PALAEONTOLOGICAL FIELD ASSESSMENT FOR THE PROPOSED UMSOBOMVU SOLAR PV ENERGY FACILITIES, NORTHERN AND EASTERN CAPE

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PGS HERITAGE
+ 27 (0) 12 332 5305 | +27 (0) 86 675 8077 | contact@pgsheritage.co.za | PO Box 32542, Totiusdal, 0134

Offices in South Africa, Kingdom of Lesotho and Mozambique

Head Office:
906 Bergarend Streets
Waverley, Pretoria,
South Africa

Directors: HS Steyn, PD Birkholtz, W Fourie

Declaration of Independence

I, Elize Butler, declare that –

General declaration:

- I act as the independent palaeontological specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favorable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected a palaeontological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realize that a false declaration is an offense in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

PALAEONTOLOGICAL CONSULTANT: Banzai Environmental (Pty) Ltd

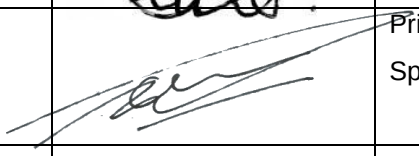
CONTACT PERSON: Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com

SIGNATURE: 

ACKNOWLEDGMENT OF RECEIPT

Report Title	**Palaeontological Field Assessment for the proposed Umsobomvu Solar PV Energy Facilities**		
Control	**Name**	**Signature**	**Designation**
Author	Elize Butler		Palaeontologist
Reviewed	Wouter Fourie		Principal Heritage Specialist
Client			

CLIENT: SiVEST

CONTACT PERSON: Stephan Jacobs, E-mail: StephanJ@sivest.co.za
Tel: +27 011 798 0600

The heritage impact assessment report has been compiled taking into account the National Environmental Management Act 1998 (NEMA) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

NEMA Regs (2014) - Appendix 6	**Relevant section in report**
1. (1) A specialist report prepared in terms of these Regulations must contain-	
a) details of-	Page ii of Report – Contact details and company and Appendix A
i. the specialist who prepared the report; and	
ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 2 – Objective
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5 – Geological and Palaeontological history
(B) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 12
d) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1 and 10
e) a description of the methodology adopted in preparing the report or carrying out the specialized process inclusive of equipment and modeling used;	Section 7 Approach and Methodology
f) details of an assessment of the specifically 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 1 and 10
g) an identification of any areas to be avoided, including buffers;	Section 1 and 10
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 – Geological and Palaeontological history

NEMA Regs (2014) - Appendix 6	Relevant section in report
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 7.1 – Assumptions and Limitation
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 or activities;	Section 1 and 10
k) any mitigation measures for inclusion in the EMPr;	Section 1 and 10
l) any conditions for inclusion in the environmental authorization;	Section 1 and 11
m) any monitoring requirements for inclusion in the EMPr or environmental authorization;	Section 1 and 11
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorized; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorized, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 11
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable.
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable.
q) any other information requested by the competent authority.	Not applicable.
2) Where a government notice *gazetted* 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.	Section 3 compliance with SAHRA guidelines

EXECUTIVE SUMMARY

Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the Palaeontological Impact Assessment to assess the proposed Umsobomvu Solar PV Energy Facilities near Noupoort, Northern and Eastern Cape Provinces. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is key to detect the presence of fossil material within the planned development footprint. This PIA is thus necessary to evaluate the potential effect of the construction on the palaeontological resources.

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. Although these localities do not currently fall in the proposed development sites, these fossiliferous sites have been identified as Highly Sensitive and No-go areas and it is recommended that a 50 m buffer will be placed around these areas. In the event that construction is necessity 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.

With the above mentioned in consideration, the proposed development, as well as all alternatives have a similar geology and therefore there is no preferences on the grounds of palaeontological fossil heritage for any specific layout among the different options under consideration. As impacts on fossil heritage usually only occur during the excavation

phase and no further impacts on fossil heritage are expected during the operation and decommissioning phases of the SEF.

The impact of development on fossil heritage are usually negative but it could also have a positive impact due to the discovery of newly uncovered fossil material that would have been unavailable for scientific research. The SEF could also provide a long-term benefit to the country by supplying renewable energy to the electricity grid.

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be protected (if possible *in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (*e.g.* recording and collection) can be carry out by a paleontologist.

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. From a Palaeontological Heritage view there are no fatal floors in the proposed SEF development project. However, it is recommended that the mitigation measures are included in the EMPr and fully implemented.

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TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

- 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 artifacts, human and hominid remains, and artificial features and structures;
- rock art is 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;
- 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;
- features, structures, and artifacts associated with a 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 influences its stability and future well-being, including:

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

Fossil

Mineralized 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 and can include (but not limited to) as stated under Section 3 of the NHRA,

- places, buildings, structures, and equipment of cultural significance;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features of cultural significance;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds, and
- sites of significance relating to the history of slavery in South Africa;

Holocene

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

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.

Table 1: Abbreviations

Abbreviations	**Description**
ASAP	Association of South African Professional Archaeologists
BRMO	Black Rock Mining operations
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DIA	Desktop Impact Assessment
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age

Abbreviations	Description
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PIA	Palaeontological Impact Assessment
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

1 INTRODUCTION

SiVEST has been appointed to undertake the EIA process for the Umsobomvu PV Energy Facilities and associated infrastructure (including Grid Connection) near Middelburg and Noupoort in the Eastern and Northern Cape Provinces. PGS Heritage was commissioned by SiVEST SA (Pty) Ltd to conduct the Heritage Impact Assessment. In turn Banzai Environmental was appointed by PGS Heritage (Pty) Ltd to conduct the Palaeontological Impact Assessment (PIA). According to the National Heritage Resources Act (NHRA) (No 25 of 1999, section 38), a PIA is key to detect the presence of fossil material within the proposed development footprint and it is thus necessary to evaluate the impact of the construction on the palaeontological resources. This Palaeontological Impact Assessment report serves to fulfil the requirement and form part of the EIA.

1.1 PROPOSED UMSOBOMVU SOLAR PV ENERGY FACILITIES

1.1.1 PROJECT DESCRIPTION

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[1].

1.2 Grid Connection

1.2.1 Mooi Plaats Solar PV Solar Grid Connection Explanation

Option 1:

- Corridor **Option 1a** links **substation 2** and **substation 1a** to Hydra D MTS; and
- Corridor **Option 1b** links **substation 2** and **substation 1b** to Hydra D MTS.

Option 2:

- Corridor **Option 2a** links **Substation 2** and **Substation 1a** to Hydra D MTS via the proposed Central Collector substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV project application site.
- Corridor **Option 2b** links **Substation 2** and **Substation 1b** to Hydra D MTS via the proposed Central Collector substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV project application site[1].

1.2.2 Wonderheuvel Solar PV Grid Connection

Option 1:

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.
  - The *northern connection* links the Proposed **Substation 3a** to Hydra D MTS via the proposed Northern Collector Substation (either substation 1a or substation 1b will act as Northern Collector, depending on which grid routing option is preferred from an environmental perspective for Mooi Plaats) located on the Mooi Plaats PV project application site.
  - The *southern connection* links the proposed **Substation 4a** to the Coleskop WEF Substation via the proposed Southern Collector Substation (either substation 6a or substation 6b will act as Southern Collector, depending on which grid routing option is preferred from an environmental perspective for Paarde Valley) 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.
  - The *northern connection* links the Proposed **Substation 3a** to Hydra D MTS via the proposed Northern Collector Substation (either substation 1a or substation 1b will act as Northern Collector, depending on which grid routing option is preferred from an environmental perspective for Mooi Plaats) located on the Mooi Plaats PV project application site.
  - The *southern connection* links the proposed **Substation 4b** to the Coleskop WEF Substation via the proposed Southern Collector Substation (either substation 6a or substation 6b will act as Southern Collector, depending on which grid routing option is preferred from an environmental perspective for Paarde Valley) 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.
    - The *northern connection* links the Proposed **Substation 3b** to Hydra D MTS via the proposed Northern Collector Substation (either substation 1a or substation 1b will act as Northern Collector, depending on which grid routing option is preferred from an environmental perspective for Mooi Plaats) located on the Mooi Plaats PV project application site.
    - The *southern connection* links the proposed **Substation 4a** to the Coleskop WEF Substation via the proposed Southern Collector Substation (either substation 6a or substation 6b will act as Southern Collector, depending on which grid routing option is preferred from an environmental perspective for Paarde Valley) 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.
    - The *northern connection* links the Proposed **Substation 3b** to Hydra D MTS via the proposed Northern Collector Substation (either substation 1a or substation 1b will act as Northern Collector, depending on which grid routing option is preferred from an environmental perspective for Mooi Plaats) located on the Mooi Plaats PV project application site.
    - The *southern connection* links the proposed **Substation 4b** to the Coleskop WEF Substation via the proposed Southern Collector Substation (either substation 6a or substation 6b will act as Southern Collector, depending on which grid routing option is preferred from an environmental perspective for Paarde Valley) located on the Paarde Valley PV Project application site.

Option 2:

- Corridor **Option 2a** links **Substation 3a** to Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector).
- Corridor **Option 2b** links **Substation 3b** to Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector).

Option 3:

- Corridor **Option 3** links **Substation 4b** to Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) [1].

1.2.3 Paarde Valley Solar PV Grid Connection

Option 1:

- Corridor **Option 1a** involves two (2) separate grid connections to serve the northern and southern sections of the application site.

- 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).
- 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.
  - 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).
  - 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.
  - 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).
  - 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.
  - 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).
  - 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.
  - The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderveuvel PV Project application site.

