FINAL BASIC ASSESSMENT REPORT

Basic Assessment for the proposed development of the up to 150 MW Padloper Solar PV Facility 2 (i.e., Padloper PV 2), as well as the proposed development of a 132 kV Overhead Power Line between the Padloper PV 2 and the proposed authorised Ishwati Emoyeni Collector Substation (i.e., Padloper EGI 2), and their associated infrastructure, near Murraysburg in the Western Cape Province



APPENDIX D.3:

Archaeology, Palaeontology and Cultural Heritage - Padloper PV 1-4

HERITAGE IMPACT ASSESSMENT:
BASIC ASSESSMENT FOR THE PROPOSED PADLOPER PHOTOVOLTAIC FACILITY 2 NEAR MURRAYSBURG, MURRAYSBURG MAGISTERIAL DISTRICT, WESTERN CAPE

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999)

HWC Case No: HWC22121416CM0209

Report for:

African Clean Energy Developments (Pty) Ltd
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With cultural landscape inputs from:
Liana Jansen

1st draft: 10 August 2023
Final report: 08 September 2023

EXECUTIVE SUMMARY

1. Site Name

Padloper Solar Facility 2

2. Location

Off farm and local gravel roads, 27 km north of Murraysburg
Remainder of Riet Poort 9 (PV and access road)
Centre point at S31° 43’ 12” E23° 44’ 50”.

3. Locality Plan



4. Description of Proposed Development

Among other things, the projects will include solar panels, a substation, electrical cabling, access roads, offices and a temporary laydown area.

5. Heritage Resources Identified

No fossils were found on site. The only significant resource in the study area is an engraving on the southern edge of the study area. The cultural landscape is also a heritage resource.

6. Anticipated Impacts on Heritage Resources

All significant sites have been avoided and no impacts are anticipated. Impacts to the landscape are unavoidable but, in this case, are deemed within acceptable limits.

7. Recommendations

It is recommended that the proposed Padloper Solar Facility 2 be authorised, but subject to the following recommendations which should be included as conditions of authorisation:

- The engraving site at waypoint 222 must be flagged as a no-go area;
- No stones may be removed from any archaeological site;
- The fossil Chance Finds Protocol must be included in the EMPr and implemented in the event that fossils are found;
- Lighting mitigation must be employed to ensure that light is directed only to where it is needed and, preferably, that it only switches on when needed;
- Buildings to be painted in earthy tones where technically feasible;
- Signage demarcating the entrance of the facility must be modest in nature and should not exceed the height of regular street signage;
- Consideration should be given to moving the substation and buildings northwards away from the scarp during the detailed design phase; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

8. Author/s and Date

Heritage Impact Assessment: Jayson Orton, ASHA Consulting (Pty) Ltd, September 2023
Palaeontological Impact Assessment: Elize Butler, Banzai Environmental, August 2023
Visual Impact Assessment: Kerry Lianne Schwartz, SLR Consulting, August 2023

Glossary

Background scatter: Artefacts whose spatial position is conditioned more by natural forces than by human agency.

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Flake: a piece of stone intentionally removed from a core. Flakes are identifiable by certain features related to the point at which the core was struck.

Handaxe: A bifacially flaked, pointed stone tool type typical of the Early Stone Age.

Holocene: The geological period spanning the last approximately 10-12 000 years.

Hominid: a group consisting of all modern and extinct great apes (i.e. gorillas, chimpanzees, orangutans and humans) and their ancestors.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Patina: The weathered surface of an artefact which has changed colour and/or texture (patinated, patination).

Pleistocene: The geological period beginning approximately 2.5 million years ago and preceding the Holocene.

Abbreviations

APHP: Association of Professional Heritage Practitioners

ASAPA: Association of Southern African Professional Archaeologists

BA: Basic Assessment

CSIR: Council for Scientific and Industrial Research

CRM: Cultural Resources Management

DFFE: Department of Forestry, Fisheries and the Environment

EA: Environmental Authorisation

ECO: Environmental Control Officer

EGI: Electricity Grid Infrastructure

EIA: Environmental Impact Assessment

EMPr: Environmental Management Program

ESA: Early Stone Age

GPS: global positioning system

HIA: Heritage Impact Assessment

HV: High Voltage

HWC: Heritage Western Cape

LSA: Later Stone Age

MSA: Middle Stone Age

NCW: Not Conservation Worthy

NEMA: National Environmental Management Act (No. 107 of 1998)

NHRA: National Heritage Resources Act (No. 25 of 1999)

NID: Notification of Intent to Develop

O&M: Operation and Management

PHRA: Provincial Heritage Resources Agency

PPP: Public Participation Process

PV: Photovoltaic

REDZ: Renewable Energy Development Zone

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

Compliance with Appendix 6 of the 2014 EIA Regulations

Requirements of Appendix 6 – GN R326 (7 April 2017)	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1.4 Appendix 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii (Preliminary Section of this report)
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3
(cA) an indication of the quality and age of base data used for the specialist report;	Section 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Sections 8.6, 8.4 and 8.8
d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.2
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
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 alternatives;	Sections 1.1.3, 5 and 6
g) an identification of any areas to be avoided, including buffers;	Section 13
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;	Sections 5.7 and 13
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3.6
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 5 Section 13
k) any mitigation measures for inclusion in the EMPr;	Sections 8 and 11
l) any conditions for inclusion in the environmental authorisation;	Section 14
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 11
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity and activities; and 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;	Sections 13.1 and 14
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 12
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 of minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply	Part A of the Assessment Protocols published in Government Notice No. 320 on 20 March 2020 is applicable (i.e. site sensitivity verification requirements where a specialist assessment is required but no specific assessment protocol has been prescribed). See Appendix 3.

Contents

Specialist declaration ..... Error! Bookmark not defined.

Glossary ..... **iv**

Abbreviations ..... **v**

Compliance with Appendix 6 of the 2014 EIA Regulations ..... **vi**

1. INTRODUCTION **1**

1.1. The proposed project 1

1.1.1. Project description 1

1.1.2. Identification of alternatives 6

1.1.3. Description of project aspects relevant to the heritage study 6

1.2. Terms of reference 6

1.3. Scope, purpose and objectives of the report 8

1.4. Details of specialist 8

2. LEGISLATIVE CONTEXT **8**

2.1. National Heritage Resources Act (NHRA) No. 25 of 1999 8

2.2. Approvals and permits 10

2.2.1. Assessment Phase 10

2.2.2. Construction Phase 10

2.3. Guidelines 10

2.4. Application timeline 10

3. APPROACH AND METHODOLOGY **11**

3.1. Literature survey and information sources 11

3.2. Field survey 12

3.3. Specialist studies 13

3.4. Impact assessment 13

3.5. Grading 13

3.6. Assumptions, knowledge gaps and limitations 13

3.7. Consultation processes undertaken 13

4. PHYSICAL ENVIRONMENTAL CONTEXT **14**

4.1. Site context 14

4.2. Site description 15

5. FINDINGS OF THE HERITAGE STUDY **17**

5.1. Palaeontology 18

5.2. Archaeology 18

5.2.1. Desktop study 18

5.2.2. Site visit 20

5.3. Graves 24

5.4. Historical aspects and the Built environment 24

5.4.1. Desktop study 24

5.4.2. Site visit 25

5.5. Cultural landscapes and scenic routes 25

5.6. Visual impact assessment 30

5.7. Statement of significance and provisional grading 31
5.8. Summary of heritage indicators 33
6. IDENTIFICATION OF ENVIRONMENTAL SENSITIVITIES 33
6.1. Sensitivities identified by the National Web-Based Environmental Screening Tool....33
6.2. Specialist Sensitivity Analysis and Verification 34
6.3. Sensitivity Analysis Summary Statement 34
7. ISSUES, RISKS AND IMPACTS 34
8. IMPACT ASSESSMENT 34
8.1. Construction Phase 35
8.1.1. Impacts to archaeological resources 35
8.1.2. Impacts to the cultural landscape 35
8.2. Operation Phase 35
8.2.1. Potential Impacts to the cultural landscape 35
8.3. Decommissioning Phase 36
8.4. Cumulative Impacts 36
8.5. Evaluation of impacts relative to sustainable social and economic benefits....40
8.6. Existing impacts to heritage resources 40
8.7. The No-Go alternative 40
8.8. Levels of acceptable change 40
9. IMPACT ASSESSMENT SUMMARY 40
10. LEGISLATIVE AND PERMIT REQUIREMENTS 41
11. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS 41
12. CONSULTATION WITH HERITAGE CONSERVATION BODIES 43
13. CONCLUSIONS 43
13.1. Statement and reasoned opinion of the specialist 44
14. RECOMMENDATIONS 44
15. REFERENCES 45
APPENDIX 1 – Curriculum Vitae 49
APPENDIX 2 - Site Sensitivity Verification 51
APPENDIX 3 – Palaeontological study 53
APPENDIX 4 – Visual Impact Assessment 54

1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by African Clean Energy Developments (Pty) Ltd (ACED) to assess the potential impacts to heritage resources that might occur through the proposed development of the suite of seven Padloper Photovoltaic (PV) solar energy facilities to be located in the area between Murraysburg, Western Cape and Richmond, Northern Cape. The present report deals with the project to be known as Padloper Solar Facility 2. Padloper Solar Facility 1 lies in Northern Cape and the five other facilities in Western Cape are assessed in separate reports (Figure 1). Padloper Solar Facility 2 and its access road will be on the Remainder of Riet Poort 9, some 26 km north of Murraysburg, and a centre point for the facility will be at S31° 43' 12" E23° 44' 50" (Figure 2).

1.1. The proposed project

1.1.1. Project description

The proposed Padloper Solar Facility 2 will consist of the following components:

Infrastructure	Component	Dimensions / Specifications
Solar PV	Type of Technology	Solar Photovoltaic (PV) Technology
	Height of PV panels	Maximum of ± 4.5 m
	Capacity of the PV Facility	Padloper PV 1: Up to 250 MW Padloper PV 2: Up to 150 MW Padloper PV 3: Up to 150 MW Padloper PV 4: Up to 150 MW
	Area of PV Array (i.e., proposed area occupied by PV Modules)	Padloper PV 1: 420 ha Padloper PV 2: 222 ha Padloper PV 3: 222 ha Padloper PV 4: 328 ha Note: The permanent fence line will run as close as possible to the solar array demarcation and substation area. Therefore the PV array area and the total fenced area (i.e., the area that includes all associated infrastructure within the fenced off area of the PV facility) is anticipated to be similar.
	Technology mounting structure	The following technologies are being considered: • Single Axis Tracking structures (aligned north-south); • Dual Axis Tracking (aligned east-west and north-south); • Fixed Tilt Mounting Structure; • Mono-facial Solar Modules; or • Bifacial Solar Modules.
	Inverter-transformer stations	3.5 MW inverters will be located across the proposed project. The exact number of inverters are still to be confirmed however all inverter-transformers will be within the PV array.
	Area occupied by inverter-transformer stations and height	Inverter-Transformer stations: 0.022 ha each The inverter stations will have a height of ± 3 m each (Excluding lightning rods. The lightning rods

Infrastructure	Component	Dimensions / Specifications
		are expected to extend 10 m high. Each inverter station will have 1 – 2 lightning rods).
Associated infrastructure		
On-site substation	A 132 kV facility substation complex will be located within the site and will have a height of up to 18 m. The area of substations relevant to the proposed facilities are as follows: Padloper PV 1: 1.55 ha Padloper PV 2: 1.93 ha Padloper PV 3: 2.71 ha Padloper PV 4: 1.74 ha	
Temporary Construction and Laydown area	Construction camp area (ha)	1 - 4 ha Note: These areas will be rehabilitated after construction and will not be retained for the operational phase.
Main access roads Please note: The existing road network will be used as far as practically possible and upgraded as needed.	Current width of access roads (m)	5 m
	Length of access roads (km)	Padloper PV 1: Approximately 10.2 km Padloper PV 2: Approximately 2.62 km Padloper PV 3: Approximately 2.35 km Padloper PV 4: Approximately 0.57 km
Internal roads Please note: The existing road network will be used as far as practically possible and upgraded as needed.	Width of access roads (m)	5 m
	Length of roads (km)	Padloper PV 1: Approximately 12.91 km Padloper PV 2: Approximately 5.88 km Padloper PV 3: Approximately 8.17 km Padloper PV 4: Approximately 9.34 km The internal road network will be used to conduct security patrols and to access all the equipment (module cleaning and equipment maintenance).
Upgrading of existing access road/s Please note: Where required for turning circle/bypass areas, however, access or internal roads may be up to 10 m to allow for larger component transport.	Yes / No	Yes. Existing roads will be used as far as practically achievable.
	Current width (m)	± 5 m
	Upgraded width (m)	± 8 m (6 m wide road surface with 1 m drain either side)
Internal transmission and/or distribution lines	All on-site medium voltage cabling (22 or 33 kV) will be buried to a maximum depth of 1.5 m.	
Site offices Including a warehouse/workshop and an operational and maintenance (O&M) control centre. The details provided in this section is for one site office.	Number of buildings	Site offices and the O&M control centre will be located in one building. The workshop and storage area may be attached to the O&M control centre. All buildings will be located within the O&M complex/footprint.
	Maximum height (m)	Up to 10 m
	Footprint (m²)	300 m²
Guard houses Note: There will be 2 guardhouses at the proposed project site. The details provided in this section is for one guard house.	Maximum height (m)	Up to 3 m
	Footprint (m²)	± 6 m x 6 m ± 36 m²
Ablution facilities	Maximum height (m)	Up to 10 m
	Footprint (m²)	Staff lockers: ± 22 m x 11 m

Infrastructure	Component	Dimensions / Specifications
Note: There will be 2 ablution facilities proposed project site, included in site offices and guardhouse footprints. The details provided in this section is for one ablution facility.		± 242 m²
Battery energy storage system (BESS)	Battery technology type	Lithium-Ion, Sodium-Ion, Solid State and Redox Flow technology types are being considered.
	Approx. footprint (ha)	± 5 ha
	Maximum height (m)	Up to 10 m
	Capacity	• Padloper PV 1: 1 500 MWh • Padloper PV 2: 900 MWh • Padloper PV 3: 900 MWh • Padloper PV 4: 900 MWh
On site medium voltage cables or cable trays	Maximum depth (m)	Up to 1.5 m
	Capacity	22 or 33 kV
Water use requirements	Estimated quantity of water (litres) required for the construction phase	• Padloper PV 1: 50 000 m³ per annum • Padloper PV 2: 30 000 m³ per annum • Padloper PV 3: 30 000 m³ per annum • Padloper PV 4: 30 000 m³ per annum
	Estimated quantity of water (litres) required for the operational phase	• Padloper PV 1: 12 000 m³ per annum • Padloper PV 2: 8 000 m³ per annum • Padloper PV 3: 8 000 m³ per annum • Padloper PV 4: 8 000 m³ per annum
	Estimated quantity of water (litres) required for the decommissioning phase:	The exact amount of water required during this phase is unknown at this stage but expected to be similar to or less than that of the construction phase.
Construction period		• Approximately 18-24 per project

It is important to note that the exact specifications of the proposed project components will only be determined during the detailed engineering phase prior to construction (subsequent to the issuing of an Environmental Authorisation (EA)), should such an authorisation be granted for the proposed projects, but that the information provided above is seen as the worst-case scenario. Figure 3 shows the project proposal as assessed in this report.

