CV's

WOUTER FOURIE

Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage

Summary of Experience

Specialised expertise in Archaeological Mitigation and excavations, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including *inter alia* -

Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave "rescue" excavations in the various provinces of South Africa

Involvement with various Heritage Impact Assessments, within South Africa, including -

- Archaeological Walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
- Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring
- Involvement with various Heritage Impact Assessments, outside South Africa, including -
- Archaeological Studies in Democratic Republic of Congo
- Heritage Impact Assessments in Mozambique, Botswana and DRC
- Grave Relocation project in DRC

Key Qualifications

BA [Hons] (Cum laude) - Archaeology and Geography - 1997

BA - Archaeology, Geography and Anthropology - 1996

Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member

Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)

CRM Accreditation (ASAPA) -

Principal Investigator - Grave Relocations

Field Director – Iron Age

Field Supervisor – Colonial Period and Stone Age

Accredited with Amafa KZN

Key Work Experience

2003- current - Director – PGS Heritage (Pty) Ltd

2007 – 2008 - Project Manager – Matakoma-ARM, Heritage Contracts Unit, University of the Witwatersrand

2005-2007 - Director – Matakoma Heritage Consultants (Pty) Ltd

2000-2004 - CEO– Matakoma Consultants

1998-2000 - Environmental Coordinator – Randfontein Estates Limited. Randfontein, Gauteng

1997-1998 - Environmental Officer – Department of Minerals and Energy. Johannesburg, Gauteng

Worked on various heritage projects in the SADC region including, Botswana, Malawi, Mozambique. Mauritius and the Democratic Republic of the Congo

CURRICULUM VITAE: ELIZE BUTLER

PROFESSION: Palaeontologist

YEARS' EXPERIENCE: 25 years in Palaeontology

EDUCATION: B.Sc Botany and Zoology, 1988
University of the Orange Free State

B.Sc (Hons) Zoology, 1991
University of the Orange Free State

Management Course, 1991
University of the Orange Free State

M. Sc. *Cum laude* (Zoology), 2009
University of the Free State

Dissertation title: The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

Registered as a PhD fellow at the Zoology Department of the UFS 2013 to current

Dissertation title: A new gorgonopsian from the uppermost D*aptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part time Laboratory assistant Department of Zoology & Entomology University of the Free State Zoology 1989-1992

Part time laboratory assistant Department of Virology

	University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–currently

TECHNICAL REPORTS

Butler, E. 2018. Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed development of the new Mutsho coal-fired power plant and associated infrastructure near Makhado, Limpopo Province.

Butler, E. 2018. Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province.

Butler, E. 2018. Palaeontological Impact Assessment of the authorisation and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. 2018.

Butler, E. 2018. Palaeontological Impact Assessment for the Proposed Landfill Site in Luckhoff, Letsemeng Local Municipality, Xhariep District, Free State.

Butler, E. 2018. Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province.

Butler, E. 2018. Palaeontological field Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London.

Butler, E. 2018. Palaeontological field assessment of the proposed development of the Wildealskloof mixed use development near Bloemfontein, Free State Province.

Butler, E. 2018. Palaeontological Field Assessment of the proposed Megamor Extension, East London.

Butler, E. 2018. Palaeontological Field Assessment for the proposed re-alignment and de-commisioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province.

Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London.

Butler, E. 2018. Palaeontological desktop assessment of the proposed Mookodi – Mahikeng 400kV line, North West Province.

Butler, E. 2018. Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328.

Butler, E. 2018. Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province.

Butler, E. 2018. Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province.

Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Thornhill Housing Project, Ndlambe Municipality, Port Alfred, Eastern Cape Province

Butler, E. 2018 Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province.

Butler, E. 2017. Palaeontological Scoping Report for the Proposed Construction of a Warehouse and Associated Infrastructure at Perseverance in Port Elizabeth, Eastern Cape Province.

Butler, E. 2017. Palaeontological Impact Assessment Of The Proposed Development Of The New Open Cast Mining Operations On The Remaining Portions Of 6, 7, 8 And 10 Of The Farm Kwaggafontein 8 In The Carolina Magisterial District, Mpumalanga Province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed development of the new open cast mining operations on the remaining portions of 6, 7, 8 and 10 of the farm Kwaggafontein 8 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed mining of the farm Zandvoort 10 in the Albert Luthuli Local Municipality, Gert Sibande District Municipality, Mpumalanga Province.

Butler, E. 2017. Palaeontological impact assessment of the proposed development of the sport precinct and associated infrastructure at Merrifield Preparatory school and college, Amathole Municipality, East London. PGS Heritage.