- The *southern connection* links **Substation 6a and 7a** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) 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.
  - The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.
  - The *southern connection* links **Substation 6b and 7b** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) 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.
  - The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.
  - The *southern connection* links **Substation 6a and 7b** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) 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.
  - The *northern connection* links **Substation 5** to Hydra D MTS via the proposed Central Collector Sub (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site.
  - The *southern connection* links **Substation 6b and 7a** to the Hydra D MTS via the proposed Central Collector Substation (substation 4a acts as Central Collector) located on the Wonderheuvel PV Project application site[1].

[1]Information provided by SiVEST

2 OBJECTIVE

The terms of reference of a Palaeontological Impact Assessment are as follows:

The objective of a Palaeontological Desktop Assessment is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to assess the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage, and 4) to **recommend** how the developer ought to protect or mitigate damage to fossil heritage.

General Requirements:

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all appropriate best practice guidelines, relevant legislation and authority requirements;
- Provide a thorough overview of all applicable legislation, guidelines;
- Cumulative impact identification and assessment as a result of other renewable energy (RE) developments in the area (including; a cumulative environmental impact table(s) and statement, review of the specialist reports undertaken for other Renewable Energy developments and an indication of how the recommendations, mitigation measures and conclusion of the studies have been considered);
- Identification sensitive areas to be avoided (including providing shapefiles/kmls);
- Assessment of the significance of the proposed development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    - Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
    - Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place as a result of the activity.
    - Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective

impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

- Comparative assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures in order to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (e.g. permits, licenses etc.).

Specific Requirements:

- Describe and map the palaeontological heritage features of the site and surrounding area. This is to be based on desk-top reviews, fieldwork, available databases, findings from other palaeontological heritage studies in the area, where relevant. Include reference to the grade of heritage feature and any heritage status the feature may have been awarded.
- Assess the impacts and provide mitigation measures to include in the environmental management plan.
- Map palaeontological heritage sensitivity for the site. Clearly show any “no-go” areas in terms of heritage (i.e. “very high” sensitivity) and provide recommended buffers or set-back distances.
- Identify and assess potential impacts from the project on palaeontology, as required by heritage legislation (including cumulative impacts from other wind farms within a radius of 50 km).
- Provide an updated sensitivity map for the Umsobomvu PV project site.
- Assess the project alternatives provided, including the no-go alternative

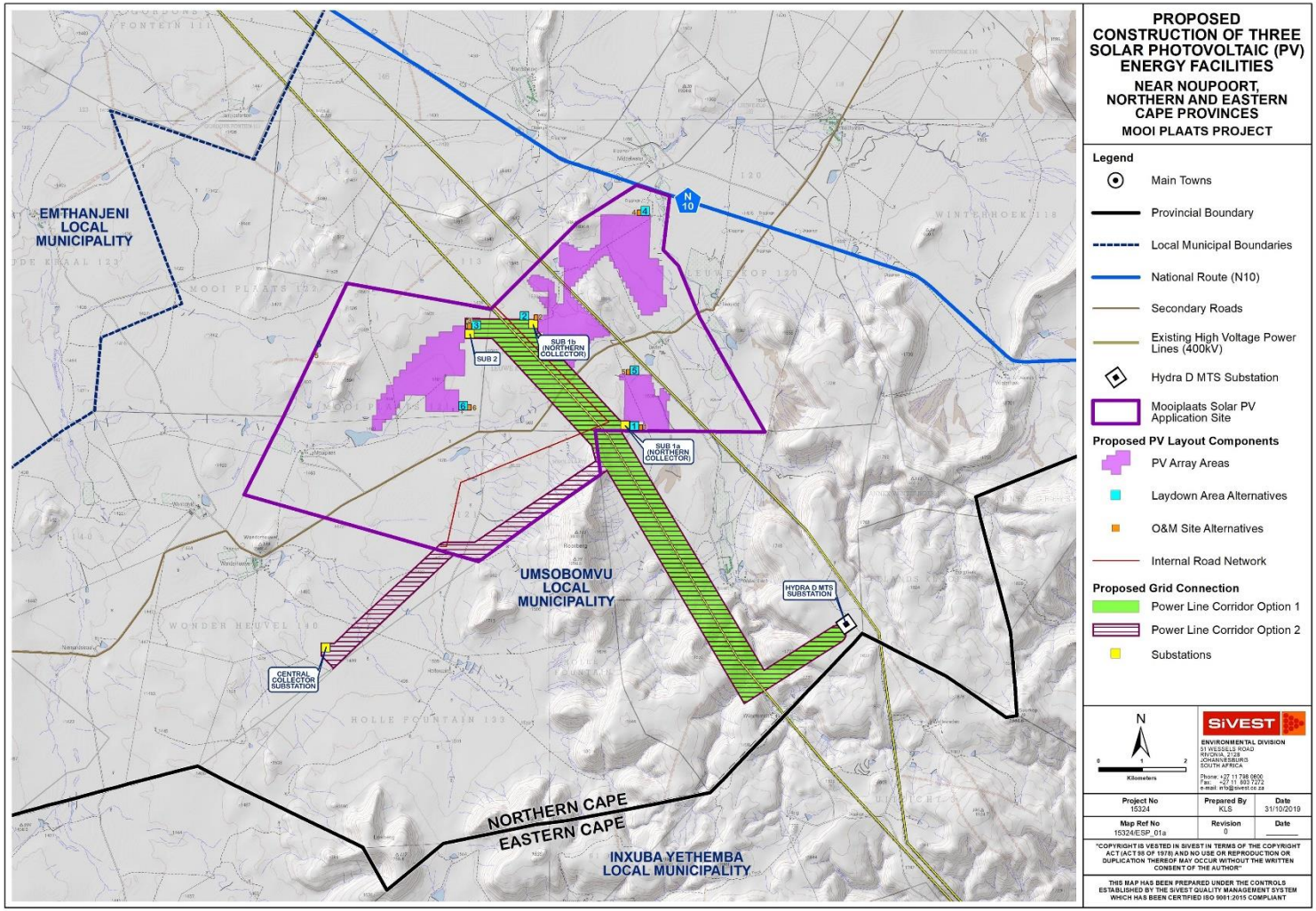


Figure 1: Site Locality of the proposed Mooi Plaats PV Energy facility near Noupoort, Northern Cape Province. Map provided by SiVEST

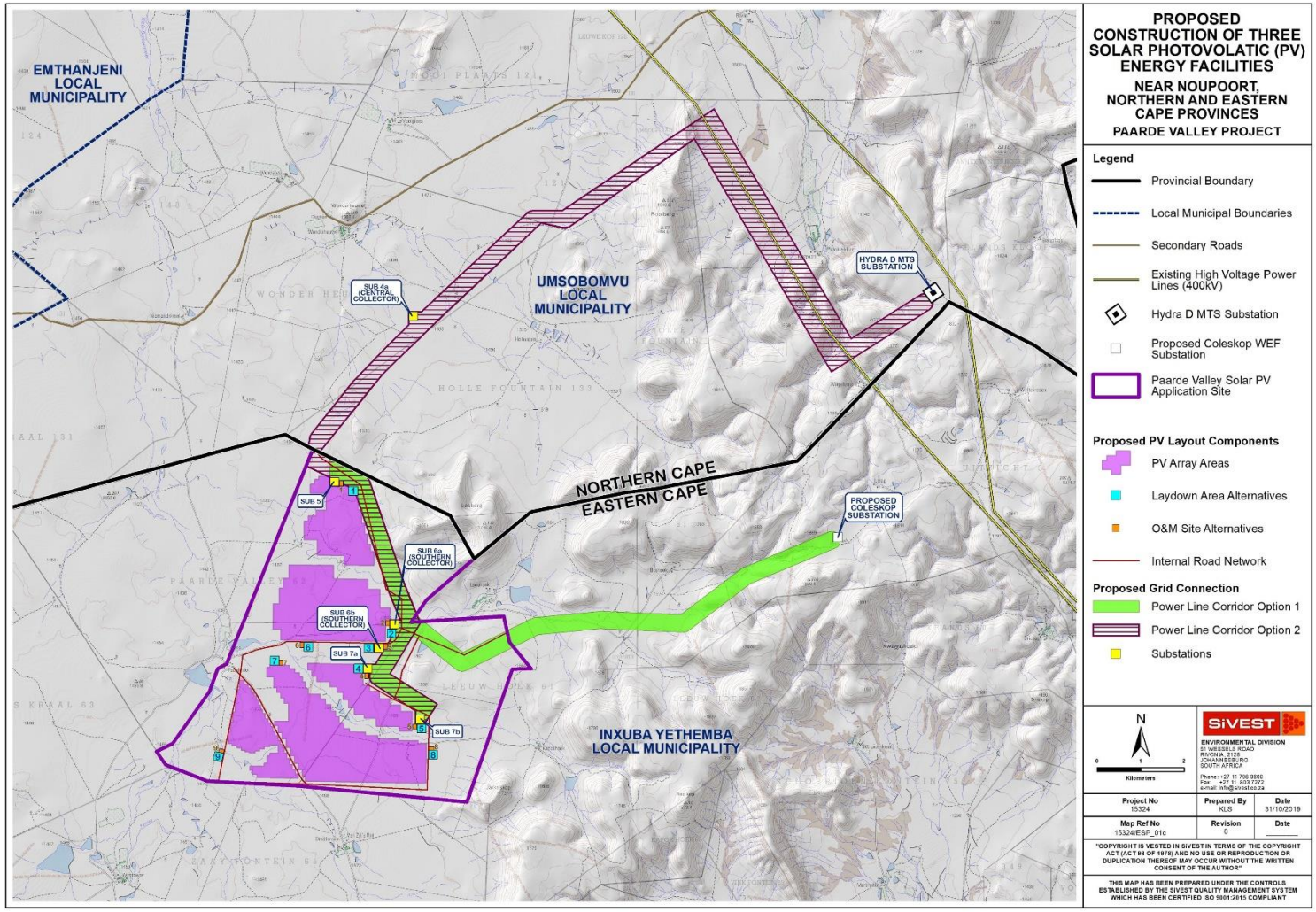


Figure 2: Site Locality of the proposed Paarde Valley PV Energy facility near Middelburg, Eastern Cape Province. Map provided by SiVEST