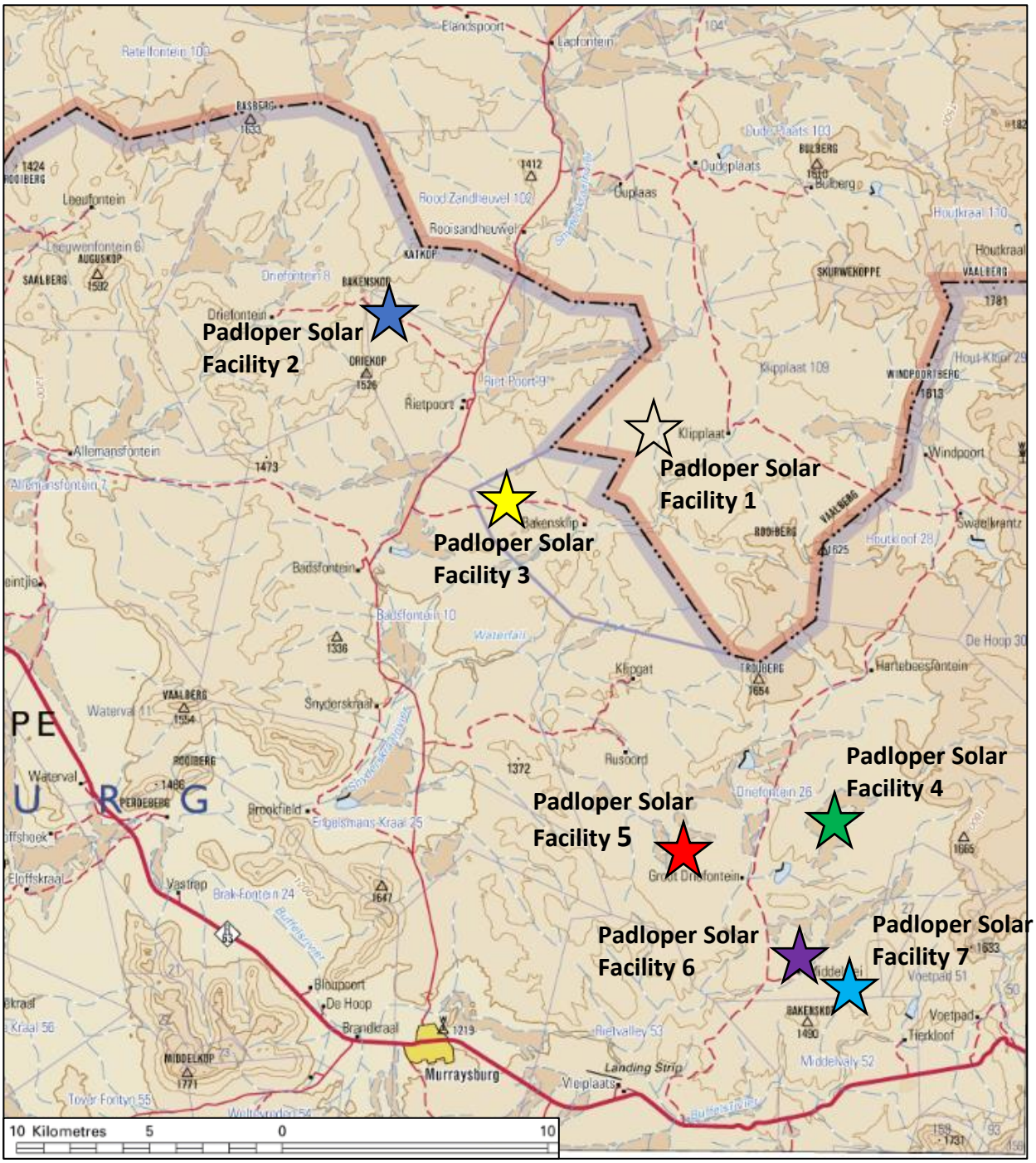


Figure 1: *Extract from 1:250 000 mapsheet 3122 showing the location of the Padloper Solar Facility 2 site (dark blue star). The locations of the other six facilities are shown for context.*

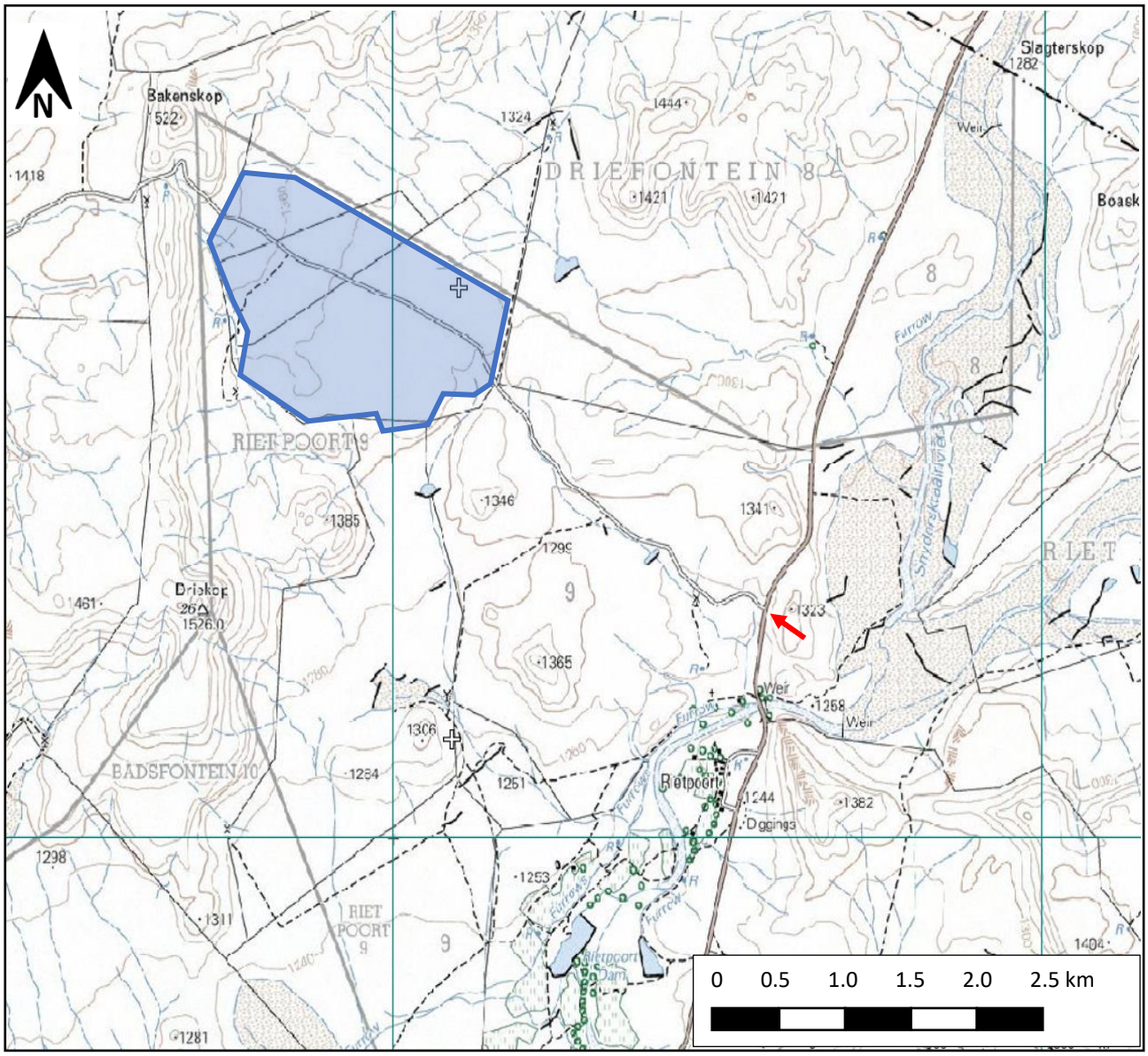


Figure 2: *Extract from 1:50 000 topographic map 3123DA, DB, DC & DD showing the location of the Padloper Solar Facility 2 site (blue polygon). The entrance to the proposed access road is marked by the red arrow. Source: Chief Directorate: National Geo-Spatial Information. Website: www.ngi.gov.za.*

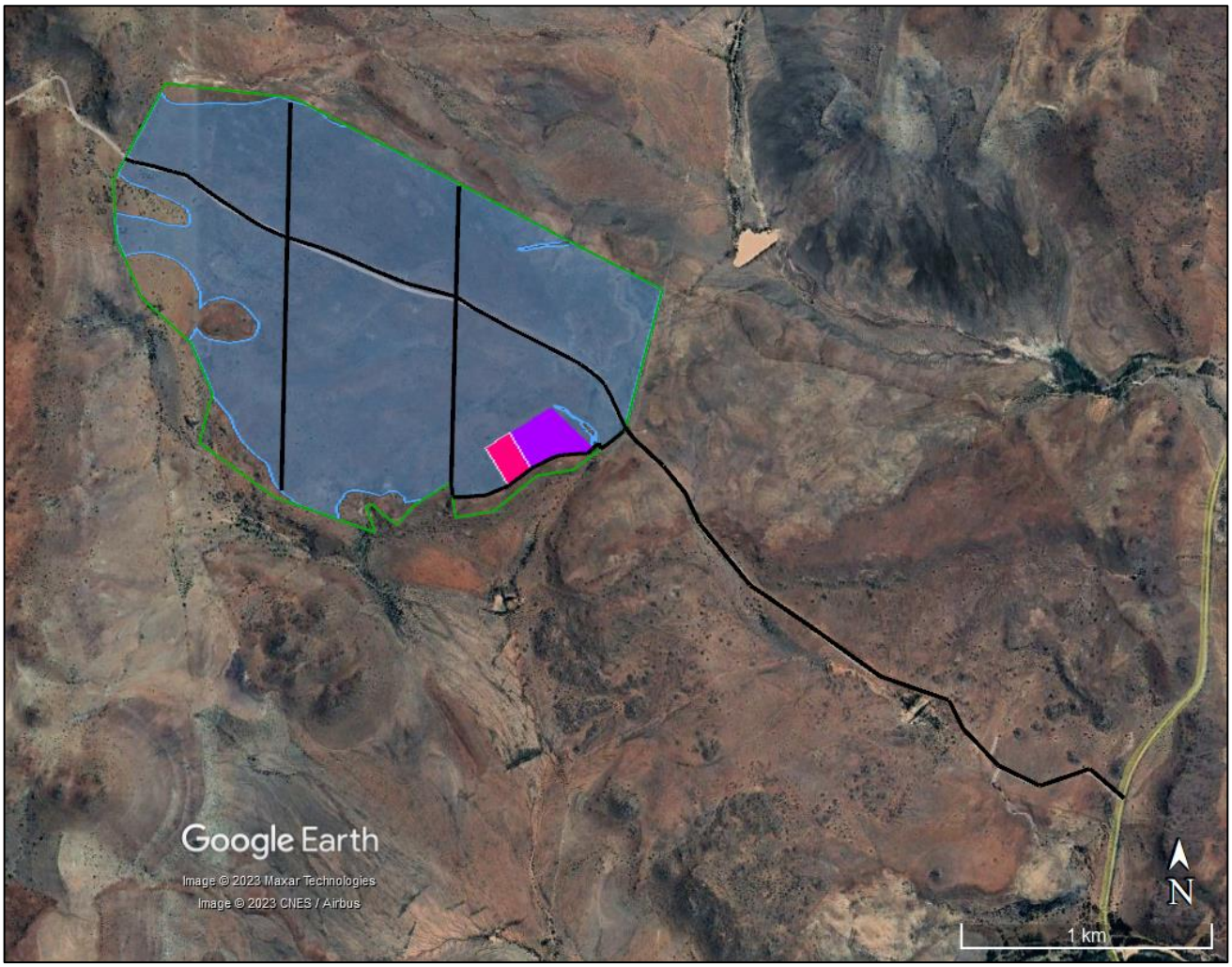


Figure 3: *Aerial view of the study area showing the Padloper Solar Facility 2 project layout. Black lines are access and internal roads, blue area is solar panels, purple block is the temporary laydown area, pink block is the facility substation complex, green polygon is the study area.*

1.1.2. Identification of alternatives

No alternative sites were considered. However, a preferred development area was provided for assessment with the final footprint within that area chosen based on sensitivities identified by the specialists. The final footprint was also designed following specialist inputs to reduce impacts.

1.1.3. Description of project aspects relevant to the heritage study

All aspects of the proposed development are relevant, since excavations for foundations may impact on archaeological and/or palaeontological remains, while the above-ground aspects create potential visual (contextual) impacts to the cultural landscape and any significant heritage sites that might be visually sensitive.

1.2. Terms of reference

ASHA Consulting was asked to do the following:

- Describe regional and local features of the receiving environment;

- Conduct a field survey to search for sensitive areas and sites of heritage significance;
- Map sensitive features;
- Assess (identify and rate) the potential impacts on the environment within a Heritage Impact Assessment (HIA) report;
- Identify relevant legislation and legal requirements; and
- Provide recommendations on possible mitigation measures, rehabilitation procedures, and management guidelines.

A Notification of Intent to Develop (NID) was submitted to HWC on 15 December 2022 and they responded on 21 February 2023 with the following comment:

RESPONSE TO NOTIFICATION OF INTENT TO DEVELOP: HERITAGE IMPACT ASSESSMENT REQUIRED
In terms of Section 38(8) of the National Heritage Resources Act (Act 25 of 1999) and the Western Cape Provincial Gazette 6061, Notice 298 of 2003

NOTIFICATION OF INTENT TO DEVELOP: PROPOSED SEVEN SOLAR PHOTOVOLTAIC (PV) FACILITIES WITH A CAPACITY OF BETWEEN 100 AND 350 MW EACH AND THE ASSOCIATED INFRASTRUCTURE, AND SEVEN ASSOCIATED 132 KV OVERHEAD POWER LINES LOCATED ON FARM 9, PORTIONS 2, 3 AND 7 OF FARM 26, MURRAYSBURG, SUBMITTED IN TERMS OF SECTION 38(1) OF THE NATIONAL HERITAGE RESOURCES ACT (ACT 25 OF 1999)

The matter above has reference: HWC22121416CM0209

Heritage Western Cape is in receipt of your application for the above matter received. This matter was discussed at the Heritage Officers Meeting held on 20th of February 2023.

You are hereby notified that, since there is reason to believe that the proposed seven Solar Photovoltaic (PV) Facilities with a capacity of between 100 and 350mw each and the associated infrastructure, and seven associated 132 kV overhead power lines on the farms; Rietpoort 9, PV4: Portion 3 of Driefontein 26, PV5: Portion 2 of Driefontein 26, PV6: Portion 7 of Driefontein 26, PV7: Portion 7 of Driefontein 26 in the Murraysburg District and PV3: Klipplaat 109 in the Richmond District, Beaufort West, Western Cape will impact on heritage resources, HWC requires that a Heritage Impact Assessment (HIA) that satisfies the provisions of Section 38(3) of the NHRA be submitted. Section 38(3) of the NHRA provides

*(3) The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): **Provided that the following must be included:***
(a) The identification and mapping of all heritage resources in the area affected;
(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;
(c) an assessment of the impact of the development on such heritage resources;
(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
(f) if heritage resources will be adversely affected by the proposed development, The consideration of alternatives; and
(g) plans for mitigation of any adverse effects during and after the completion of the proposed development.