Butler, E. 2017. Palaeontological impact assessment of the proposed construction of the Lehae training and fire station, Lenasia, Gauteng Province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of a 132KV powerline from the Tweespruit distribution substation (in the Mantsopa local municipality) to the Driedorp rural substation (within the Naledi local municipality), Free State province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of Tina Falls Hydropower and associated power lines near Cumbu, Mthlontlo Local Municipality, Eastern Cape.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed Belvoir aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of the Melkspruit-Rouxville 132KV Power line.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed consolidation of the proposed Ilima Colliery in the Albert Luthuli local municipality, Gert Sibande District Municipality, Mpumalanga Province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed development of the H2 Energy Power Station and associated infrastructure on Portions 21; 22 And 23 of the farm Hartebeestspruit in the Thembisile Hani Local Municipality, Nkangala District near Kwamhlanga, Mpumalanga Province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the Sandriver Canal and Klippan Pump station in Welkom, Free State Province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the 132kv and 11kv power line into a dual circuit above ground power line feeding into the Urania substation in Welkom, Free State Province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed diamonds alluvial & diamonds general prospecting right application near Christiana on the remaining extent of portion 1 of the farm Kaffraria 314, registration division HO, North West Province.

Butler, E. 2017. Palaeontological impact assessment for the proposed development of a new cemetery, near Kathu, Gamogara local municipality and John Taolo Gaetsewe district municipality, Northern Cape.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of open pit mining at Pit 36W (New Pit) and 62E (Dishaba) Amandelbult Mine Complex, Thabazimbi, Limpopo Province.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed rehabilitation of 5 ownerless asbestos mines.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the new coal-fired power plant and associated infrastructure near Makhado, Limpopo Province.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed construction of the Mangaung Gariep Water Augmentation Project.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed extension of the Kareerand Tailings Storage Facility, associated borrow pits as well as a storm water drainage channel in the Vaal River near Stilfontein, North West Province.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed construction of a filling station and associated facilities on the Erf 6279, district municipality of John Taolo Gaetsewe District, Ga-Segonyana Local Municipality Northern Cape.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed of the Lephalale Coal and Power Project, Lephalale, Limpopo Province, Republic of South Africa.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Overvaal Trust PV Facility, Buffelspoort, North West Province.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed Lanseria outfall sewer pipeline in Johannesburg, Gauteng Province.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Hartebeesfontein, near Panbult, Mpumalanga.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Rustplaas near Piet Retief, Mpumalanga.

Butler, E. 2017. Palaeontological assessment of the proposed development of a 3000 MW Combined Cycle Gas Turbine (CCGT) in Richards Bay, Kwazulu-Natal.

Butler, E. 2017. PIA site visit and report of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed construction of a Photovoltaic Solar Power station near Collett substation, Middelberg, Eastern Cape.

Butler, E. 2017. Palaeontological Impact Assessment of the proposed Belvior aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape.

Butler, E. 2017. Palaeontological Impact Assessment for the proposed township establishment of 2000 residential sites with supporting amenities on a portion of farm 826 in Botshabelo West, Mangaung Metro, Free State Province.

Butler, E. 2017. Palaeontological Impact Assessment for the Development of the Proposed Ventersburg Project-An Underground Mining Operation near Ventersburg and Henneman, Free State Province.

Butler, E. 2017. Palaeontological Impact Assessment for the Development of the Proposed Revalidation of the lapsed General Plans for Elliotdale, Mbhashe Local Municipality.

Butler, E. 2017. Palaeontological desktop assessment of the proposed development of a 3000 MW combined cycle gas turbine (CCGT) in Richards Bay, Kwazulu-Natal.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the new open cast mining operations of the Impunzi mine in the Mpumalanga Province.

Butler, E. 2017. Palaeontological Desktop Assessment of the proposed development of the Lephalale coal and power project, Lephalale, Limpopo Province, Republic of South Africa.

Butler, E. 2017. Palaeontological Desktop Assessment of the construction of the proposed Viljoenskroon Munic 132 KV line, Vierfontein substation and related projects.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Development of a Wastewater Treatment Works at Lanseria, Gauteng Province.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Establishment of a Diesel Farm and a Haul Road for the Tshipi Borwa mine Near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province.

Butler, E. 2017. Palaeontological Desktop Assessment for the Proposed Changes to Operations at the UMK Mine near Hotazel, In the John Taolo Gaetsewe District Municipality in the Northern Cape Province.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed prospecting right project without bulk sampling, in the Koa Valley, Northern Cape Province.

Butler, E. 2017. Palaeontological Desktop Assessment for the proposed Aroams prospecting right project, without bulk sampling, near Aggeneys, Northern Cape Province.

Butler, E. 2017 Palaeontological Desktop Assessment of the proposed development of a railway siding on a portion of portion 41 of the farm Rustfontein 109 is, Govan Mbeki local municipality, Gert Sibande district municipality, Mpumalanga Province.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed development of four Leeuwberg Wind farms and basic assessments for the associated grid connection near Loeriesfontein, Northern Cape Province.

Butler, E. 2016.: Palaeontological desktop assessment of the establishment of the proposed residential and mixed use development on the remainder of portion 7 and portion 898 of the farm Knopjeslaagte 385 Ir, located near Centurion within the Tshwane Metropolitan Municipality of Gauteng Province.