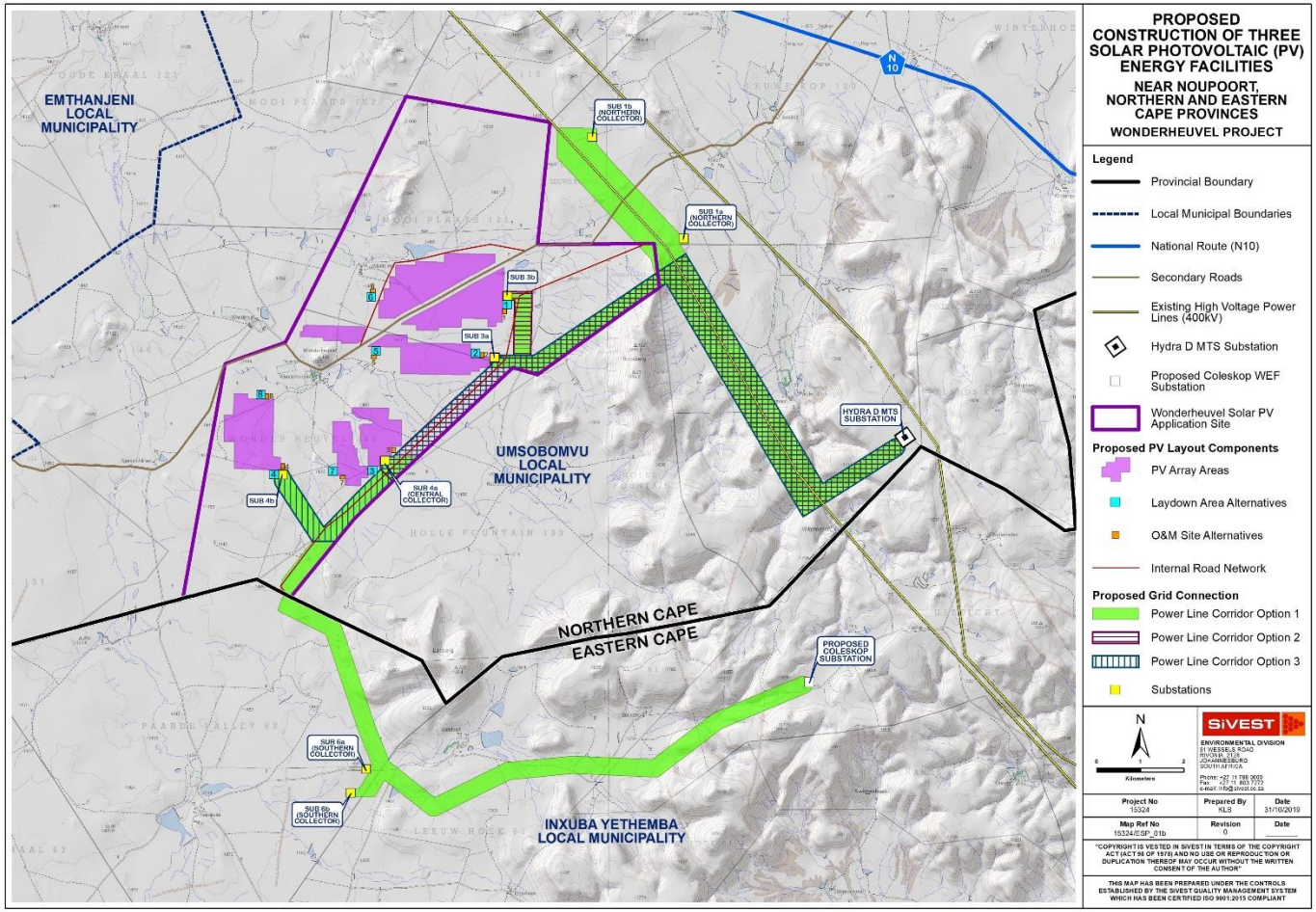


Figure 3: Site Locality of the proposed Wonderheuvel PV Energy facility near Noupoort, Northern Cape Province. Map provided by SiVEST

3 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (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.

4 LEGISLATION

4.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This DIA forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- the construction of a bridge or similar structure exceeding 50 m in length;
- any development or other activity which will change the character of a site—
- (exceeding 5 000 m^2 in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 m^2 in extent;
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY

The geology of the three Solar Photovoltaic (PV) Energy Facilities, and associated grid connection infrastructure is present on the 1:250 000 3124 Middelburg Geological Map (Counsel for Geoscience, Pretoria) (Figure 4-6). The proposed development is 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 (Figure 4-6). 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 (Mc Carthy *et al*., 2005).

5.1 Geology

The development area is underlain by a series of Karoo sandstones, mudstones and shales, deposited under fluvial environments of the Adelaide Subgroup that forms part of the Beaufort Group. The Beaufort group overlays the Ecca Group and consists essentially of sandstones and shales, deposited in the Karoo Basin from the Middle Permian to the early part of the Middle Triassic periods and was deposited on land through alluvial processes. The Beaufort Group covers a total land surface area of approximately 200 000 km^2 in South Africa and is the first fully continental sequence in the Karoo Supergroup. The Beaufort Group is divided into the Adelaide subgroup and the overlying Tarkastad subgroup (Johnson *et al*, 2006).

The Adelaide subgroup rocks were deposited under a humid climate that allowed for the establishment of wet floodplains with high water tables and are interpreted to be fluvio-lacustrine sediments. The Balfour Formation forms the upper part of the Adelaide Subgroup and part of what was called lower to middle Beaufort. The Adelaide Subgroup contains alternating greyish-red, bluish-grey, or greenish-grey mudrocks in the southern and central parts of the Karoo Basin with very fine to medium grained, grey lithofeldspathic sandstones. Thicker sandstones of the Adelaide are usually multi-storey and usually have cut-and fill features. The sandstones are characterized internally by horizontal lamination together with parting lineation and less frequent trough cross-bedding as well as current ripple lamination. The bases of the sandstone units are massive beds, while ripple lamination is usually confined to thin sandstones towards the top of the thicker units.

The mudrocks of the Adelaide Subgroup usually has massive and blocky weathering apart from in the Normandien and Daggaboersnek Member. Sometimes desiccation cracks and impressions of raindrops are present. In the mudstones of the Beaufort Group calcareous nodules and concretions occur throughout.

The arenaceous Katberg Sandstone Formation of the Tarkastad Subgroup comprise of fine to medium-grained pinkish-grey sandstone with subordinate greenish-grey mudstone. The Katberg tabular sheet sandstones are vertically superimposed and divided by erosion surfaces lined with intraformational mud-pebble conglomerates. A maximum thickness of 1000 m has been measured (Hiller and Stavrakis, 1984). At the end of the Permian the rivers changed from a meandering river system in the Balfour Formation to a large sand braided fan system in the Katberg Sandstone Formation (Johnson *et al*, 2006, Smith *et al*, 2006)

During Jurassic times the subcontinent was inundated with basaltic lava to form the capping basalts of the Jurassic aged Drakensberg Group. During the Jurassic the volcanic Drakensberg were formed and cracks in the earth's crust were filled with molten lava that cooled to form dolerite dykes. Magma injected horizontally between sediments, cooled down and formed horizontal stills of dolerite.

The Beaufort Group is subdivided into a series of biostratigraphic units on the basis of its faunal content, namely the *Daptocephalus* Assemblage Zone (Balfour Formation) and the *Lystrosaurus* Assemblage (Katberg Formation) (Figure 7) (Groenewald et al, 1995; Groenewald, 1996)).

The Tertiary to Quaternary Cenozoic superficial deposits consist of aeolian sand, alluvium (clay, silt and sand deposited by flowing floodwater in a river valley/ delta producing fertile soil), colluvium (material collecting at the foot if a steep slope), spring tufa/tuff (a porous rock composed of calcium carbonate and formed by precipitation from water, for example, around mineral springs) and lake deposits, peats, pedocretes or duricrusts (calcrete, ferricrete), soils and gravels (Partridge *et a*l, 2006).

5.2 Palaeontology

The Beaufort Group is the third of the main subdivisions of the Karoo Supergroup (Johnson et al, 2006). The flood plains of the Beaufort Group (Karoo Supergroup) are internationally renowned for the early diversification of land vertebrates and provide the worlds' most complete transition from early "reptiles" to mammals. The diverse *Daptocephalus* Assemblage Zone biotas are of extraordinary interest in that they provide some of the best available information on ecologically complex terrestrial ecosystems immediately preceding the catastrophic end-Permian mass extinction (Abdala *et al*, 2006; Mc Carthy *et al*., 2005, Gastaldo *et al.* 2005, Retallack *et al.,* 2006).

Sediments of the Beaufort Group are relatively rich in fossils, especially vertebrate fossils. The *Daptocephalus* Assemblage Zone is characterized by the occurrence of the two therapsids namely *Dicynodon* and *Theriognathus.* The *Daptocephalus* Assemblage Zone expands into the lower Palingkloof Member of the Upper Balfour Formation. This Zone is characterized by the occurrence

of the two therapsids namely *Dicynodon* and *Theriognathus*. The *Daptocephalus* Zone shows the greatest vertebrate diversity and includes numerous well preserved genera and species of dicynodonts, biarmosuchians, gorgonopsian, therocephalian and cynodont therapsid Synapsida as well as captorhinid Reptilia and less well represented eosuchian Reptilia, Amphibia and Pisces (Kitching, 1977; National Palaeontology Museum databases). Trace fossils of vertebrates and invertebrates as well as *Glossopteris* flora plants have also been described (Bamford, 2004).