(Our emphasis)
This HIA must in addition have specific reference to the following:
- Visual Impact Assessment on the cultural landscape
- Archaeological Impact Assessment
- Palaeontological Impact Assessment
- Cultural Landscape Assessment including that of the Built Environment

The HIA must have an overall assessment of the impacts to heritage resources which are not limited to the specific studies referenced above.

The required HIA must have an integrated set of recommendations.

The comments of relevant registered conservation bodies; all Interested and Affected parties; and the relevant Municipality must be requested and included in the HIA where provided. Proof of these requests must be supplied.

It must be noted that at the time of submission DFFE had granted permission for combined specialist reporting. This was subsequently changed to allow only certain projects to be combined but, for

simplicity, the heritage reports have been separated. All six PV projects therefore have the same case number, as do the powerlines.

1.3. Scope, purpose and objectives of the report

An HIA is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the requirements of the heritage authorities such that a comment can be issued by them for consideration by the National Department of Forestry and Fisheries and Environment (DFFE) who will review the Basic Assessment (BA) and grant or refuse authorisation. The HIA report will outline any management and/or mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

1.4. Details of specialist

This specialist assessment has been undertaken by Dr Jayson Orton of ASHA Consulting (Pty) Ltd. He has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting Heritage Impact Assessments and archaeological specialist studies in South Africa (primarily in the Western Cape and Northern Cape provinces) since 2004 (please see curriculum vitae included as Appendix 1). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is an accredited heritage practitioner with the Association of Professional Heritage Practitioners (APHP; Member #43) and also holds archaeological accreditation with the Association of Southern African Professional Archaeologists (ASAPA) CRM section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

A signed specialist statement of independence is included at the front of this specialist assessment.

2. LEGISLATIVE CONTEXT

2.1. National Heritage Resources Act (NHRA) No. 25 of 1999

The NHRA protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old as well as military remains more than 75 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: “any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith”;

- Palaeontological material: “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”;
- Archaeological material: a) “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”; b) “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”; c) “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 respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), 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”; and d) “features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found”;
- Grave: “means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place”; and
- Public monuments and memorials: “all monuments and memorials a) “erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government”; or b) “which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual.”

Section 3(3) describes the types of cultural significance that a place or object might have in order to be considered part of the national estate. These are as follows:

a) its importance in the community, or pattern of South Africa’s history;
b) its possession of uncommon, rare or endangered aspects of South Africa’s natural or cultural heritage;
c) its potential to yield information that will contribute to an understanding of South Africa’s natural or cultural heritage;
d) its importance in demonstrating the principal characteristics of a particular class of South Africa’s natural or cultural places or objects;
e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group;
f) its importance in demonstrating a high degree of creative or technical achievement at a particular period;
g) its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons;
h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa; and
i) sites of significance relating to the history of slavery in South Africa.

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list “historical settlements and townscapes” and “landscapes and natural features of cultural significance” as part of the National Estate. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes.

2.2. Approvals and permits

2.2.1. Assessment Phase

Section 38(8) of the NHRA states that if an impact assessment is required under any legislation other than the NHRA then it must include a heritage component that satisfies the requirements of S.38(3). Furthermore, the comments of the relevant heritage authority must be sought and considered by the consenting authority prior to the issuing of a decision. Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to a BA. The present report provides the heritage component. HWC is required to provide comment on the proposed project in order to facilitate final decision making by the National Department of Forestry, Fisheries and the Environment (DFFE).

2.2.2. Construction Phase

If archaeological or palaeontological mitigation is required prior to construction, then the appointed archaeologist or palaeontologist would need to obtain a Workplan Approval from HWC. This would be issued in their name. This is so that the heritage authority can ensure that the appointed practitioner has proposed an appropriate methodology that will result in the mitigation being done properly. A built environment permit, if required, would need to be obtained from the PHRA.

2.3. Guidelines

HWC have issued minimum standards documents for HIAs and specialist studies. There is also a Western Cape Provincial guideline for heritage specialists working in an EIA context and which is generally useful. The reporting has been prepared in accordance with these guidelines. The relevant documents are as follows:

- Heritage Western Cape. 2016. Grading: purpose and management implications.
- Heritage Western Cape. 2019. Public consultation guidelines.
- Heritage Western Cape. 2021. Guide for Minimum Standards for Archaeology and Palaeontology reports submitted to Heritage Western Cape.
- Heritage Western Cape. 2021. Notification of Intent to Develop, Heritage Impact Assessment, (Pre-Application) Basic Assessment Reports, Scoping Reports and Environmental Impact Assessments, Guidelines for submission to Heritage Western Cape.
- Winter, S. & Baumann, N. 2005. Guideline for involving heritage specialists in EIA processes: Edition 1. CSIR Report No ENV-S-C 2005 053 E. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

2.4. Application timeline

The application to DFFE under NEMA is currently in the pre-application phase with submission of the final Basic Assessment Report estimated to be in November 2023.

3. APPROACH AND METHODOLOGY

3.1. Literature survey and information sources

A survey of available literature was carried out to assess the general heritage context into which the development would be set. The information sources used in this report are presented in Table 1 with relevant dates of each source referenced in the text as needed. Data were also collected via a field survey. The data quality is suitable for the purpose of informing this report.

Table 1: *Information sources used in this assessment.*

Data / Information	Source	Date	Type	Description
Maps	Chief Directorate: National Geo-Spatial Information	Various	Spatial	Historical and current 1:50 000 topographic maps of the study area and immediate surrounds
Aerial photographs	Chief Directorate: National Geo-Spatial Information	Various	Spatial	Historical aerial photography of the study area and immediate surrounds
Aerial photographs	Google Earth	Various	Spatial	Recent and historical aerial photography of the study area and immediate surrounds
Cadastral data	Chief Directorate: National Geo-Spatial Information	Various	Survey diagrams	Historical and current survey diagrams, property survey and registration dates
Cadastral data	CapeFarmMapper (http://gis.elsenburg.com/apps/cfm/#)	Current	Spatial	Cadastral boundaries, extents and aerial photography
Background data	South African Heritage Resources Information System (SAHRIS)	Various	Reports	Previous impact assessments for any developments in the vicinity of the study area
Palaeontological sensitivity	South African Heritage Resources Information System (SAHRIS)	Current	Spatial	Map showing palaeontological sensitivity and required actions based on the sensitivity.
Background data	Books, journals, websites	Various	Books, journals, websites	Historical and current literature describing the study area and any relevant aspects of cultural heritage
Screening Tool maps	DFFE	Current	Spatial	Potential sensitivity of the study area

3.2. Field survey

The site was subjected to a detailed foot survey on 21 September 2022 by three archaeologists (Dr Jayson Orton, Steve van den Heever and Joseph Matembo). This was during spring but, in this dry area, the season makes no meaningful difference to vegetation covering and hence the ground visibility for the archaeological survey. Other heritage resources are not affected by seasonality. During the survey the positions of finds and survey tracks were recorded on a hand-held Garmin Global Positioning System (GPS) receiver set to the WGS84 datum (Figure 4). Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

It should be noted that the amount of time between the dates of the field inspection and final report do not materially affect the outcome of the report.

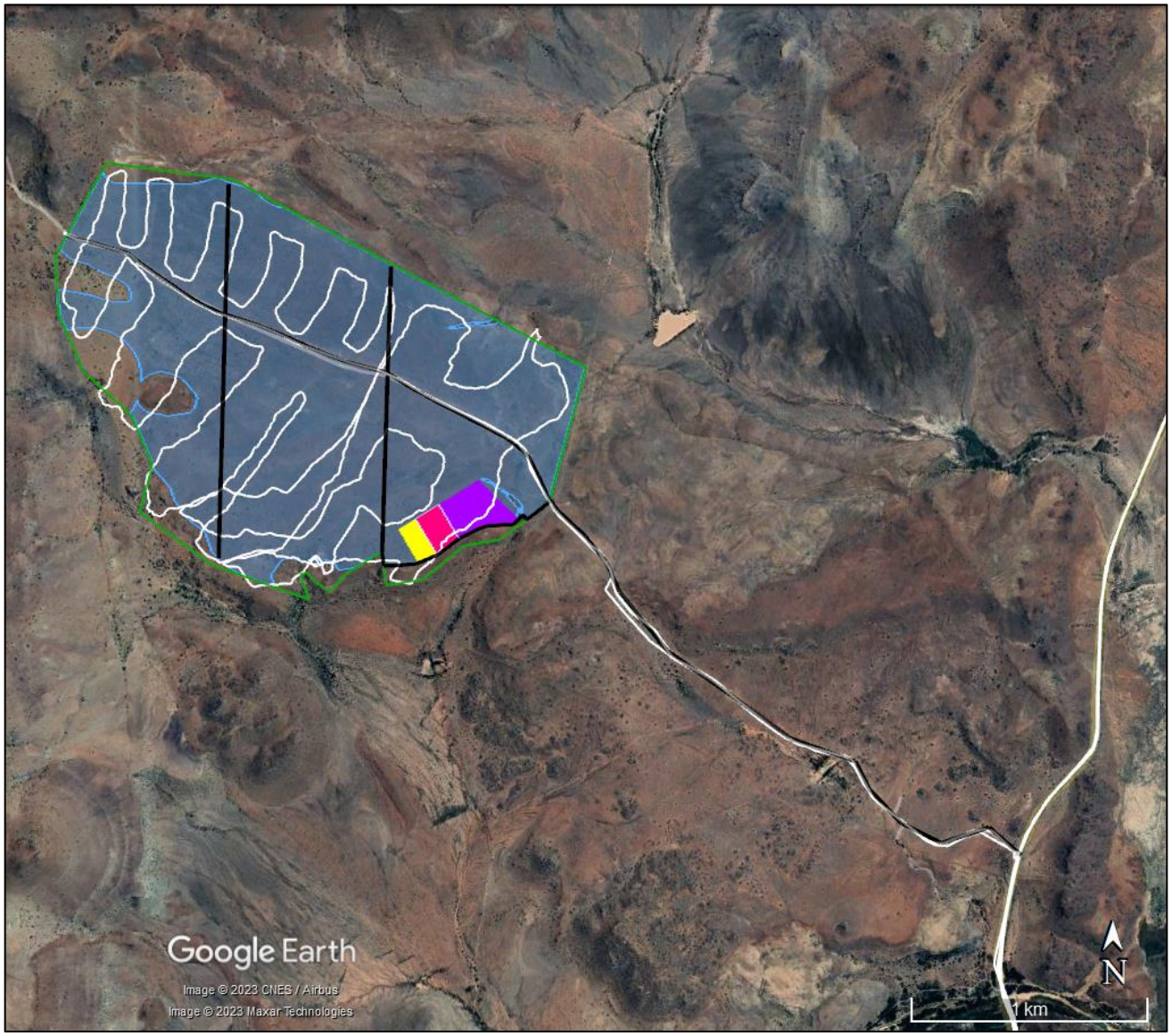


Figure 4: *Aerial view of the Padloper Solar Facility 2 study area (green polygon with buildable area in blue) showing the survey tracks (white lines).*

3.3. Specialist studies

As per the HWC request, specialist studies of archaeology, palaeontology, cultural landscape and visual impacts were carried out. While archaeology and cultural landscape are included within this report, the other two are appended in full and summarised within the present HIA.

3.4. Impact assessment

For consistency among specialist studies, the impact assessment was conducted through application of a methodology supplied by the CSIR.

3.5. Grading

Section 7 of the NHRA provides for the grading of heritage resources into those of National (Grade 1), Provincial (Grade 2) and Local (Grade 3) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade 1 and 2 resources are intended to be managed by the national and provincial heritage resources authorities, while Grade 3 resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance, but this is generally yet to happen. Heritage Western Cape (2016), however, uses a system in which resources of local significance are divided into Grade 3A, 3B and 3C. These approximately equate to high, medium and low local significance, while sites of very low or no significance (and generally not requiring mitigation or other interventions) are referred to as Not Conservation Worthy (NCW).

3.6. Assumptions, knowledge gaps and limitations

The field study was carried out at the surface only and hence any completely buried archaeological sites would not be readily located. Similarly, it is not always possible to determine the depth of archaeological material visible at the surface. The survey aimed to identify all obvious heritage resources and achieve a reasonably dense survey coverage. It is assumed that the findings would be indicative of the overall pattern on the landscape.

Cumulative impacts are difficult to assess due to the variable site conditions that would have been experienced in different areas and in different seasons. Survey quality is thus likely to be variable. As such, some assumptions need to be made in terms of what and how much heritage might be impacted by other developments in the broader area.

3.7. Consultation processes undertaken

The draft HIA was submitted to relevant interested and affected parties as required by HWC in their response to the NID application (Section 1.2). The report was also included in the main public participation process (PPP) required under NEMA as part of the BA.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site context

The suite of seven sites is in a very remote, rural area between 11 km and 26 km from Murraysburg and between 37 km and 57 km from Richmond. The area is accessed only by local gravel roads. The solar facility sites are all in a largely natural landscape with only occasional signs of livestock farming evident (fences, water tanks, tracks). The sites fall entirely within the Beaufort West Renewable Energy Development Zone (REDZ). Padloper Solar Facility 2 and Padloper Solar Facility 3 fall within the Central Electricity Grid Infrastructure (EGI) Corridor, Padloper Solar Facilities 5 to 7 fall within the Eastern EGI Corridor, and Padloper Solar Facility 4 falls on the edge of, but largely outside, the Eastern EGI Corridor (Figure 5).