Butler, E. 2016. Proposed 132kV overhead power line and switchyard station for the authorised Solis Power 1 CSP project near Upington, Northern Cape. Savannah SA

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoort, Northern Cape. Prepared for Savannah Environmental.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 1 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoort concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoort, Northern Cape. Savannah South Africa.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed upgrading of the main road MR450 (R335) from the Motherwell to Addo within the Nelson Mandela Bay Municipality and Sunday's river valley Local Municipality, Eastern Cape Province. Terratest.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed development of two burrow pits (DR02625 and DR02614) in the Enoch Mgijima Municipality, Chris Hani District, Eastern Cape..

Butler, E. 2016. Palaeontological impact assessment of the proposed Motuoane Ladysmith Exploration right application, Kwazulu Natal.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed construction of up to a 132kv power line and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State and Northern Cape Provinces. PGS Heritage.

Butler, E. 2016. Palaeontological Impact Assessment for the proposed construction of two 5 Mw Solar Photovoltaic Power Plants on Farm Wildebeestkuil 59 and Farm Leeuwbosch 44, Leeudoringstad, North West Province.

Butler, E. 2016. Palaeontological impact assessment for the proposed Aggeneys south prospecting right project, Northern Cape Province.

Butler, E. 2016. Palaeontological impact assessment for the proposed construction of two 5 MW solar photovoltaic power plants on farm Wildebeestkuil 59 and farm Leeuwbosch 44, Leeudoringstad, North West Province.

Butler, E. 2016. Palaeontological Impact Assessment construction of the proposed Metals Industrial Cluster and associated infrastructure near Kuruman, Northern Cape province. Savannah South Africa.

Butler, E. 2016. Ezibeleni waste Buy-Back Centre (near Queenstown), Enoch Mgijima Local Municipality, Eastern Cape.

Butler, E. 2016. Chris Hani District Municipality Cluster 9 water backlog project phases 3a and 3b: Palaeontology inspection at Tsomo WTW.

Butler, E. 2016. Recommended Exemption from further Palaeontological studies: Proposed Construction of the Gunstfontein Switching Station, 132kv Overhead Power Line (Single Or Double Circuit) and ancillary infrastructure for the Gunstfontein Wind Farm Near Sutherland, Northern Cape Province. Savannah South Africa.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Modderfontein Filling Station On Erf 28 Portion 30, Founders Hill, City Of Johannesburg, Gauteng Province.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Modikwa Filling Station on a Portion of Portion 2 of Mooihoek 255 Kt, Greater Tubatse Local Municipality, Limpopo Province.

Butler, E. 2016. Recommendation from further Palaeontological Studies: Proposed Construction of the Heidedal filling station on Erf 16603, Heidedal Extension 24, Mangaung Local Municipality, Bloemfontein, Free State Province.

Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 2 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Savannah SA.

Butler, E. 2016. Palaeontological Impact Assessment of of the proposed Senqu Pedestrian Bridges in Ward 5 of Senqu Local Municipality, Eastern Cape Province.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Orkney solar energy farm and associated infrastructure on the remaining extent of Portions 7 and 21 of the farm Wolvehuis 114, near Orkney, North West Province..

Butler, E. 2015. Palaeontological impact assessment of the proposed consolidation, re-division and development of 250 serviced erven in Nieu-Bethesda, Camdeboo local municipality, Eastern Cape.

Butler, E. 2015. Palaeontological impact assessment of the proposed mixed land developments at Rooikraal 454, Vrede, Free State. 2015.

Butler, E. 2015. Palaeontological impact assessment of the proposed Orange Grove 3500 residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape. 2015

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Gonubie residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape Province.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed township establishment on the remainder of portion 6 and 7 of the farm Sunnyside 2620, Bloemfontein, Mangaung metropolitan municipality, Free State, Bloemfontein.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 1 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse729, near Vryburg, North West Province.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 2 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province.

Butler, E. 2015. Palaeontological Impact Assessment of the proposed Spectra foods broiler houses and abattoir on the farm Maiden Manor 170 and Ashby Manor 171, Lukhanji Municipality, Queenstown, Eastern Cape Province.

Butler, E. 2015. Palaeontological Heritage Impact Assessment report on the establishment of the 65 mw Majuba Solar Photovoltaic facility and associated infrastructure on portion 1, 2 and 6 of the farm Witkoppies 81 HS, Mpumalanga Province.

Butler, E. 2015. Palaeontological exemption report of the proposed truck stop development at Palmiet 585, Vrede, Free State. 2015.

Butler, E. 2014. Palaeontological Impact Assessment of the proposed development of private dwellings on portion 5 of farm 304 Matjesfontein Keurboomstrand, Knysna District, Western Cape Province.

Butler, E. 2014. Palaeontological Impact Assessment for the proposed upgrade of existing water supply infrastructure at Noupoort, Northern Cape Province. 2014.

Appendix E

Palaeontological Impact Assessment