The lower Palingkloof Member is of special importance as it precedes the Permo-Triassic Extinction Event which destroyed the vertebrate fauna and extinguished the diverse glossopterid plants (Bamford, 2004).

The lower *Lystrosaurus* Assemblage Zone forms part of the Katberg Formation. Fauna and flora from this assemblage zone is rare as few genera survived the Permo-Triassic Extinction Event (Botha et al, 2007) The *Lystrosaurus* Assemblage Zone is characterized by the dicynodont, *Lystrosaurus*, and captorhinid reptile, *Procolophon*. The biarmosuchian and gorgonopsian Therapsida did not survive into the *Lystrosaurus* Assemblage Zone although the therocephalian and cynodont Therapsida are present in moderate quantities. Captorhinid Reptilia are reduced, but this interval is characterised by a unique diversity of oversize amphibians. Fossil fish, millipedes and diverse trace fossils have also been recorded.

Quaternary fossil assemblages are generally rare and low in diversity and is spread out over a wide geographic area. These fossil assemblages may sometimes occur in extensive alluvial and colluvial deposits cut by dongas. In the past palaeontologists did not concentrate their research on Cenozoic superficial deposits although they sometimes comprise of important fossil biotas. Fossils assemblages may comprise of bones, horn corns, fragments of ostrich eggs and mammalian teeth; as well as reptile skeletons. Microfossils, non- marine mollusc shells and freshwater stromatolites are also known from Quaternary deposits. Plant material such as foliage, pollens peats and wood are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts).

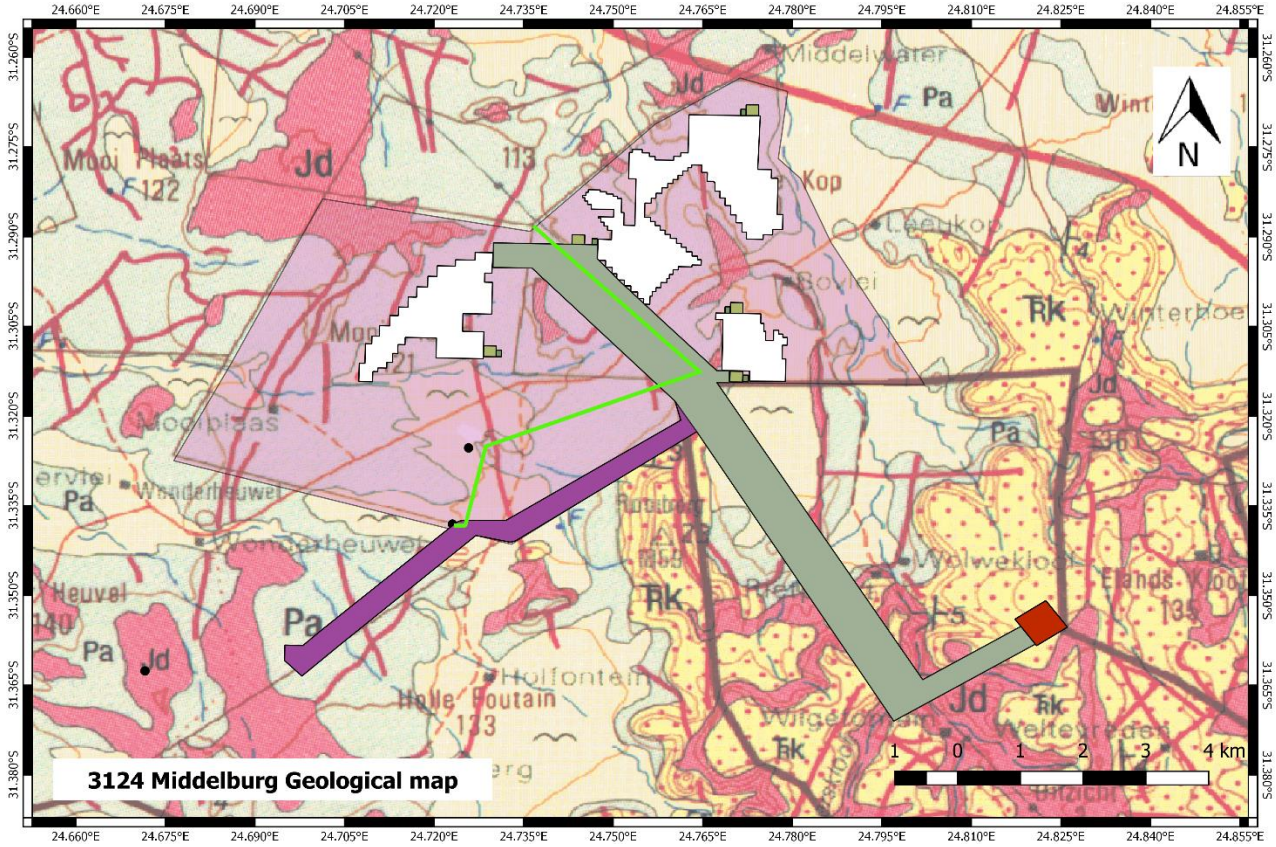


Figure 4: Surface geology of the proposed Umsobomvu Solar PV Energy Facilities: Mooi Plaats. The proposed development is underlain by the Adelaide and Tarkastad Subgroup, Beaufort Group, Karoo Supergroup) as well as Jurassic Karoo Dolerite. Map drawn QGIS Desktop 2.18.1. Map drawn QGIS Desktop 2.28.18

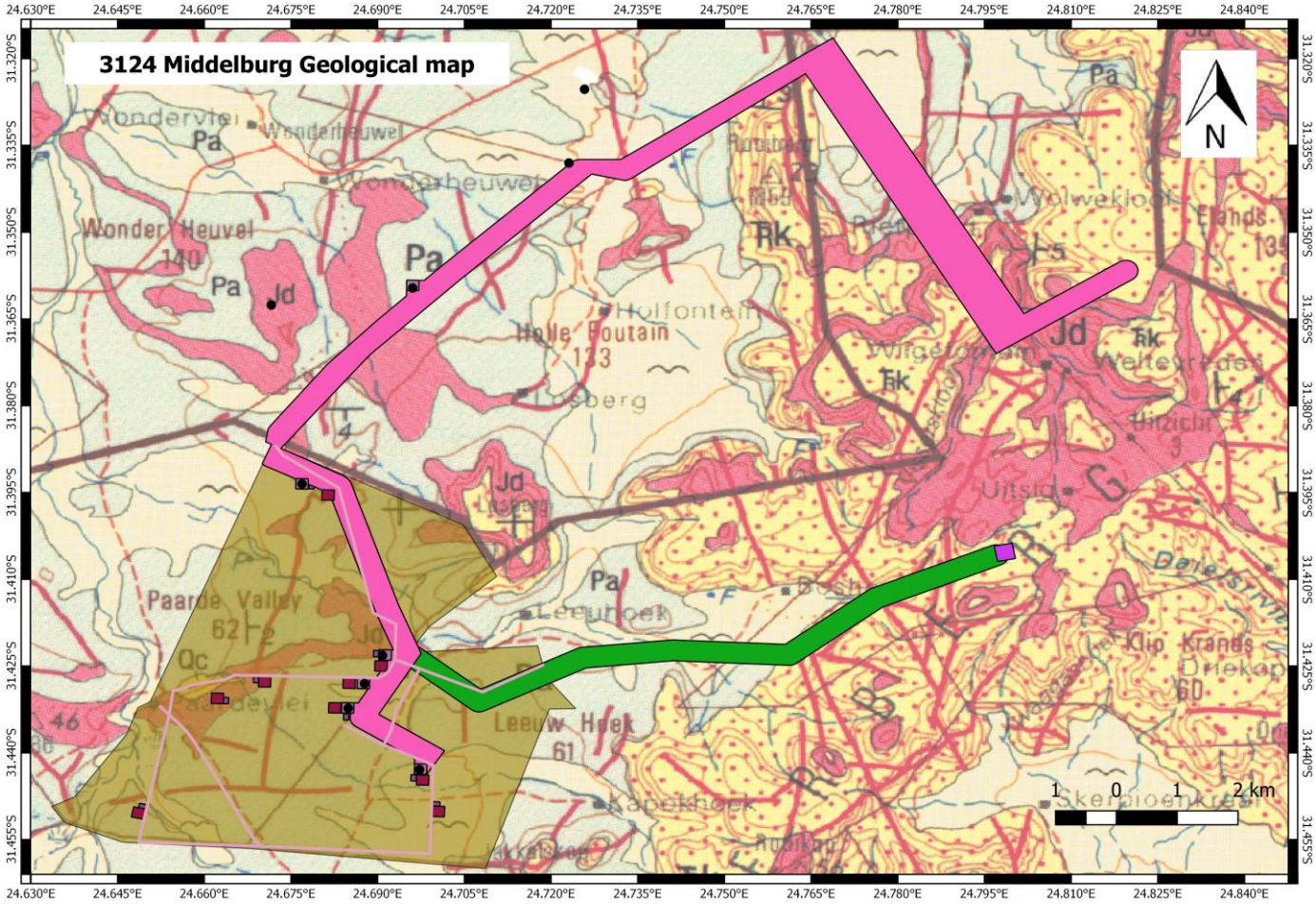


Figure 5: Surface geology of the proposed Umsobomvu Solar PV Energy Facilities: Paarde Valley. The proposed development is underlain by the Adelaide and Tarkastad Subgroup, Beaufort Group, Karoo Supergroup) as well as Jurassic Karoo Dolerite. Map drawn QGIS Desktop 2.28.18