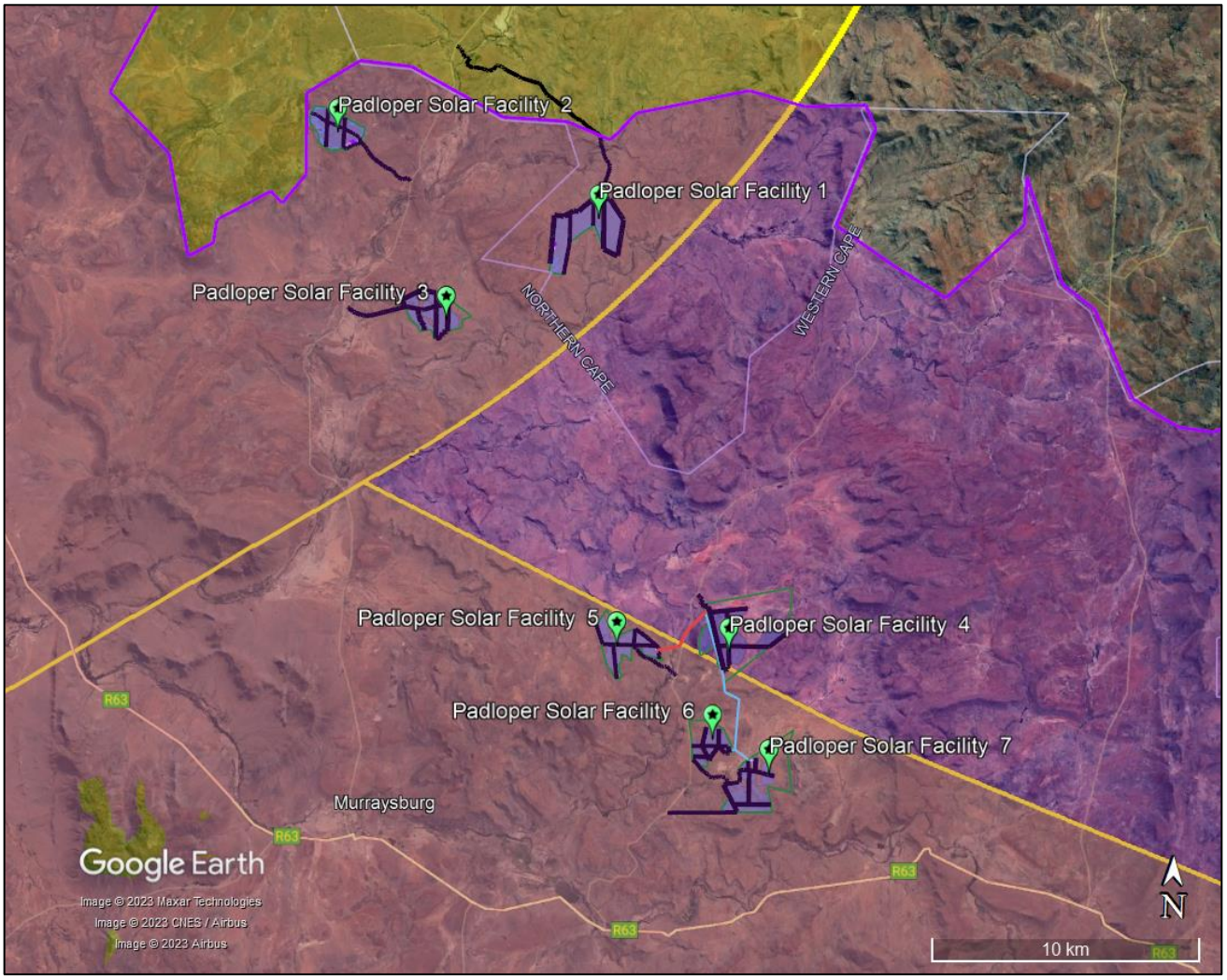


Figure 5: *Map showing the suite of seven Padloper solar projects to be within the Beaufort West REDZ (purple) and the Central and Eastern EGI Corridors (yellow). Note, however, that Padloper Solar Facility 4 only has a small section within the Eastern EGI Corridor.*

4.2. Site description

The access road to the PV site follows an existing farm track and winds gently uphill towards the PV site. The PV site itself lies on a flat, but gently sloping piece of land with a dolerite ridge immediately west of the site. There are few rock outcrops and the substrate is a mixture of sand and gravel, and low vegetation. Figures 6 to 11 show the nature of the study area, with specific features highlighted in the captions.



Figure 6: *View towards the east from the north-western edge of the Padloper Solar Facility 2 study area showing the flat, but gently sloping terrain with a gravel farm track running through the centre.*



Figure 7: *View towards the south through the eastern part of the Padloper Solar Facility 2 study area. The hills in the background are just outside the study area boundary.*



Figure 8: *View towards the southwest in the north-western part of the Padloper Solar Facility 2 study area showing dolerite rock outcrops in that area. The dolerite hill in the background is beyond the study area.*

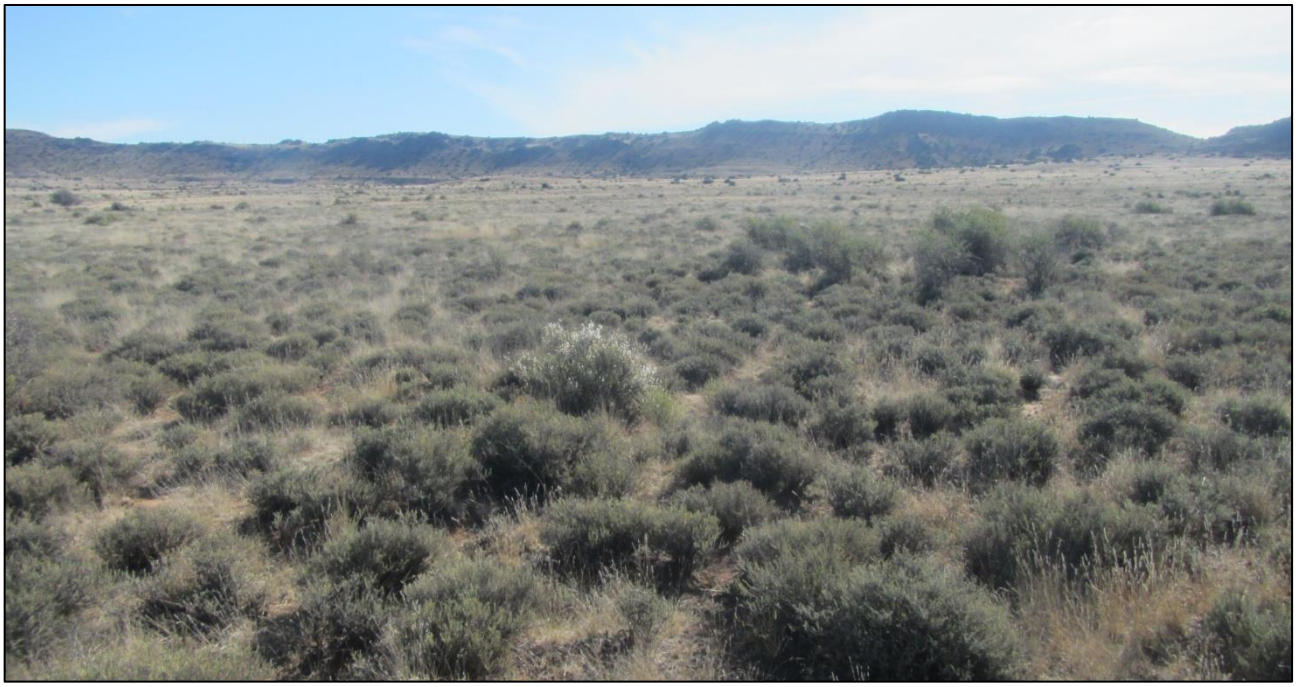


Figure 9: *View towards the west through the centre of the Padloper Solar Facility 2 study area showing the flat terrain. The study area extends towards the base of the ridge in the background.*



Figure 10: *View towards the north from the southern edge of the Padloper Solar Facility 2 study area.*



Figure 11: *View towards the northwest along a section of the access track in its eastern part.*

5. FINDINGS OF THE HERITAGE STUDY

This section describes the heritage resources recorded in the various study areas during the course of the project. For convenience, each of the six proposed PV developments is described separately.

5.1. Palaeontology

The SAHRIS Palaeosensitivity Map shows the Padloper Solar Facility 2 site to be of mostly zero palaeontological sensitivity (Figure 12). These areas overlie unfossiliferous dolerite but a small area of the site is of very high sensitivity. A specialist palaeontological study was commissioned and the findings are summarised here.

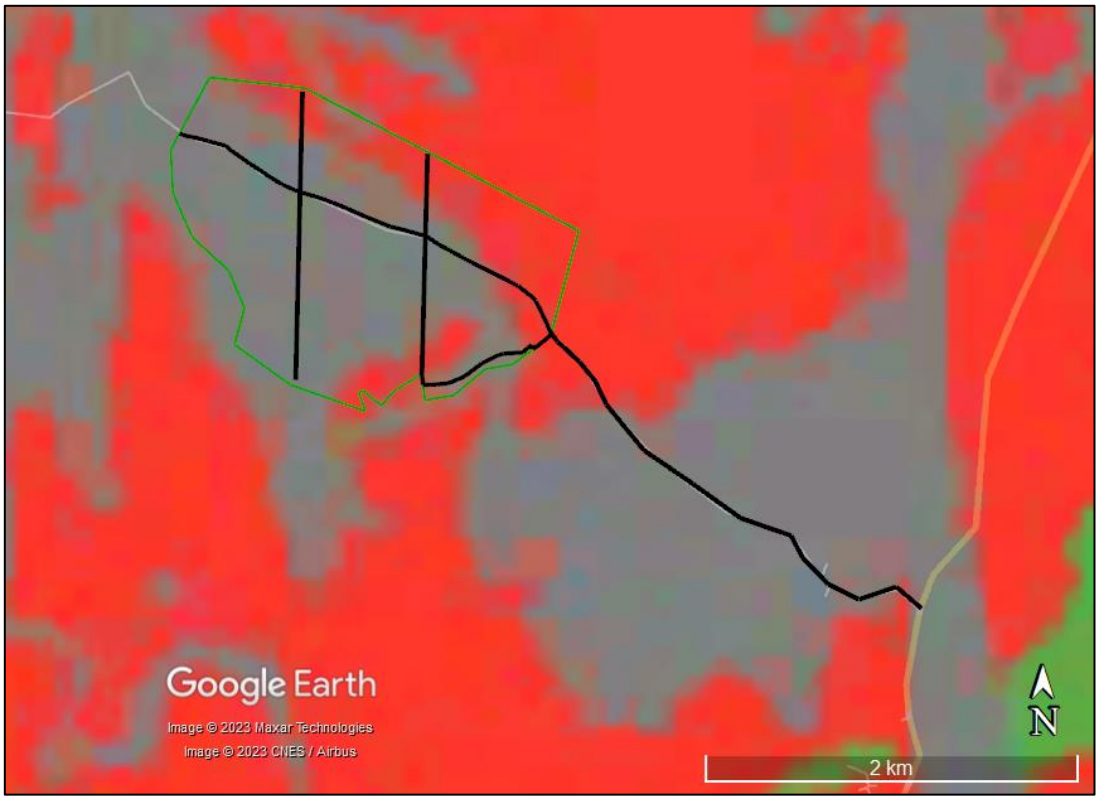


Figure 12: *Extract from the SAHRIS Palaeosensitivity Map showing the Padloper Solar Facility 2 site (green = project study area, black = project roads). Grey background colour is zero sensitivity, red is very high sensitivity.*

Butler (2023) notes that the Karoo geological deposits are well-known for the wealth of fossils that they contain. Her site visit, however, revealed no fossils of any sort. There is still a chance of fossils being present in the site, but the potential significance of impacts is expected to be low.

The lack of fossiliferous outcrops is no doubt partly due to the extensive covering of sand and silt that was evident across most of the study area.

5.2. Archaeology

5.2.1. Desktop study

The Karoo region has a long history going back to the Early Stone Age (ESA) as testified to by occasional diagnostic artefacts from this period (generally handaxes). Middle Stone Age (MSA) artefacts are generally the most commonly encountered stone age materials in the Karoo and are generally well patinated, indicating their great age. Later Stone Age (LSA) finds are less common but generally of higher significance because of their better contexts (Orton *et al.* 2016). The vast majority

of material tends to be what is referred to as background scatter. This can be defined as "widespread isolated artefacts whose distribution results from either primary or secondary causes" (Orton 2016:121). In this dry landscape, LSA archaeological sites are well-known to be focused most strongly on water sources, but dolerite and other rock outcrops, which offer opportunities for shelter and a vantage point to watch for potential prey, are also commonly occupied landscape features. The dolerite also offered surfaces on which to do rock engravings, while small sandstone shelters were sometimes painted. This pattern is well demonstrated by surveys in the wider area (Binneman *et al.* 2011; Halkett 2014; Hart 2016; Orton 2012, 2021a, 2021b, 2021c, 2021d, 2022a, 2022b). Most sites are scatters of stone artefacts, often accompanied by ostrich eggshell fragments and sometimes pottery, but some include fragments of bone and, rarely, archaeological deposits. The latter would normally be found in rock shelters but, due to the nature of the local geology, overhangs are rare. Rock shelters form in sandstone bands, but the rock outcrops in the vicinity of the present study area are mostly of dolerite.

Some distance to the southwest, near Three Sisters, Binneman *et al.* (2011) found MSA and LSA artefacts in various places. Pottery was seen at one LSA site, but ostrich eggshell fragments were more commonly associated with these sites, including some painted rock shelters. The Seacow River Valley, lying some 40 to 140 km east and northeast of the current study area, is one of the best studied parts of South Africa. There, Sampson (1984, 2010; Sampson *et al.* 2015) recorded vast numbers of Stone Age sites with many of them being Khoekhoe sites, including kraals. ESA and MSA sites were also found to occur. Hart's (2016) study immediately southeast of the present study area located many LSA sites but found ESA and MSA occurrences to be very rare. The LSA sites were mostly stone artefact scatters but some included pottery. A few circular stone-walled features were also recorded. Working in the present study area, Halkett (2014) also documented a number of LSA sites, many containing retouched tools and some with pottery. Near Murraysburg, Tusenius (2012) found background scatters of LSA materials in one area and a background scatter of mixed age materials including an ESA handaxe in another (Tusenius 2015). Nearby, Kaplan (2007) found a scatter of LSA artefacts with occasional MSA artefacts in between. Deacon (2007) worked along the N1 to the west and found background scatter artefacts pertaining to the MSA and LSA and also scratched engravings that he supposed to be from the 20th century. They included a horse and rider and an ostrich. Such engravings are relatively common in the central Karoo having been recorded between Three Sisters and Beaufort West (Orton 2010) and also – in very large numbers – some 140 km west of the study area (Orton 2022b). Morris (1988) has reviewed these recent engravings and notes that they have been attributed by Battiss (1948) to Europeans and Griquas and by Fock (1979) to 'Hottentots'. Morris (1988) suggests that some were almost certainly made by early Baster and Trekboer immigrants and that the tradition continued into the 20th century. He also notes the inclusion of wagons and human figures in western clothing.

LSA rock art sites occur in low density through the wider area, and include painted and engraved 'geometric tradition' sites as well as painted and engraved 'fine line' tradition sites (Binneman *et al.* 2011; Halkett 2014; Hart 2016; Orton 2021a, 2021b, 2021c, 2021d, 2022a, 2022b, in prep.). One of Hart's (2016) sites was considered as being of provincial significance due to the layering of painted imagery on the shelter wall and the very unusual inclusion of engravings on the same surface. Hart (2016) considered it likely that hundreds, if not thousands, of rock art sites occurred in his large study area. Most of those he recorded were engravings on dolerite outcrops with many of them being heavily patinated. However, younger images extending into the recent historical past were also documented. A similar pattern was found to pertain in the present study area by Halkett (2014), but he only found one rock painting which was a small shelter with red finger smears on its back wall. He notes that engravings were commonly found on suitable dolerite surfaces with most being scratched

designs. Morris (2006) notes the existence of another rock painting site nearby as do Malherbe *et al.* (2011). Parkington *et al.* (2008) have documented many engravings in the Karoo region. They do not map their work but do provide a historical map of engraving distribution which shows the densest concentration being well to the north around the Kimberley region.

An interesting aspect of Karoo archaeology is rock gongs. These are (usually) dolerite rocks that are naturally perched in such a way that when struck they release a ringing musical note. The gongs are identified by heavily worn patches where they have been repeatedly struck. Parkington *et al.* (2008) have studied a number of gongs from Nelspoort and Vosburg, 70 km to the southwest and 140 km northwest of the present study area respectively, while Orton (2021b) recorded two further examples in the Nuweveld about 120 km to the west of Murraysburg. Both of the latter were surrounded by extensive stone artefact scatters indicating occupation of the area.

Historical stone-walled kraals and features are known to occur in the general area (Binneman *et al.* 2011; Gribble 2020; Halkett 2014; Hart 2016; Orton 2021a, 2021b, 2021c, 2021d, 2022a, 2022b; Tusenius 2012). These are likely mostly from the 19th century and represent the material remains of the early European farmers in the area. Such features are usually associated with variable density scatters of historical materials such as glass, ceramics and metal items. A large concentration of such material was recorded in the middle of the present study area at the old farmstead of Driefontein.

5.2.2. Site visit

Finds from the survey are listed in Table 2 with their locations mapped in Figure 13.

Table 2: *List of finds from the heritage survey of the Padloper Solar Facility 2 study area.*

Waypoint	Location	Description	Significance Grade
220	S31 43 33.2 E23 44 51.8	A smoothed/ground area on a flat dolerite outcrop.	Very low NCW
221	S31 43 32.9 E23 44 50.4	A smoothed/ground area on a flat dolerite outcrop.	Very low NCW
222	S31 43 34.3 E23 44 52.6	A patch of smoothed rock with faint well-patinated cross-hatching scratched onto it. A second area of similar smoothing and hatching but with a different, and slightly more prominent, design occurs about 60 cm away.	Medium IIIB
223	S31 43 25.8 E23 45 07.3	An ephemeral scatter of LSA artefacts in hornfels and some ostrich eggshell fragments. They are on the east side of a large bush.	Very low NCW

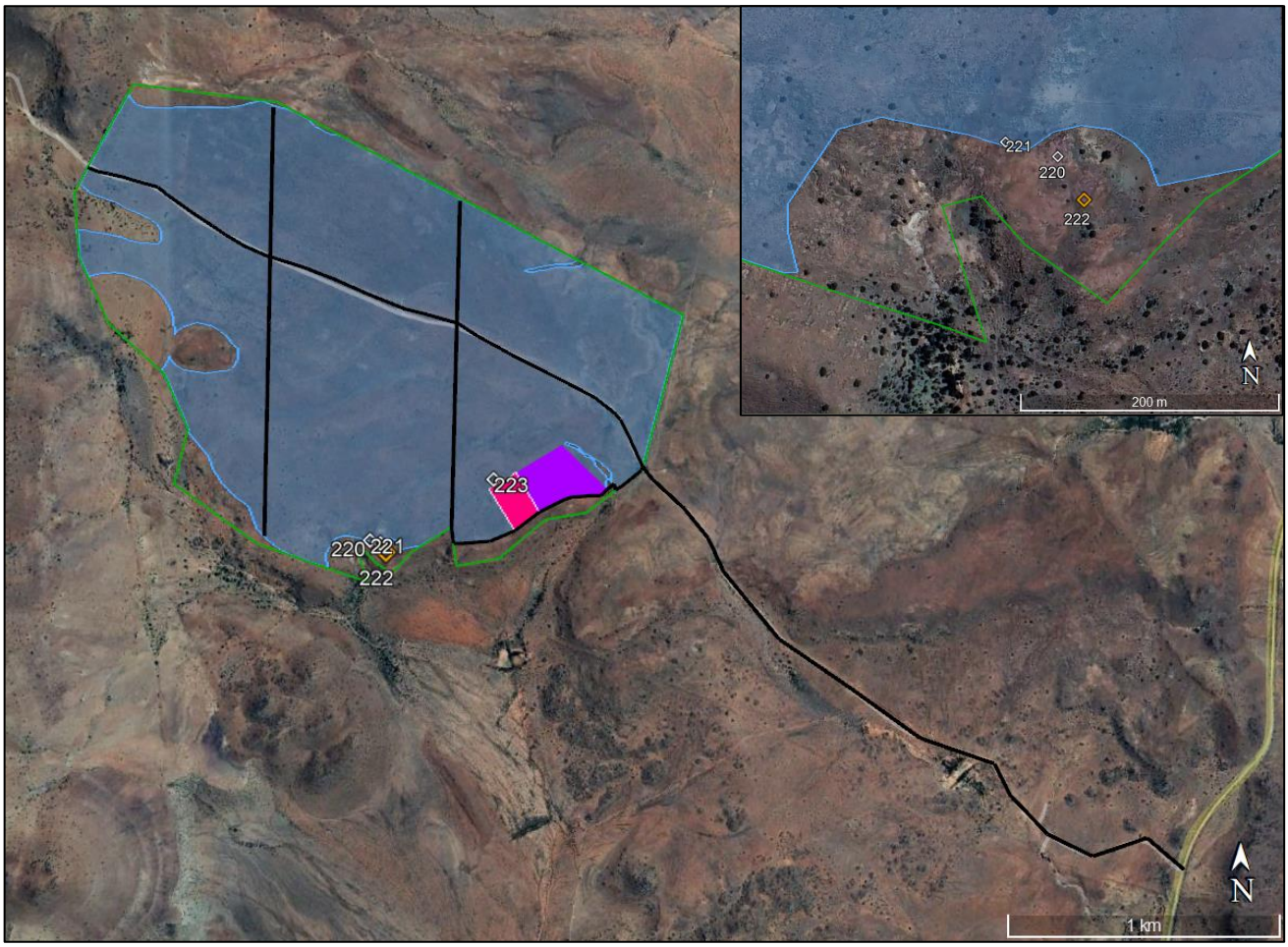


Figure 13: *Map showing the distribution of finds from the survey in the Padloper Solar Facility 2 study area. Orange symbol = Grade IIIB, white = NCW.*

One ephemeral scatter of LSA stone artefacts and ostrich eggshell fragments was seen at waypoint 223 in the PV study area but there were far too few artefacts present to derive any meaningful information from the site. Along the southern edge of the study area the land falls away to the south. The edge of the high-lying ground has an area of exposed dolerite on which several smoothed patches were seen (waypoints 220 to 222). At waypoint 222 there were two separate patches of smoothed rock, both of which had scratched/engraved cross-hatching on them (Figure 14). One of the patches was more heavily smoothed (Figures 15 & 16). The cross-hatched design on the second was clearer owing to the minimal smoothing (Figures 17 & 18). It is possible that the smoothing was done after the cross-hatching.



Figure 14: *View of the dolerite bedrock outcrop with the smoothed and engraved patch in mid-picture (waypoint 222).*



Figure 15: *The first smoothed patch on a dolerite outcrop at waypoint 222 with a faint grid design scratched onto it.*



Figure 16: *Close-up of the first smoothed and engraved patch at waypoint 222.*



Figure 17: *The second engraved patch at waypoint 222 which is less smoothed.*



Figure 18: *Close up of the second engraved patch at waypoint 222.*

5.3. Graves

No graves were seen anywhere in the study area, but it is likely that some farm graves would be present near the farmsteads in the area. The chance of unmarked graves being present within the proposed footprint is extremely low because of the rocky nature of the substrate.

5.4. Historical aspects and the Built environment

5.4.1. Desktop study

During the mid-18th century the first trekboers from the Cape made their way to the vicinity of the Sneeuberg and found the grazing to be excellent. They were granted loan farms there and very soon came into conflict with the Bushmen who were living in the area. The Bushmen started killing shepherds in the veld, attacking farms and stealing livestock. Malherbe *et al.* (2011) note that in the two and a half years from July 1786 to December 1788 the Bushmen killed 107 shepherds and stole 17 970 small stock and 6299 large stock. In addition, 99 horses were stolen or killed. The solution arrived at by the Dutch East India Company was to eliminate the Bushmen and between 1786 and 1795 at least 2500 were killed and another 600 captured.

Livestock farming drove the local economy with wool becoming a major product in the early 1800s.

The parish of Richmond was formed in 1843 with Graaff Reinett the next closest. To reduce travel distances, a new town was needed in between and Murraysburg was founded in 1855 on the farm Eenzaamheid. The name Murraysburg derives from Reverend Andrew Murray of Graaff-Reinet and Barend Burger. The proceeds of the plots sold in 1855 were used to build a church and parsonage. An unusual requirement in the sale of the plots was that the new owners were required to plant

quince hedges around their boundaries (Fransen 2004). Schoeman (2013) notes that after the Dutch Reformed Church bought Eenzaamheid in 1855 the town remained church property until 1949 when it was bought by the divisional council which had already been established by 1895. Fransen (2004) lists several significant structures in the town, but only two in the surrounding areas – these are to the east and southeast.

During the Anglo-Boer War Murraysburg was the only town in the Cape Colony that had too few men to form a town guard. As a result Boer Commandos roamed the area freely and burned down several buildings in July 1901 (Schoeman 2013). There does not appear to have been any significant war action in the vicinity of Murraysburg.

5.4.2. Site visit

No historical resources were found anywhere close to the PV study area or its proposed access road.

5.5. Cultural landscapes and scenic routes

The term "Cultural Landscape "unites the products of so-called 'natural' ecological processes and phenomena on the one hand, and the products emerging from the processes of transformation of the 'natural' site by people in constructing their 'built' world, on the other. Any area consists of many sites, most of which have been inhabited by people for thousands of years. These places have been moulded, shaped and changed both by natural processes and by people engaged in adapting the environment to their pursuits. Cultural landscapes are what one generation inherits from another: in them are embedded values held dear by those gone by.

The significance of the landscape reflects not just the sum of the individual parts, but rather landscapes as an integral whole. It is the nature of the relationship between features, and between these features and the broader landscape setting (context) that is important. What is also important is an understanding about how these landscapes have been produced. In other words, it is essential that the physical informants and historical events that have given structure and form to the landscape features are understood and appropriately interpreted with regard to heritage significance.

The broader landscape in which the suite of solar facilities would be situated is largely natural, but with enclaves of rural/agricultural character at all the farmsteads where human interventions are evident. The land is largely used for livestock rearing with agriculture only practiced along the rivers where wider floodplains occur. The farmsteads tend to also be close to these areas. Elsewhere, the only signs of human activity in the landscape are occasional farm tracks, farm fences, wind pumps, small reservoirs and, along the rivers, flood irrigation infrastructure.

According to the Terrestrial Biodiversity and Species Specialist Impact Assessment (Colloty 2023), the 3 sites are situated within the Eastern Upper Karoo (NKu 4) vegetation unit. This unit is considered Least Concern from a conservation status and is characterised by low lying areas separated by a higher lying plateaus and/or inselbergs (koppies). The higher lying areas also contain several areas with rocky outcrops, ridges and or cliffs. While the sites are largely untransformed, current impacts are localised due to grazing and the presence of previously cultivated areas near homesteads and the current road and tracks found. The naturally occurring ridges and outcrops provide certain microclimates for unique species, increasing their conservation status. Along with Aquatic habitats along water courses and rivers, these habitats or corridors associated with these habitats, were

mapped (Colloty 2023) as No-Go areas, as they provide habitat variability and unique species assemblages when compared to the grassland areas.

A key aspect of the cultural landscape to consider is the fact that the wider study area falls within a REDZ and two EGI corridors (see Section 4 above) and has approvals in place for wind energy facilities (WEFs; see Section 8.4 below). The REDZs were delineated following a Strategic Environmental Assessment process and are thus landscapes in which the presence of renewable energy facilities is generally acceptable and to be expected.

The Padloper Solar Facility 2 is proposed on a high-lying, flat plateau (Figures 19 and 20). It is at least 2.3 km from the nearest public road which means it will only be minimally visible in the landscape, and only edge-on because it will be at an elevation some 60 m higher than the road. As such, the facility should not result in a high degree of change to the local sense of place, although, importantly, it is noted that the substation (which is the highest part of the facility) is proposed near the edge of the escarpment and could be reasonably prominently visible, though still quite far away. The facility will generally not be highly prominent in the landscape because of the lack of publicly accessible top-down views and the generally undulating nature of the wider area. According to Mucina and Rutherford (2006), the most extensive vegetation type occurring in the study area is Eastern Upper Karoo, interspersed with scattered patches of Upper Karoo Hardeveld. The Vegetation cover across the study area is predominantly short and sparse and thus will not provide any significant visual screening.

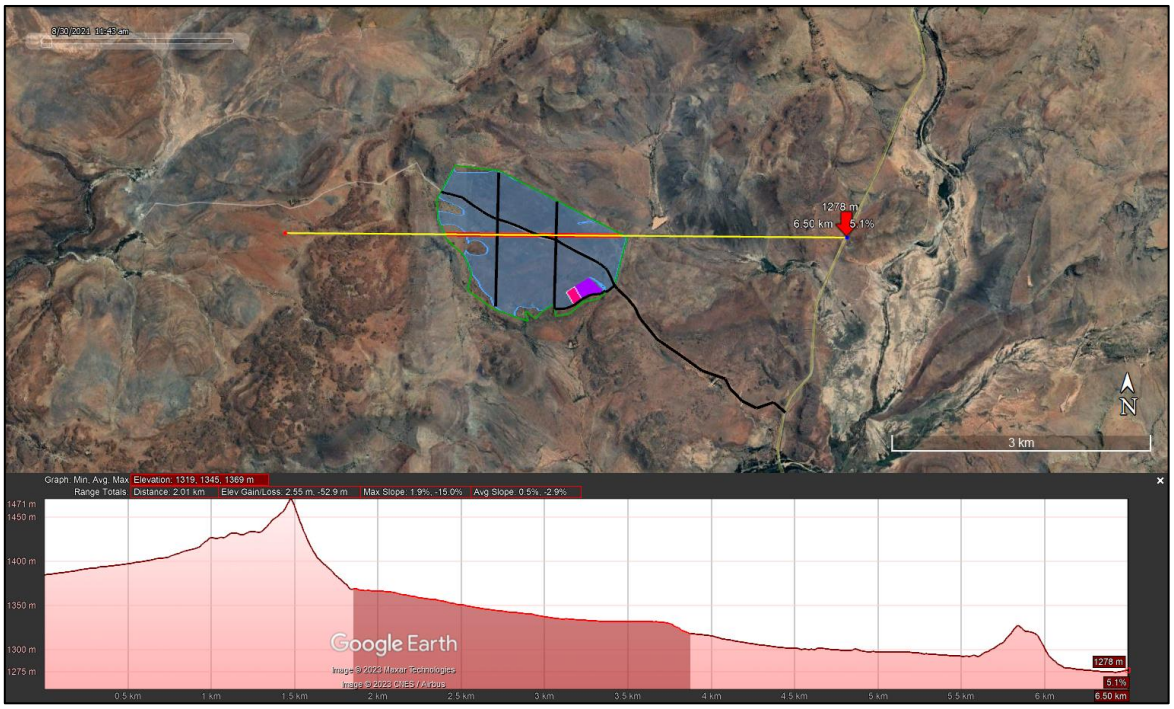


Figure 19: *West to east cross-section through the Padloper Solar Facility 2 site. The red shading on the cross-section shows the location of the facility. The red arrow is at the public road.*