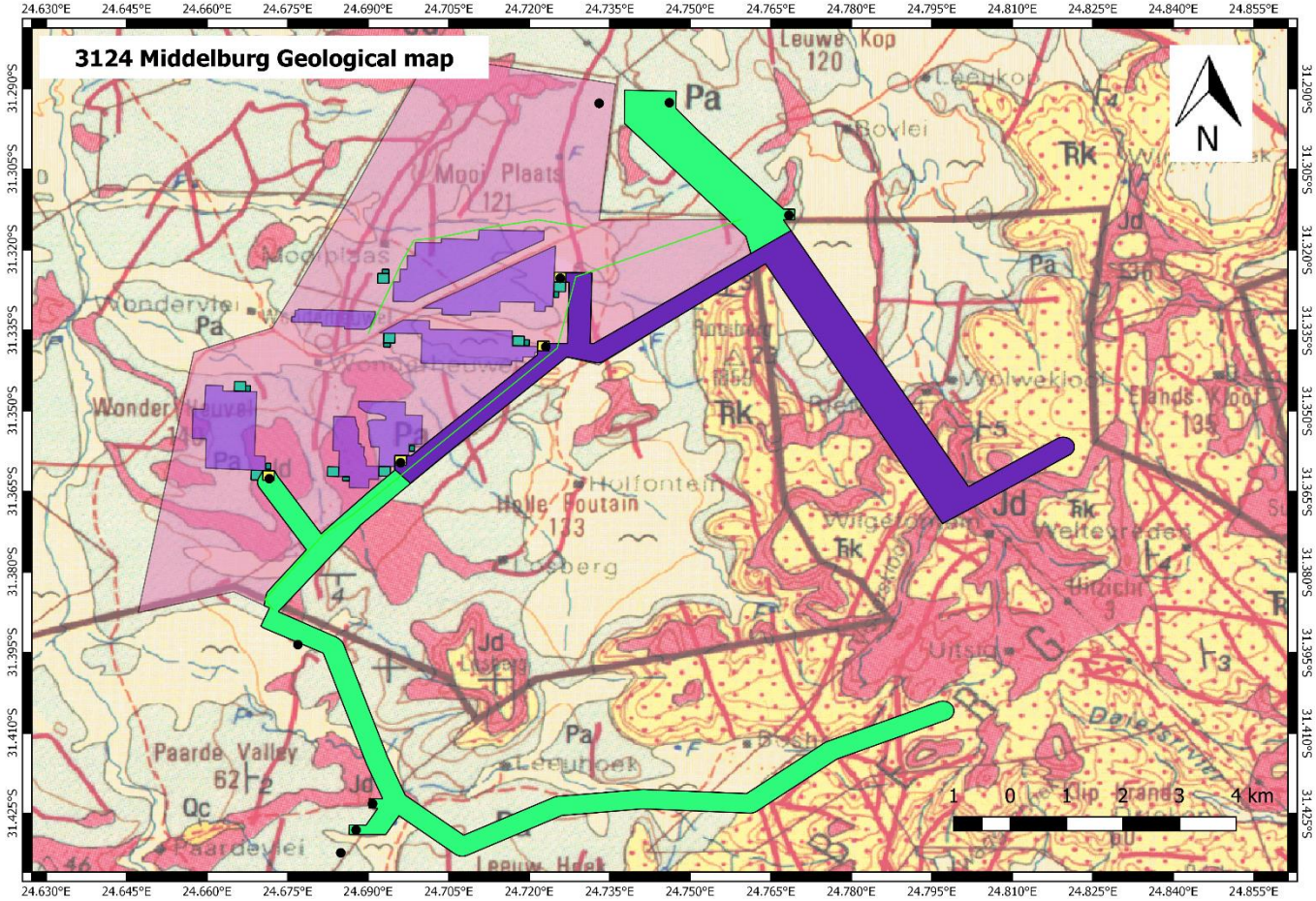
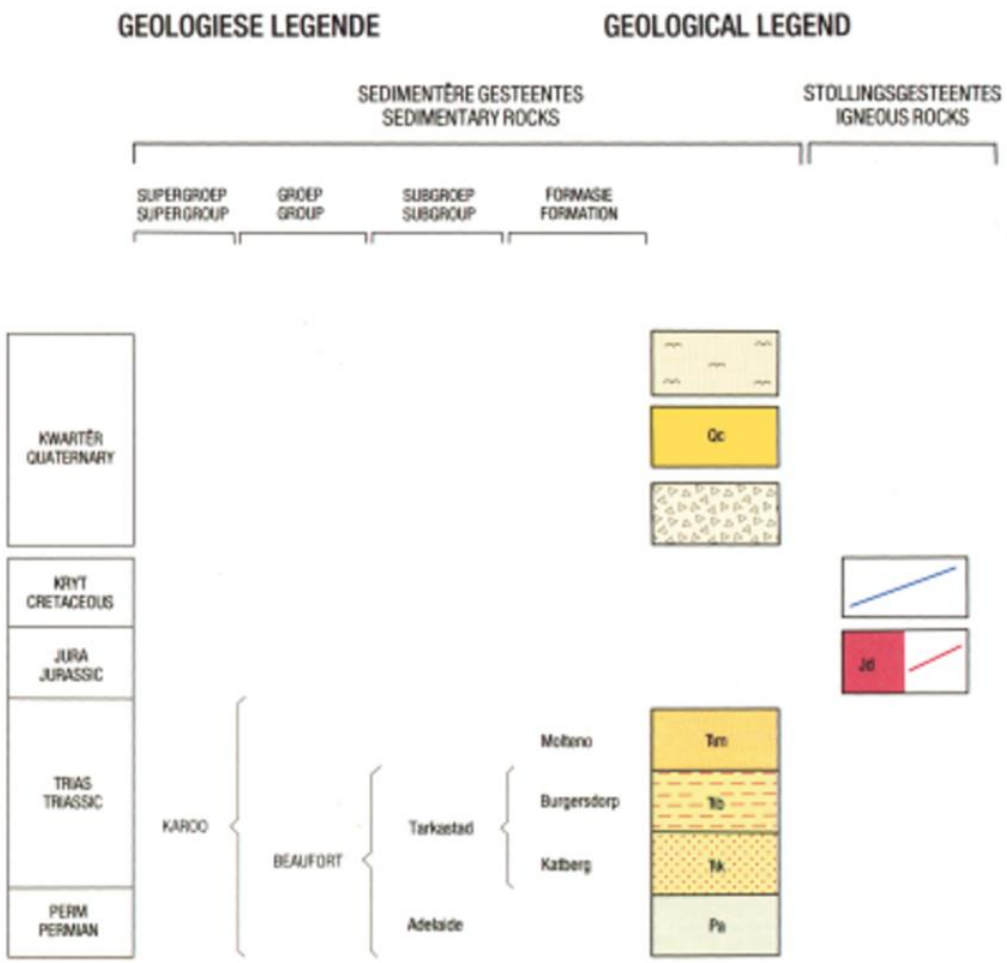


Figure 6: Surface geology of the proposed Umsobomvu Solar PV Energy Facilities: Wonderheuvel. The proposed development is underlain by the Adelaide and Tarkastad Subgroup, Beaufort Group, Karoo Supergroup) as well as Jurassic Karoo Dolerite. Map drawn QGIS Desktop 2.28.18

Map Clarification



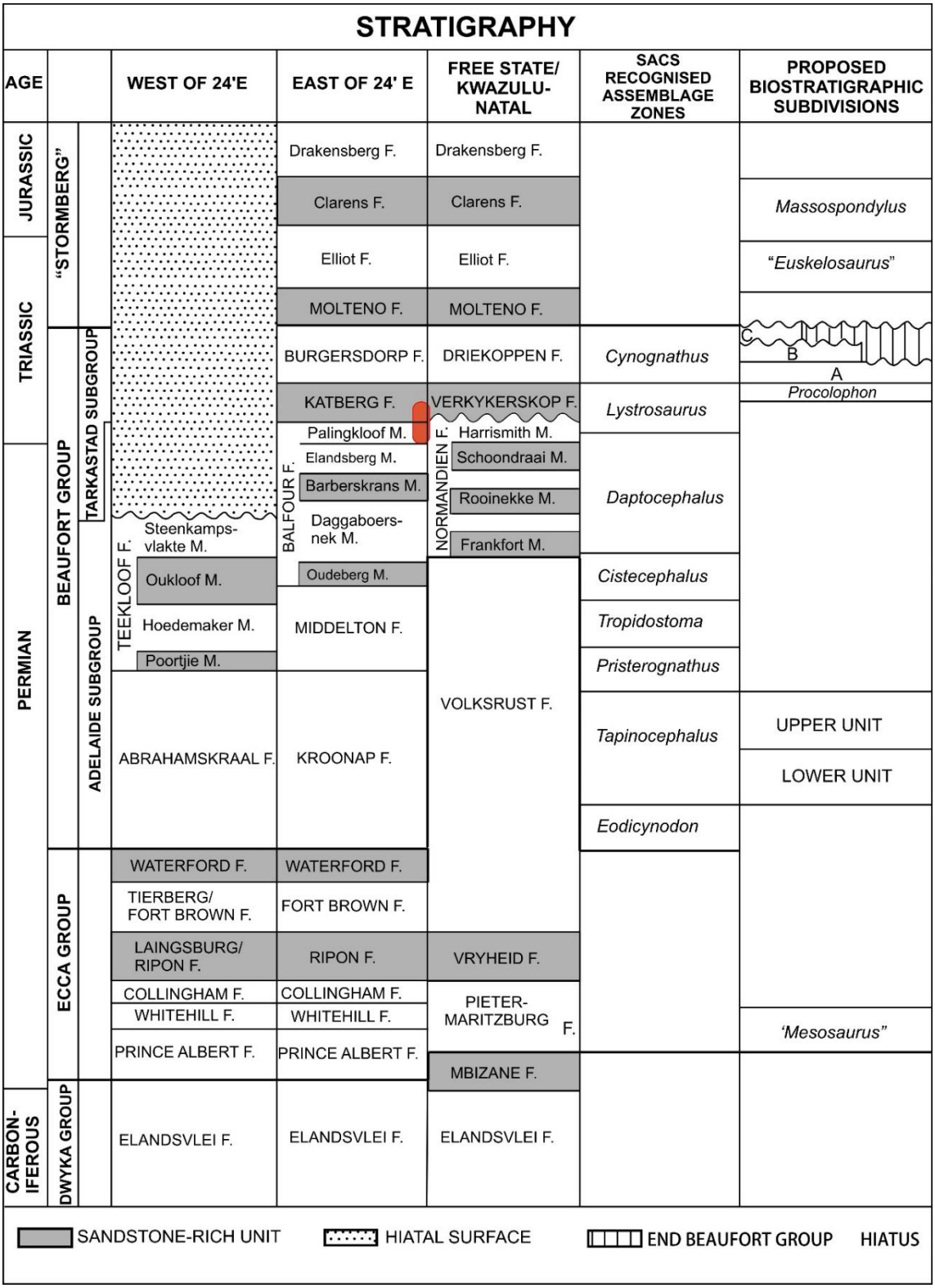


Figure 7: *Lithostratigraphic (rock-based) and biostratigraphic (fossil-based) subdivisions Beaufort Group of the Karoo Supergroup with rock units and fossil assemblage zones relevant to the present study marked in red (Modified from Rubidge, 1995). Abbreviations: F. = Formation, M. = Member*