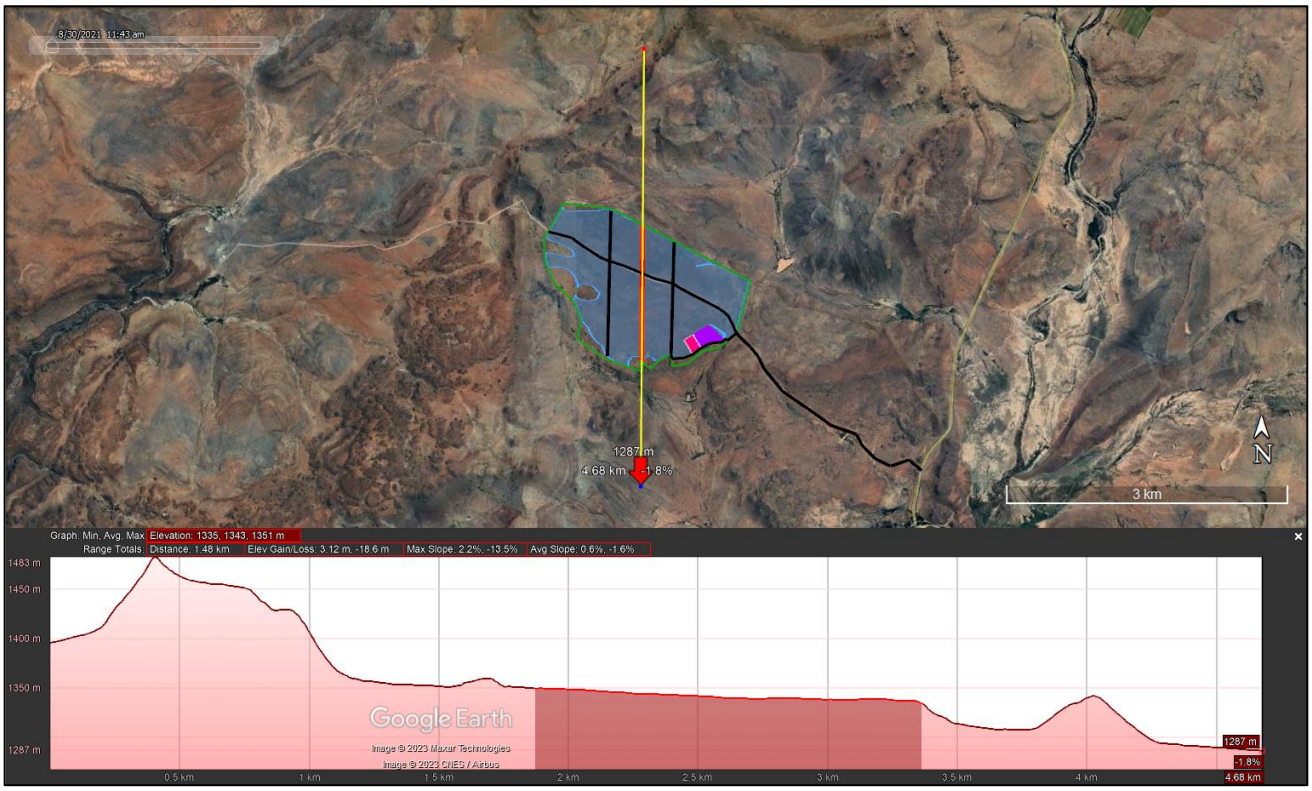


Figure 20: *North to south cross-section through the Padloper Solar Facility 2 site. The red shading on the cross-section shows the location of the facility.*

At its closest point, the proposed Padloper Solar Facility 2 site lies 2.8 km from the Rietpoort farmstead which contains heritage structures (Figure 21). The farmstead is within a wide, shallow valley and falls within an area that would be moderately visually exposed to the solar facility. However, because the facility will be on higher ground, and there are limited trails to this area, the landscape context of the farmstead is unlikely to be much compromised by the presence of the solar facility. However, the effect of lighting at night should be considered, as this could adversely impact on the value placed on the night sky by local residents and visitors.

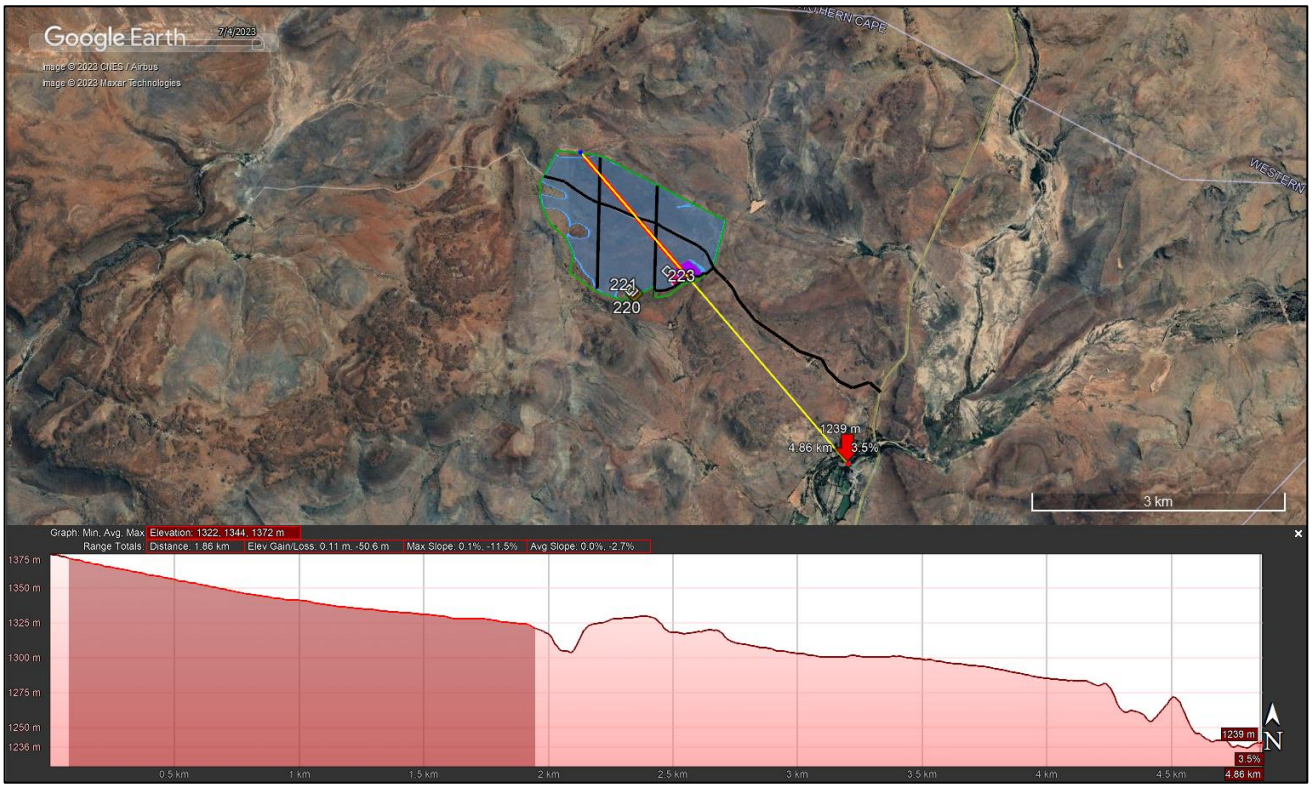


Figure 21: *Aerial view and cross-section showing the location of the nearest historical structure in the landscape (at the red arrow). The dark shaded area in the section is the location of the proposed Padloper Solar Facility 2.*

Aside from archaeological materials, the only anthropogenic traces on the site itself are tracks and fences.

It is noted that farmsteads are scattered throughout the wider area (and indeed the entire Karoo region) and almost always contain historical structures. The next nearest historical structure to the Padloper Solar Facility 2 study area lies some 4.9 km to the northwest (this is the Rooisandheuwel farmstead), but it will be completely shielded from view of the facility due to screening by topography. There are no tourism facilities in the immediate study area. The nearest – from an online search – is some 7.5 km south of the Padloper Solar Facility 2 site.

The broader landscape is generally quite scenic, but, despite the distinctive dolerite hills that occur, is not unique because the escarpment and its foothills occur in an extensive swathe across the wider area. Towards the west, in the vicinity of Beaufort West, the escarpment is substantially more dramatic with cliffs and steeper topography. The area around Murraysburg does not feature cliffs, but patches of exposed rock do occur on the hills in places.

The physical nature of the landscape is shown in Figures 6 to 11 and it is evident that the PV study area itself is virtually entirely natural in character with its cultural significance limited to its visual amenity. In this regard, the visual resources study by Winter and Oberholzer (2013) identifies no significant resources in the vicinity of the study area. The only significant features they note are in the steeper mountains to the south and southwest with one small area to the northwest (Figure 20).

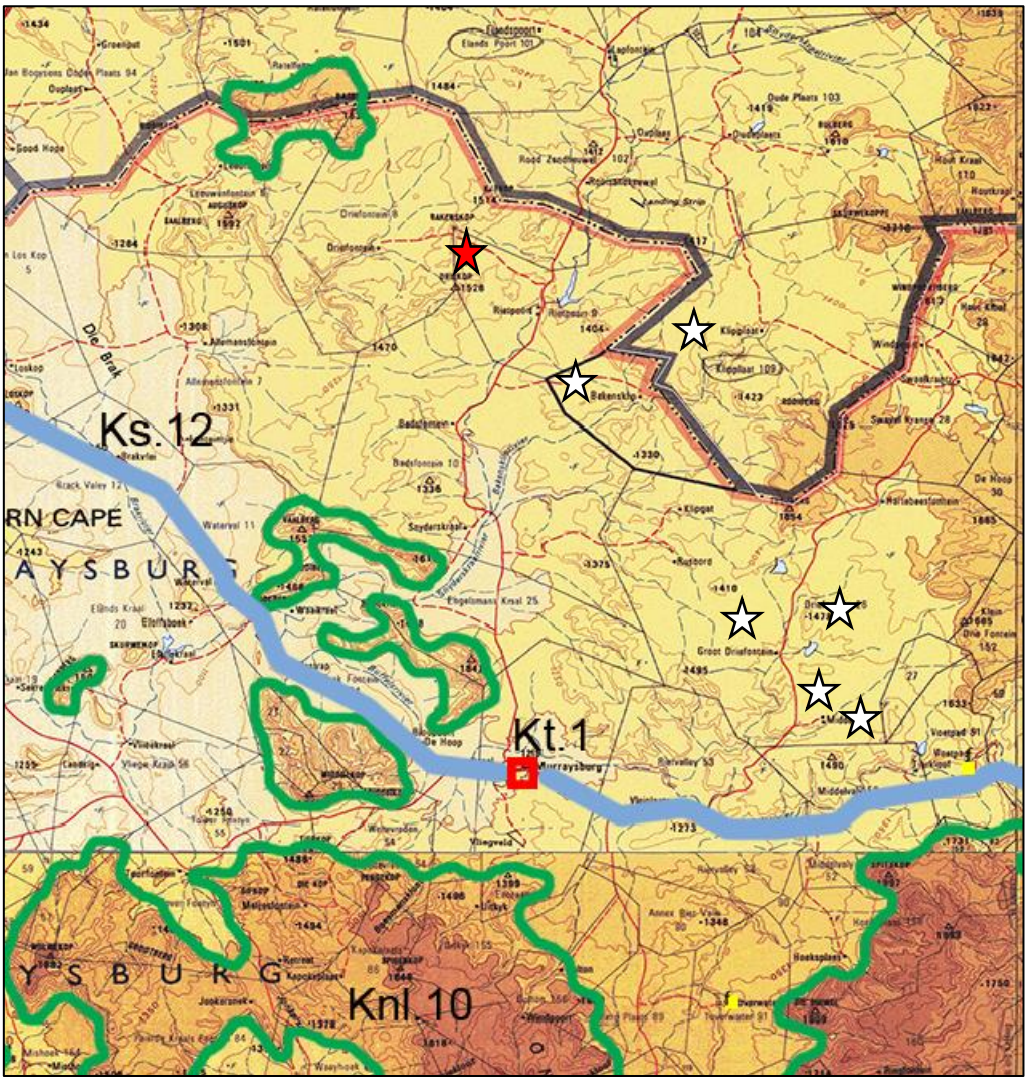


Figure 20: *Map showing significant scenic resources identified by Winter and Oberholzer relative to the study area (red star). Source of map: Winter & Oberholzer (2013).*

Due to the remoteness of the area and very low density of human habitation, sources of light pollution are rare. This means that the night-time landscape will be dark with picturesque, star-filled skies predominating.

The R63 that runs well to the southwest (minimum 18.5 km) of the PV study area can be regarded as a scenic route, and was indeed identified as such by Winter and Oberholzer (2013). Due to distance and topography, the facility will not be visible from the R63. The local gravel roads linking Murraysburg and Richmond, and from one of which the proposed PV site can be accessed, are not well enough travelled to be accorded the same status as scenic routes. Schwartz (2023) sees them as only local access routes with no scenic or tourism potential. Owing to topography, the PV site is only likely to be minimally visible from one of these roads. This is confirmed by the viewshed map discussed below.

An important part of the landscape assessment is that the area has already been approved for inclusion within the Beaufort West REDZ (see Section 4.1). As such, renewable energy facilities should be expected within the area. Importantly, the project lies within the boundary of an already approved wind energy facility (WEF). Another wind project has also been approved just to the southeast (Figure

21). WEFs are substantially more visible in the landscape and, should they be constructed, they will dominate the local environment. The concentration of renewable energy facilities in the REDZs is desirable, as this avoids a low density proliferation of such facilities that might otherwise occur across the wider landscape. Importantly, unless visual mitigation is strictly controlled, light pollution will become an issue at night. The red aviation warning lights on the top of wind turbines are a particular concern in this regard and would transform and pollute the night-time landscape.

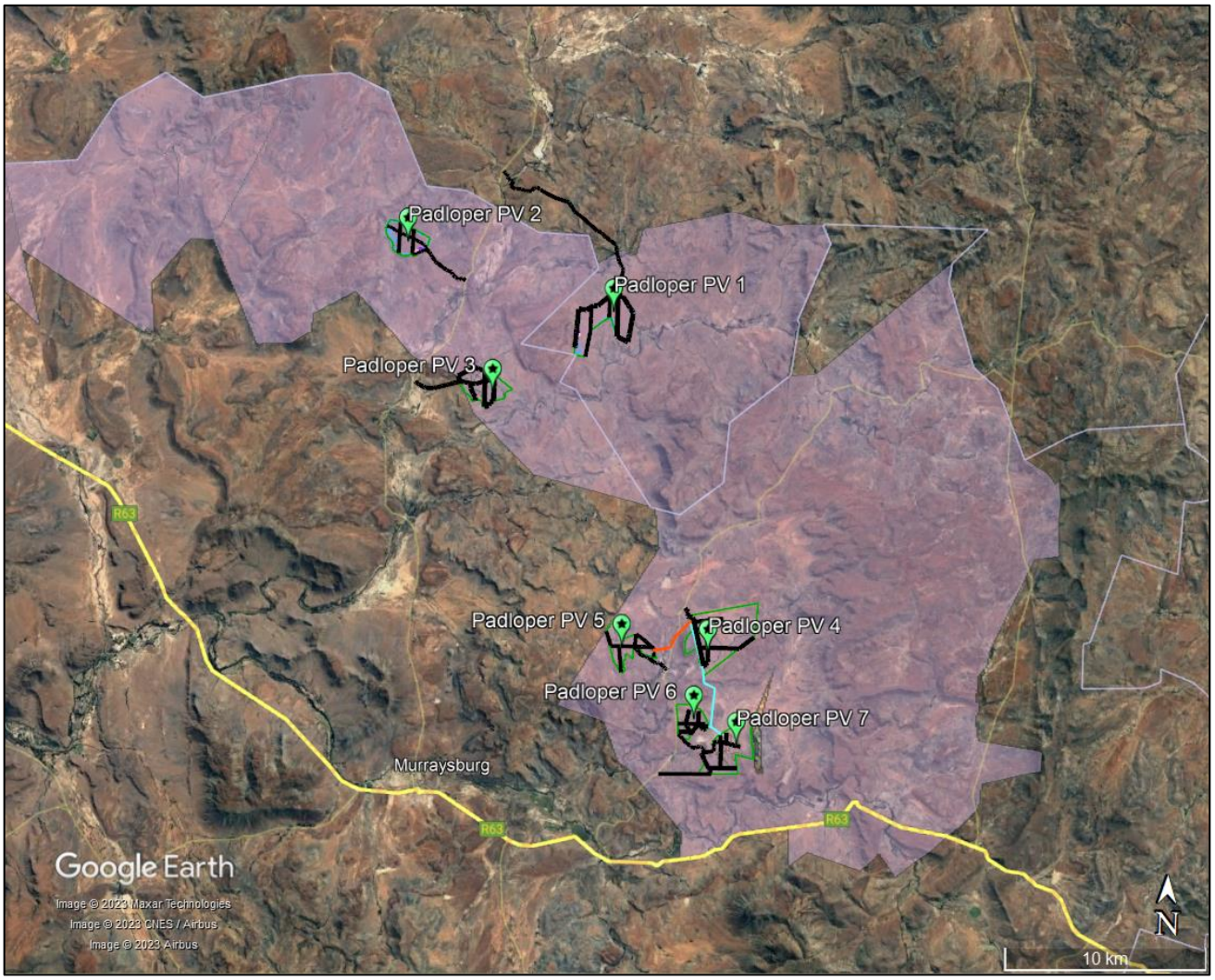


Figure 21: *Aerial view showing the seven proposed Padloper SEF projects relative to the land on which WEFs have been approved (pink shading).*

5.6. Visual impact assessment

The visual specialist notes the wider landscape to be undulating with distinctive hills and koppies in places (Schwartz 2023). The topography affects views in the landscape with longer views only available from higher-lying areas. Similarly, objects in the landscape have their visibility affected by topography with objects at high elevations being far more visible than objects in valleys and on enclosed plateaus. Agricultural lands are noted to be very sparse due to the climate, with natural vegetation present throughout most of the wider area. Farmsteads are widely spaced, and livestock density is low. Human transformation and visual degradation of the landscape is noted to be minimal. These factors result in the particular sense of place of the area. Schwartz (2023) sees the wider study area as being part of the wider Karoo landscape of western and central South Africa.

Despite the topography, Schwartz (2023) rates the visual absorption capacity of the wider area as low due to the lack of screening vegetation on the landscape. Figure 22 shows the viewshed map created for Padloper Solar Facility 2. Schwartz (2023) notes that identified sensitive and potentially sensitive visual receptors will not be able to see the facility. However, on site, the land cover is shrubland and construction of the facility would significantly alter the character of the site.

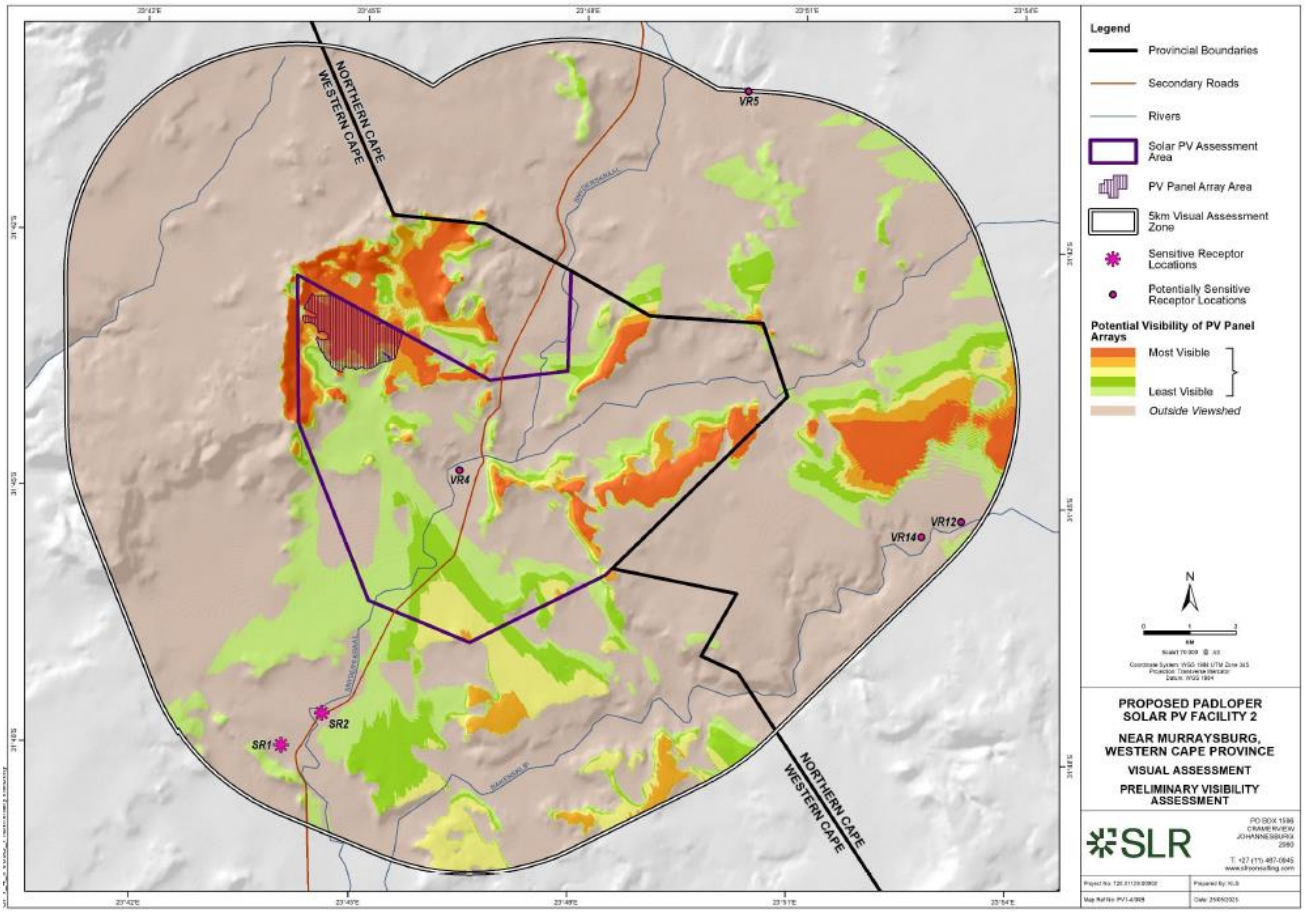


Figure 22: *Viewshed map for the Padloper Solar Facility 2. Source: Schwartz (2023).*

5.7. Statement of significance and provisional grading

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ‘‘cultural significance’’ means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance. The reasons that a place may have cultural significance are outlined in Section 3(3) of the NHRA (see Section 2 above).

The palaeontological study did not locate any fossils, largely because of the unconsolidated deposits mantling the bedrock. However, fossils are known to occur in the general area and, because of the high sensitivity of the geology, there is a strong possibility that fossils will still be present in the study area. The cultural significance of any such fossils is unknown, but most finds from the area would likely be graded IIIC, or possibly IIIB.

Archaeological resources were sparse with just one being graded above NCW. This one was considered to have medium cultural significance for its aesthetic and scientific values and is allocated a grade of IIIB.

Graves are deemed to have high cultural significance at the local level for their social value. None are currently known from the study area but it is possible that graves could occur in the wider landscape. They would be allocated a grade of IIIA.

The cultural landscape is largely a natural landscape with aesthetic value and is rated as having medium cultural significance at the local level. It can be graded IIIB.

Figure 22 provides a grade map of the study area. Sites graded NCW are omitted from the map for the sake of clarity.

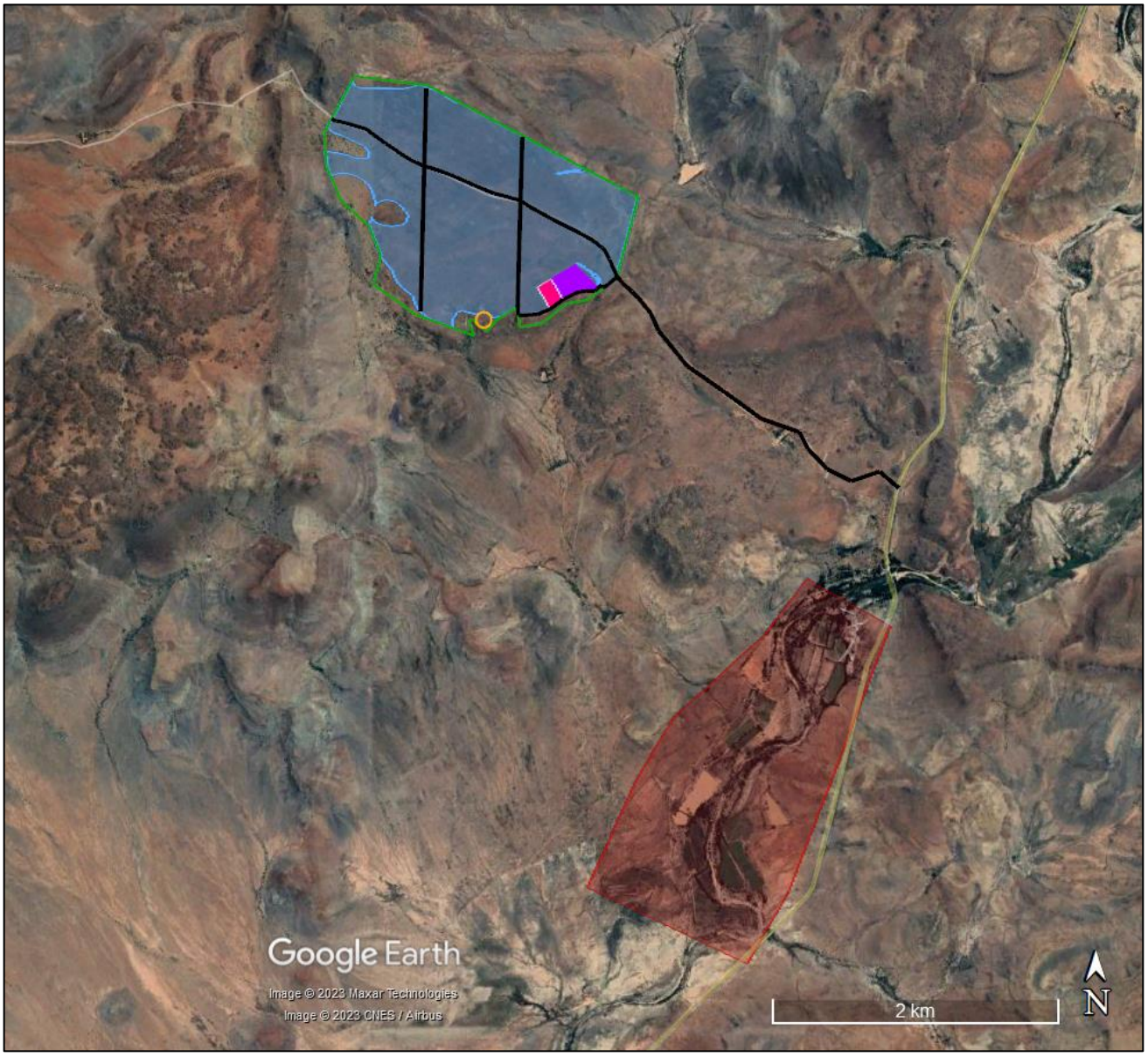


Figure 22: *Grade map of the Padloper Solar Facility 2 study area. Red = IIIA; orange = IIIB; yellow = IIIC.*

5.8. Summary of heritage indicators

The following indicators are provided:

- Uncontrolled damage to fossils should be minimised as far as possible.
- Archaeological sites should be protected with a buffer of at least 30 m if possible. Reusing of existing roads through the buffers is allowed but any widening must take place away from the site.
- Direct damage to archaeological sites should be avoided as far as possible and, where some damage to significant sites is unavoidable, scientific/historical data should be rescued.
- The facility should not dominate views from multiple publicly accessible locations.

6. IDENTIFICATION OF ENVIRONMENTAL SENSITIVITIES

6.1. Sensitivities identified by the National Web-Based Environmental Screening Tool

Figure 23 shows the screening tool map for archaeology and cultural heritage. The entire site is indicated as being of low sensitivity.