6 GEOGRAPHICAL LOCATION OF THE SITE

The proposed three (3) Solar Photovoltaic (PV) Energy Facilities, with associated grid connection infrastructure comprises of the following farms and portions of farms:

- ***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.

7 APPROACH AND METHODOLOGY

The objective of a Palaeontological Impact Assessment is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the palaeontological impact assessment are:

1. to identify the palaeontological importance of the exposed and rocks below the surface in the development footprint
2. to evaluate the palaeontological importance of the formations
3. to determine the impact of the development on fossil heritage; and
4. to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The potentially fossiliferous rocks present within the study area are established from 1:250 000 geological maps and utilized when a palaeontological desktop study is compiled. The topography of the development area is identified using 1:50 000 topography maps as well as Google Earth Images of the development area. Fossil heritage within the rock formation is obtained from palaeontological impact studies in the same region, the PalaeoMap from SAHRIS; and databases of various institutions. The palaeontological importance of each rock unit is calculated and the

probable impact of the proposed development footprint on local fossil heritage is established on the following criteria

1. the palaeontological importance of the rocks,
2. the type and scale of the development, and
3. Quantity of bedrock excavated.

A field-based assessment by a palaeontologist is required when rocks of moderate to high palaeontological sensitivity are present within the study area. Based on both the desktop data and field assessment, the impact significance of the planned development is determined and recommendations for further studies or mitigation is made. In general, destructive impacts on palaeontological heritage only happen during construction. The excavations will change the current topography and may destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

Mitigation involves the collection and recording of fossils preceding construction or during construction when fossiliferous bedrock is uncovered. Importantly, preceding the excavation of any fossil heritage a permit from SAHRA must be obtained and the material will have to be housed in a permitted institution (Museum or university). When mitigation is applied correctly, a positive impact is possible because our knowledge of local palaeontological heritage may be increased.

7.1 SAHRA minimum standards for Palaeontology reports

As per the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" it states that "Although the details of the Phase 1 Minimum Standards discussed below may not apply directly where these are specifically archaeological, these standards can be used as a general guide to what is needed in Phase 1 palaeontological reports". The compliance of this PIA to these standards is described in below.

7.2 Assumptions and Limitation

The accuracy of Palaeontological Impact Assessments 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.

8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- The Palaeosensitivity Map from the SAHRIS website.
- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- Geological Map 1: 250 000 3124 Middelburg.
- A Google Earth map with polygons of the proposed development was obtained from *SiVEST*.

9 SITE VISIT

As part of the PIA, a field-survey of the development footprint was conducted on 24 to 28 January 2019 to assess the potential risk to palaeontological material (fossil and trace fossils) in the proposed footprint of the development. A physical field-survey was conducted on foot and by motor vehicle within the proposed development footprint. The results of the field-survey, the author's experience, aerial photos (using Google Earth, 2018), topographical and geological maps and other reports from the same area were used to assess the proposed development footprint. No consultations were undertaken for this Impact Assessment as it will be undertaken as part of the EIA process

Figure 8: Flat topography and low vegetation of the proposed Mooi Plaats development 31°17' 24"S 47°09' 25"E

Figure 9: Flat topography and low vegetation of the proposed Mooi Plaats development 31° 16' 35"S 24° 45' 52"E

Figure 10: Existing power line on the development Mooi Plaats footprint 31° 16' 352"S 24° 45' 03"E

Figure 11: Dolerite outcrop on the development Mooi Plaats footprint 31° 17’ 38”S 24° 45’ 54”E

Figure 12: Unfossiliferous outcrop in the Balfour Formation on the Mooi Plaats development 31° 19' 19"S 24° 43' 22"E

Figure 13: Dry Riverbed in the Balfour Formation (Paarde Valley development)
31° 21'19 S 24 47 59" E

Figure 14: Existing powerline on Paarde Valley development *31°21'56"S 24°47'57" E*

Figure 15: Unfossiliferous mountain side without any outcrops on the Paarde Valley development *31°22'02" S24°48'46" E*

Figure 16: Unfossiliferous dolerite outcrops on the Paarde Valley development 31°21'48" S 24°49'04" E

Figure 17: Quaternary deposits covering the underlying sediments on the Paarde Valley development

31°24'22.14"S 24°47'57.06"E

Figure 18: Side of a mountain indicating the lack of outcrop on the Paarde Valley development 31°24'11" S 24°48'18" E

Figure 19: Igneous Jurassic dolerite outcrop on the Paarde Valley development 31°23'54"S 24°47'24"E

Figure 20: General lack of outcrops
31°22'48" S 24°8'02" E

Figure 21: Quaternary to Recent colluvium and alluvium on Wonderheuvel development 31°26'34.78"S 24°41'19.37"E

Figure 22: Tabular bedded sandstones of the Katberg Formation s high up on the mountain 31°22'01" S 24°47'59" E in the Paarde Valley Corridor

Figure 23: Small exposure of grey, blocky weathered, mudrocks with blocky weathering. 31°20'23" S 24 40'46" E

Figure 24: Fragmented fossil found loose on the surface near the home stead just south of the Mooi Plaats (Adelaide Subgroup, Balfour Formation)
31°20'23" S 24 40'47" E

Figure 25: Flat topography of the development
31°25'14" S 24°42'41" E in a southernly direction

Figure 26: Unfossiliferous sandstone outcrops of the Katberg Formation on the Paarde Valley Corridor development

31°25'18.41"S 24°43'33.41"E

Figure 27*: In situ Lystrosaurus* skull in the Tarkastad Subgroup, *Lystrosaurus* AZ . 31°19’43.07”S 24°44’45.05” E (Paarde Valley Corridor 1&2)

Figure 28*: Flat topography on the Wonderheuvel development*
31°25'27"S 24°40'49"E

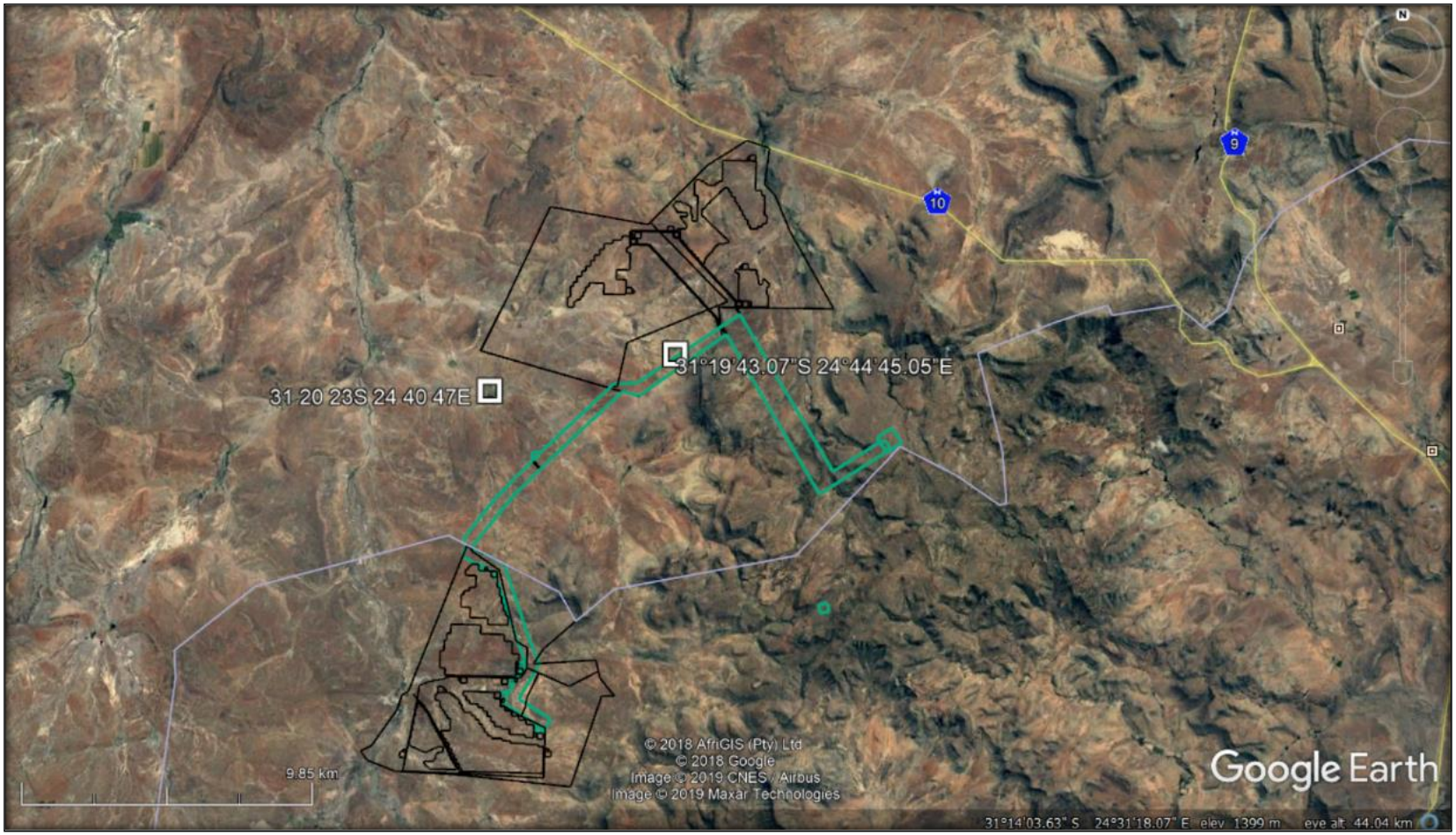


Figure 29*: Location of the fossils found on the* Umsobomvu Solar PV Energy Facilities

10 FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

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.

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. Although these localities do not currently fall in the proposed development sites, these fossiliferous sites have been identified as Highly Sensitive and No-go areas and it is recommended that a 50 m buffer will be placed around these areas. In the event that construction is necessity 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.

With the above mentioned in consideration, the proposed development, as well as all alternatives have a similar geology and therefore there is no preferences on the grounds of palaeontological fossil heritage for any specific layout among the different options under consideration. As impacts on fossil heritage usually only occur during the excavation phase and no further impacts on fossil heritage are expected during the operation and decommissioning phases of the SEF.

The impact of development on fossil heritage are usually negative but it could also have a positive impact due to the discovery of newly uncovered fossil material that would have been unavailable for scientific research. The SEF could also provide a long-term benefit to the country by supplying renewable energy to the electricity grid.

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations the **Chance Find Protocol** must be implemented by the ECO in charge of these developments. These discoveries ought to be protected (if possible *in situ*) and the ECO must report to SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that correct mitigation (*e.g.* recording and collection) can be carry out by a paleontologist.

It is consequently recommended that no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required pending the discovery of newly discovered fossils. From a Palaeontological Heritage view there are no fatal floors in the proposed SEF development project. However, it is recommended that the mitigation measures are included in the EMPr and fully implemented.

11 CHANCE FIND PROCEDURE

A following procedure will only be followed in the event that fossils are uncovered during excavation.

11.1 Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the **National Heritage Resources Act (Act 25 of 1999) (NHRA).** According to Section 3 of the Act, all Heritage resources include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the citizens of South Africa. Palaeontological resources may not be excavated, broken, moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

11.2 Background

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past millions of years ago. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

11.3 Introduction

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the Environmental Control Officer (ECO) of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ECO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

11.4 Chance Find Procedure

- If a chance find is made the person responsible for the find must immediately **stop working** and all work must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ECO or site manager. The

ECO must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.

- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ECO (site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ECO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development.

12 IMPACT ASSESSMENTS

Impact on Palaeontological Heritage will only occur during the construction phase of the proposed development with no impacts on the preconstruction, operational and decommissioning phases. Impacts will only occur when the vegetation is cleared and levelled, and excavations into the bedrock will occur

The Nature of the Impact is to Damage, destroy or permanently seal-in fossils at or below the ground surface that are un-available for scientific study, this will occur during vegetation clearance or during the construction phase. The extent will have an effect nationally (3). Since fossil heritage is known from these formations the probability of impacts on palaeontological heritage during the construction phase is probable (3). Impacts on fossil heritage are generally **irreversible** (4). By taking a precautionary approach, an insignificant loss of fossil resources is expected (**No Loss**). (1). The expected duration of the impact is assessed as potentially permanent to **long term**. In the

absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be permanent. (4).

The cumulative effect of the development of the SEF and WEF and associated infrastructure within the proposed location is considered to be **High**. This is as a result of the broader Middelburg and Noupoort areas being considered as fossiliferous (3). Probable significant impacts on palaeontological heritage during the construction phase are high, but the intensity of the impact on fossil heritage is rated as medium as fossil heritage is common in the greater Middelburg and Noupoort area (2).

Should the project progress without due care to the possibility of fossils being present at the proposed site the resultant damage, destruction or inadvertent relocation of any affected fossils will be **permanent and irreversible**. Thus, any fossils occurring within the area are potentially scientifically and culturally significant and any negative impact on them would be of **high** significance (without the implementation of mitigation measures)

IMPACT RATINGS

As the geology of all the alternatives is the same a single impact rating table is provided (Table) for all three (3) proposed Solar PV Energy Facilities. The impact assessment rating is based on the rating scale as contained in Appendix B.

Table 2: Combined impact table for the Mooi Plaats, Wonderheuvel and Paarde Valley PV and grid options is presented here

MOOI PLAATS, WONDERHEUVEL and PAARDE VALLEY SOLAR PV FACILITIES																				
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																				
Fossil Heritage		1	2	4	4	4	4	60	Negative -	High Impact	A palaeontologist must conduct a field visit after vegetation clearance. Fossil Excavation will need a SAHRA permit. If an excavation is impossible, the fossil and locality could be protected and the development	1	1	4	4	4	2	28	Negative -	Medium Impact

											moved and Chance Find Protocol									
Operational Phase																				
No Impact								0			Not applicable							0		
Decommissioning Phase																				
No Impact								0			Not applicable							0		
Cumulative																				
Fossil Heritage		2	2	4	4	4	2	32	Negative -	Medium Impact	Not applicable	1	1	4	4	4	1	14	Negative -	Low Impact

MOOI PLAATS, WONDERHEUVEL and PAARDE VALLEY SOLAR PV FACILITIES																				
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																				
Fossil Heritage	Excavations and site clearance of the development will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock.	1	2	4	4	4	4	60	- Negative	High Impact	A palaeontologist must conduct a field visit after vegetation clearance. Fossil Excavation will need a SAHRA permit. If an excavation is impossible, the fossil and locality could be protected and the development moved	1	1	4	4	4	2	28	Negative -	Medium Impact

Operational Phase																				
No Impact								0										0		
Decommissioning Phase																				
No Impact								0										0		
Cumulative																				
Fossil Heritage	Excavations and site clearance of the development will involve substantial excavations into the superficial sediment cover as well as locally into the underlying bedrock.	2	2	4	4	4	2	32	Negative -	Medium Impact	A palaeontologist must conduct a field visit after vegetation clearance. Fossil Excavation will need a SAHRA permit. If an excavation is impossible, the fossil and locality could be protected and the development moved	1	1	4	4	4	1	14	Negative -	Low Impact

12.1 Cumulative Impacts

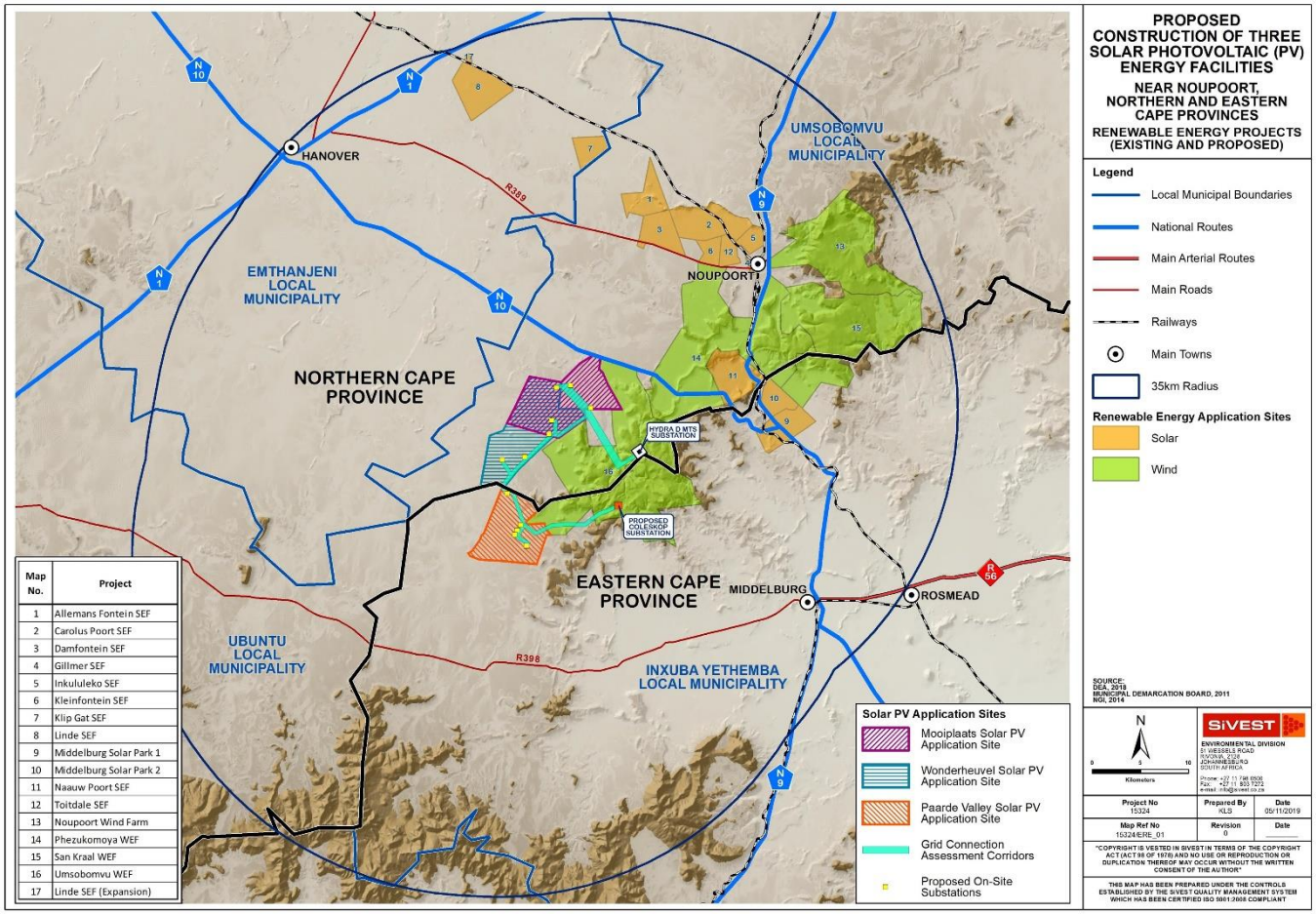


Figure 30: Other Renewable Energy developments in relation to the Umsobomvu SEF application area (SiVEST 2018)

A total of 17 Renewable Energy Facilities (13 Solar Energy Facilities and 3 Wind Energy Facilities) are present in a 35 km radius of the proposed Umsobomvu Solar PV Energy Facilities.13 of these facilities have been approved while 2 facilities are operational and 2 are in and EIA Process (Table 2)

It was difficult to obtain all the relevant Palaeontological Impact Assessments from the internet except the following

ALMOND, J. E., 2017. Palaeontological Impact Assessment of the proposed Phezukomoya wind farm near Nouwpoort, Northern and Eastern Cape.

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.

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Table 2: Other Renewable Energy developments in relation to the Umsobomvu application area (SiVEST 2019)

Project	DEA Reference No	Technology	Capacity	Status of Application / Development
Allemans Fontein SEF	14/12/16/3/3/1/730	Solar	20MW	Approved
Carolus Poort SEF	14/12/16/3/3/1/729	Solar	20MW	Approved
Damfontein SEF	14/12/16/3/3/1/728	Solar	20MW	Approved
Gillmer SEF	14/12/16/3/3/1/735	Solar	20MW	Approved
Inkululeko SEF	14/12/16/3/3/1/553	Solar	20MW	Approved
Kleinfontein SEF	12/12/20/2654	Solar	20MW	Approved
Klip Gat SEF	14/12/16/3/3/2/354	Solar	75M	Approved
Linde SEF	12/12/20/2258	Solar	40MW	In Operation
Linde SEF (Expansion)	14/12/16/3/3/1/1122	Solar	75MW	Approved
Middelburg Solar Park 1	12/12/20/2465/2	Solar	75MW	Approved
Middelburg Solar Park 2	12/12/20/2465/1	Solar	75MW	Approved
Naauw Poort SEF	14/12/16/3/3/2/355	Solar	75MW	Approved
Toitdale SEF	12/12/20/2653	Solar	20MW	Approved
Noupoort Wind Farm	12/12/20/2319	Wind	188MW	In Operation
Phezukomoya WEF	14/12/16/3/3/1/1028	Wind	315MW	EIA in Process
San Kraal WEF	14/12/16/3/3/1/1069	Wind	390MW	EIA in Process
Umsobomvu WEF	14/12/16/3/3/2/730	Wind	140MW	Approved

Project	Findings	Recommendations
Allemans Fontein SEF	Mudstones and sandstones and dolerite	No fossils observed, No special recommendations Proceed with Project
Carolus Poort SEF	Katberg and Balfour Formations present, dolerite	No fossils observed, No special recommendations Proceed with Project
Damfontein SEF	Mudstones and sandstones and dolerite	Pre-construction site visit
Gillmer SEF	Mudstones and sandstones and dolerite	No fossils observed, No special recommendations Proceed with Project
Inkululeko SEF	-	-
Kleinfontein SEF	-	-
Klip Gat SEF	Adelaide Subgroup and dolerite	Pre-construction site visit
Linde SEF	-	-
Linde SEF (Expansion)	-	-
Middelburg Solar Park 1	Katberg and Balfour Formations, dolerite and Quaternary	Pre-construction site visit
Middelburg Solar Park 2	Katberg and Balfour Formations, dolerite and Quaternary	Pre-construction site visit
Naauw Poort SEF	Katberg Formation	Pre-construction site visit
Toitdale SEF	-	-
Noupoort Wind Farm	Katberg Formation, dolerite and Quaternary	No site visits pending discovery of fossils
Phezukomoya WEF	Katberg and Balfour Formations present; fragmentary bones vertebrate burrows,	Buffer, mitigation
San Kraal WEF	Katberg and Balfour Formations present;	Buffer, mitigation
Umsobomvu WEF		

12.2 Comparative Assessments of alternatives (Palaeontology)

PROPOSED UMSOBOMVU SOLAR PV ENERGY FACILITIES

COMPARATIVE ASSESSMENT OF ALTERNATIVES

PV AND GRID CONNECTION INFRASTRUCTURE

Key

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

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	Similar geology
Laydown Area and O&M Building Site Option 2	No Preference	Similar geology
Laydown Area and O&M Building Site Option 3	No Preference	Similar geology
Laydown Area and O&M Building Site Option 4	No Preference	Similar geology
Laydown Area and O&M Building Site Option 5	No Preference	Similar geology
Laydown Area and O&M Building Site Option 6	No Preference	Similar geology
WONDERHEUVEL SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	No Preference	Similar geology
Laydown Area and O&M Building Site Option 2	No Preference	Similar geology
Laydown Area and O&M Building Site Option 3	No Preference	Similar geology

PV INFRASTRUCTURE ALTERNATIVES (LAYDOWN AREAS AND O&M BUILDINGS)	Preference	Reasons (incl. potential issues)
Laydown Area and O&M Building Site Option 4	No Preference	Similar geology
Laydown Area and O&M Building Site Option 5	No Preference	Similar geology
Laydown Area and O&M Building Site Option 6	No Preference	Similar geology
Laydown Area and O&M Building Site Option 7	No Preference	Similar geology
Laydown Area and O&M Building Site Option 8	No Preference	Similar geology
PAARDE VALLEY SOLAR PV FACILITY:		
Laydown Area and O&M Building Site Option 1	No Preference	Similar geology
Laydown Area and O&M Building Site Option 2	No Preference	Similar geology
Laydown Area and O&M Building Site Option 3	No Preference	Similar geology
Laydown Area and O&M Building Site Option 4	No Preference	Similar geology
Laydown Area and O&M Building Site Option 5	No Preference	Similar geology
Laydown Area and O&M Building Site Option 6	No Preference	Similar geology
Laydown Area and O&M Building Site Option 7	No Preference	Similar geology
Laydown Area and O&M Building Site Option 8	No Preference	Similar geology
Laydown Area and O&M Building Site Option 9	No Preference	Similar geology

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	Similar geology
Grid Connection Option 1b	No Preference	Similar geology
Grid Connection Option 2a	No Preference	Similar geology
Grid Connection Option 2a	No Preference	Similar geology
WONDERHEUVEL SOLAR PV FACILITY:		
Grid Connection Option 1a	No Preference	Similar geology
Grid Connection Option 1b	No Preference	Similar geology
Grid Connection Option 1c	No Preference	Similar geology
Grid Connection Option 1d	No Preference	Similar geology
Grid Connection Option 2a	No Preference	Similar geology
Grid Connection Option 2b	No Preference	Similar geology
Grid Connection Option 3	No Preference	Similar geology
PAARDE VALLEY SOLAR PV FACILITY:		
Grid Connection Option 1a	No Preference	Similar geology
Grid Connection Option 1b	No Preference	Similar geology
Grid Connection Option 1c	No Preference	Similar geology
Grid Connection Option 1d	No Preference	Similar geology
Grid Connection Option 2a	No Preference	Similar geology
Grid Connection Option 2b	No Preference	Similar geology
Grid Connection Option 2c	No Preference	Similar geology
Grid Connection Option 2d	No Preference	Similar geology

12.3 Conclusion

The proposed development, as well as all alternatives have a similar geology and therefore there is no preferences on the grounds of palaeontological fossil heritage for any specific layout among the different options under consideration. As impacts on fossil heritage usually only occur during the excavation phase and no further impacts on fossil heritage are expected during the operation and decommissioning phases of the SEF.

The impact of development on fossil heritage are usually negative but it could also have a positive impact due to the discovery of newly uncovered fossil material that would have been unavailable for scientific research. The SEF could also provide a long-term benefit to the country by supplying renewable energy to the electricity grid.

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Appendix A – Elize Butler CV

CURRICULUM VITAE

ELIZE BUTLER

PROFESSION: Palaeontologist

YEARS' EXPERIENCE: 26 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. 2014. Palaeontological Impact Assessment of the proposed development of private dwellings on portion 5 of farm 304 Matjesfontein Keurboomstrand, Knysna District, Western Cape Province. Bloemfontein.

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CONFERENCE CONTRIBUTIONS

NATIONAL

PRESENTATION

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INTERNATIONAL VISITS

Natural History Museum, London	July 2008
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Appendix B

14 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.

14.1 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.

14.2 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).

14.2.1 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 3: 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 4: 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

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 by the wind turbines as well.	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 be detailed in the EMPr.**	2	2	2	1	4	2	22	-	Low
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 heavy machinery on the site and the noise generated.	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 measures will be detailed in the EMPr.**	2	2	2	1	2	2	18	-	Low
Cumulative																				
Broad-scale ecological processes	Transformation and presence of the facility will contribute to cumulative habitat loss and impacts on broad-scale ecological	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**	2	3	2	1	3	2	22	-	Low

	processes such as fragmentation.										**activity. These measures will be detailed in the EMPr.**									