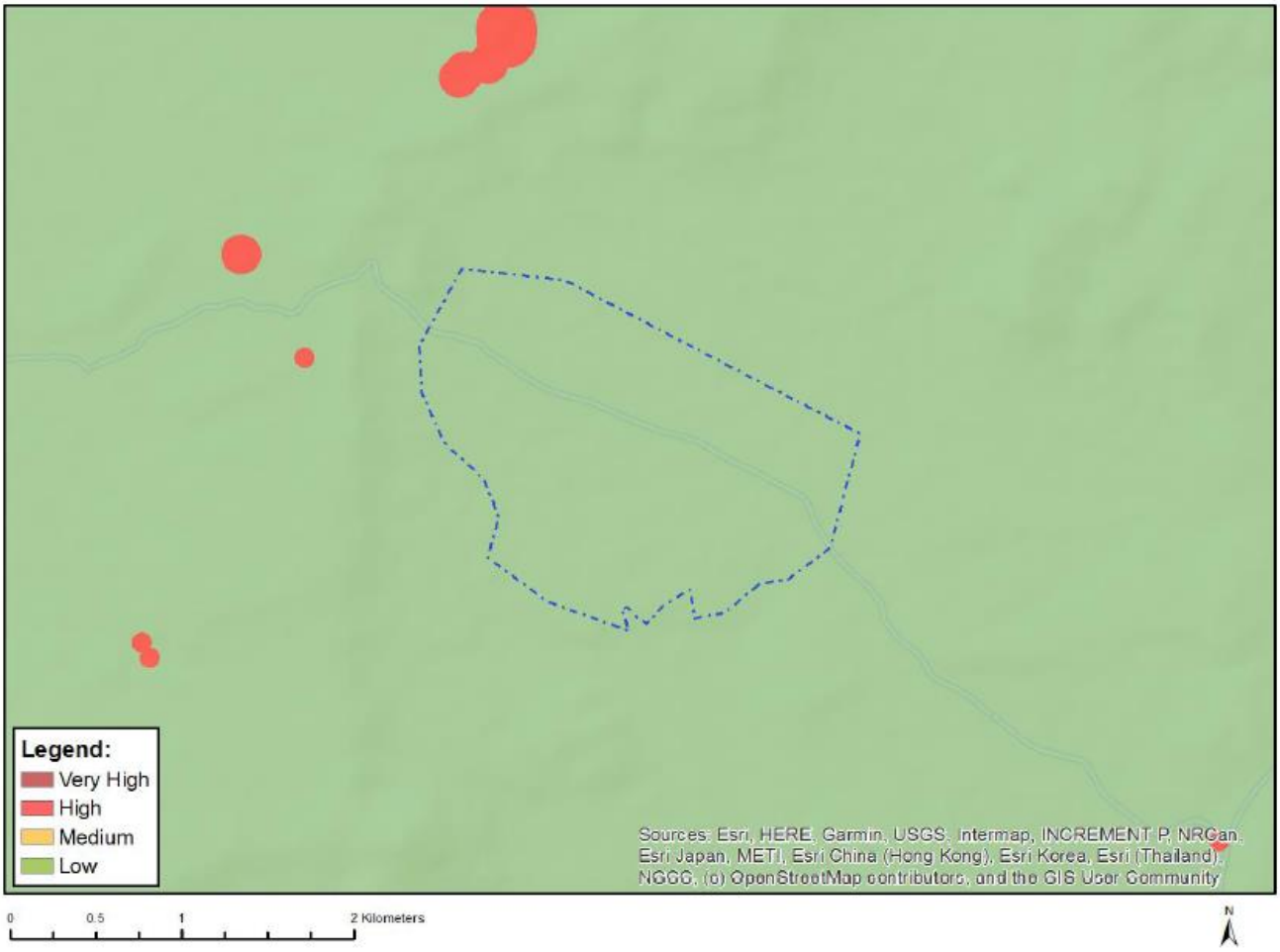


Figure 23: *Screening tool map of the Padloper Solar Facility 2 study area.*

6.2. Specialist Sensitivity Analysis and Verification

The field survey has revealed that the solar facility site is indeed of generally low sensitivity, but one heritage site with high sensitivity has been recorded within the study area. The mapping of sensitivity is shown in Figure 22, but following the prescribed heritage grading system.

6.3. Sensitivity Analysis Summary Statement

The fieldwork showed that the solar facility site is generally of low sensitivity but with one small patch high sensitivity. The entire access road is considered to be low sensitivity. Heritage resources can still be present in the low sensitivity areas but the probability of resources of high cultural significance being found there is considered to be very low. **The heritage specialist thus disputes the National Screening Tool sensitivity rating.**

7. ISSUES, RISKS AND IMPACTS

The potential impacts identified during the assessment are as follows:

Construction Phase

- Direct impacts to palaeontological resources
- Direct impacts to archaeological resources
- Direct impacts to the cultural landscape.

Operational Phase

- Direct impacts to the cultural landscape.

Decommissioning Phase

- Direct impacts to the cultural landscape.

Cumulative impacts

- Cumulative impacts to palaeontological resources
- Cumulative impacts to archaeological resources
- Cumulative impacts to the cultural landscape.

Impacts to graves were also considered, but were ruled out based on the rocky nature of the substrate throughout the study area. The rocky substrate means that people would likely have buried their dead in river floodplains were excavatable sediments occur. No such environments will be impacted by the proposed project.

8. IMPACT ASSESSMENT

It should be noted that impacts to palaeontology are addressed in the separate palaeontological specialist study which is appended to this report and are thus not repeated here. Visual impacts are also assessed separately but the conclusions of the visual study are used here to inform the assessment of impacts to the cultural landscape. Each potential impact is discussed below and they are all summarised in Table 3.

8.1. Construction Phase

8.1.1. Impacts to archaeological resources

Direct impacts to archaeology would occur during the construction phase when the surface is cleared in preparation for construction of roads, solar panels and other infrastructure. Because culturally significant sites are not expected to occur, the consequence is slight and the potential impact significance is rated as **very low negative**. A very small chance of impacting the engravings at waypoint 222 exists but if the developer ensures that this site is avoided and that chance finds get reported then the post-mitigation impact will remain at the **very low negative** level.

There are no fatal flaws in terms of construction phase impacts to archaeology.

8.1.2. Impacts to the cultural landscape

Direct cultural landscape impacts arise when inappropriate or incompatible structures and equipment are introduced into the rural/natural landscape during the construction phase. The impacts are deemed to be local because the project will not be very tall (with the exception of the substation at 18 m high) and there are many hills in the area to limit visibility in the landscape. Impacts would be medium term. Although the landscape is of medium cultural significance and impacts would definitely occur, the consequence is rated as substantial because of the limited visibility of the project in the landscape and general lack of cultural landscape elements in the PV study area. The significance before mitigation is **moderate negative**. The VIA also rates this impact (i.e. visual intrusion in the landscape) as moderate negative. Mitigation will entail minimising the construction duration, minimising all disturbance and scarring of the landscape and ensuring effective rehabilitation of any areas that will not be required during operation of the facility and ensuring that signage is modest in size and similar to regular street signage. These measures will reduce the rating to **low negative** after mitigation. This, too, is in agreement with the VIA rating.

There are no fatal flaws in terms of construction phase impacts to the cultural landscape.

8.2. Operation Phase

8.2.1. Potential Impacts to the cultural landscape

Direct cultural landscape impacts are a result of inappropriate or incompatible structures and equipment occurring in the rural/natural landscape during the operation phase. The impacts are again deemed to be local. The operation phase would be long term. The consequence is rated as moderate with the impact significance being **low negative**. The VIA rates this impact (i.e. visual intrusion in the landscape) as moderate negative. Mitigation will not make any meaningful difference to the impacts but, nonetheless, all maintenance vehicles should stay within demarcated areas to avoid impacting undeveloped land, lighting mitigation (downlighters and motion detectors) should be employed, buildings should be painted in earthy tones where technically feasible, and signage should be of modest proportions and preferably no higher than regular street signage. With mitigation the significance will remain at the **low negative** level. For operation the VIA sees the impact as remaining moderate negative after mitigation.

There are no fatal flaws in terms of operation phase impacts to the cultural landscape.

8.3. Decommissioning Phase

Direct impacts during the decommissioning phase would be identical in nature to those from the construction phase except that the equipment on site would be uninstalling and removing the facility from the site. All ratings are the same, including those of the VIA.

8.4. Cumulative Impacts

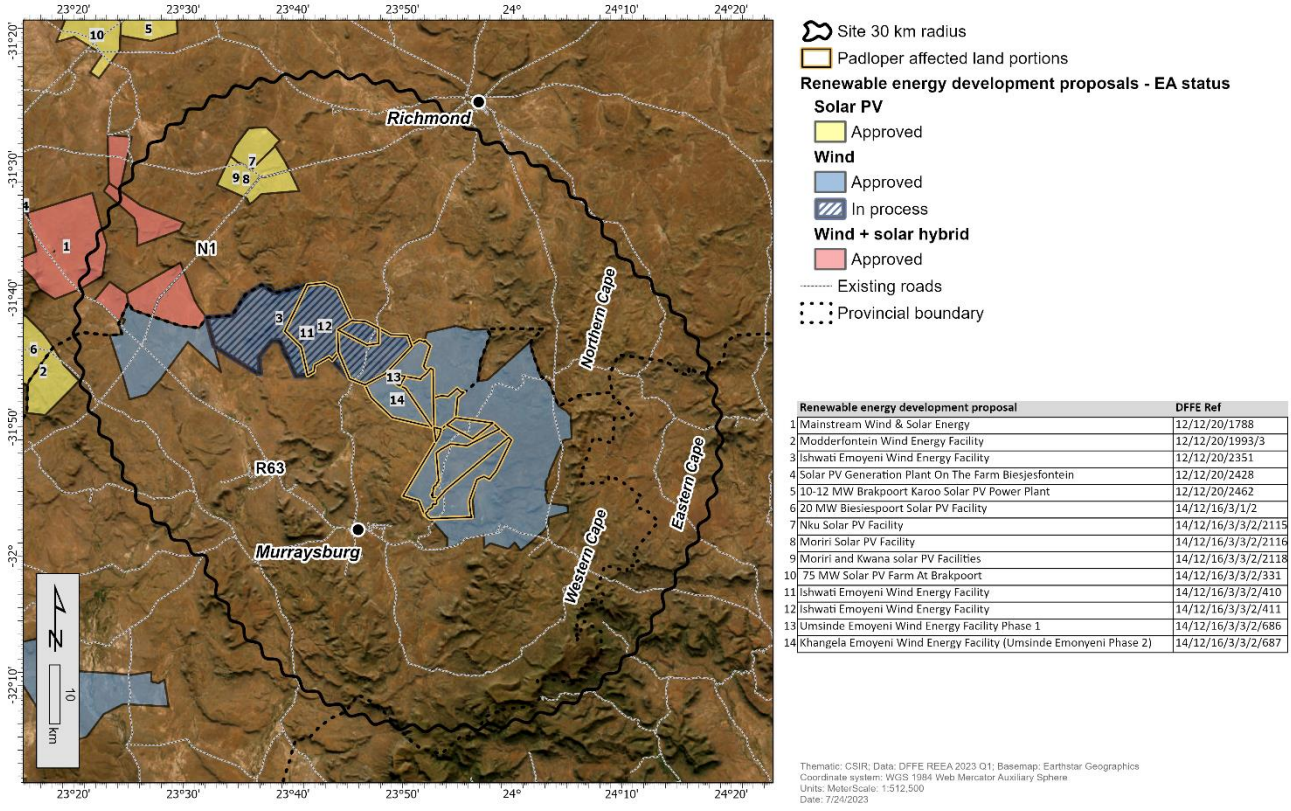
Note that cumulative impacts to palaeontology are considered by the relevant specialist study.

It is impossible to quantify the impacts to heritage resources because comprehensive surveys, especially for wind energy facilities, are impossible and, for various reasons, the reliability of the reported surveys is likely to be variable. Furthermore, cultural significance assessment is variable between practitioners. Although some archaeological sites are likely to be lost during the future construction of other facilities, it is clear that culturally significant heritage resources are rare on the local landscape and focused on farm complexes. Also, the individual significance of each site is such that it does not extend beyond the local area. Impacts to buildings and graves would be extremely rare and make no contribution to the assessment of cumulative impacts. The Padloper Solar Facility 2 layout avoids all known significant archaeological sites and will thus make a negligible contribution to cumulative impacts. The cumulative impacts are deemed to be of **Low negative** significance in this case but with project specific mitigation as listed in Table 4 this would drop to **Very low negative** after mitigation.

The construction of other facilities will also affect the cultural landscape. It is deemed preferable to cluster renewable energy developments such that the impacts are kept to one area. In the present instance this has been done as is evident from the map in Figure 24. Importantly, it is noted that all of the Padloper PV projects lie within the approved sites for wind energy facilities. Because of the spread out nature of the various projects, the cumulative impacts would be regional in extent and the consequence is rated as being moderate. The impacts are very likely to occur if the projects are constructed. However, because the wind energy facilities will be vastly more prominent in the landscape than the PV facilities, the cumulative impact contribution of Padloper Solar Facility 2 will be minimal. The cumulative impacts are deemed to be of **low negative** significance in this case regardless of project-specific mitigation measures. Extra renewable energy facilities would also result in extra powerlines running through the landscape to facilitate the various grid connections.

Proposed Padloper Solar Photovoltaic (PV) and Electricity Grid Infrastructure (EGI) cluster

near Murraysburg, in the Western Cape and Northern Cape, South Africa



	Renewable energy development proposal	DFFE Ref
1	Mainstream Wind & Solar Energy	12/12/20/1788
2	Modderfontein Wind Energy Facility	12/12/20/1993/3
3	Ishwati Emoyeni Wind Energy Facility	12/12/20/2351
4	Solar PV Generation Plant On The Farm Biesjesfontein	12/12/20/2428
5	10-12 MW Brakpoort Karoo Solar PV Power Plant	12/12/20/2462
6	20 MW Biesiespoort Solar PV Facility	14/12/16/3/1/2
7	Nku Solar PV Facility	14/12/16/3/3/2/2115
8	Moriri Solar PV Facility	14/12/16/3/3/2/2116
9	Moriri and Kwana solar PV Facilities	14/12/16/3/3/2/2118
10	75 MW Solar PV Farm At Brakpoort	14/12/16/3/3/2/331
11	Ishwati Emoyeni Wind Energy Facility	14/12/16/3/3/2/410
12	Ishwati Emoyeni Wind Energy Facility	14/12/16/3/3/2/411
13	Umsinde Emoyeni Wind Energy Facility Phase 1	14/12/16/3/3/2/686
14	Khangela Emoyeni Wind Energy Facility (Umsinde Emonyeni Phase 2)	14/12/16/3/3/2/687

Figure 24: *Map showing other projects considered in the assessment of cumulative impacts.*

Table 4: *Assessment of impacts.*

Impact	Impact Criteria		Significance and Ranking (Pre-Mitigation)	Potential Mitigation Measures	Significance and Ranking (Post-Mitigation)	Confidence Level
Construction Phase						
Damage or destruction of archaeological materials	Status	Negative	Very low (5)	- Ensure avoidance of the engraving at waypoint 222 - Report any chance finds	Very low (5)	High
	Spatial extent	Local				
	Duration	Permanent				
	Consequence	Slight				
	Probability	Very unlikely				
	Reversibility	Non-reversible				
	Irreplaceability	High				
Intrusion of PV and equipment into the landscape	Status	Negative	Moderate (3)	- Minimise duration of construction period - Minimise cut-and-fill and landscape scarring in general - Ensure effective rehabilitation of areas not needed during operation - Signage to be modest in size	Low (4)	High
	Spatial extent	Local				
	Duration	Short term				
	Consequence	Substantial				
	Probability	Very likely				
	Reversibility	Moderate				
	Irreplaceability	Moderate				
Operational Phase						
Intrusion of PV into the landscape	Status	Negative	Low (4)	- Ensure that all maintenance vehicles stay within designated areas - Make use of motion sensors, downlighters, etc to minimise lighting impacts at night - Paint structures in earthy tones to reduce contrast where technically feasible - Signage to be modest in size	Low (4)	High
	Spatial extent	Local				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Very likely				
	Reversibility	Moderate				
	Irreplaceability	Moderate				
Decommissioning Phase						
Intrusion of PV and equipment into the landscape	Status	Negative	Moderate (3)	- Minimise duration of decommissioning period - Ensure effective rehabilitation of all areas disturbed by decommissioning activities	Low (4)	High
	Spatial extent	Local				
	Duration	Short term				
	Consequence	Substantial				
	Probability	Very likely				
	Reversibility	Moderate				
	Irreplaceability	Moderate				
Cumulative impacts						
Impacts to archaeology	Status	Negative	Very low (4)	- Ensure avoidance of the engraving at waypoint 222 - Report any chance finds	Very low (4)	High
	Spatial extent	Local				
	Duration	Permanent				

	Consequence	Slight				
	Probability	Very unlikely				
	Reversibility	Non-reversible				
	Irreplaceability	High				
Intrusion of PV and equipment into the landscape	Status	Negative	Low (4)	- Minimise duration of construction period - Minimise cut-and-fill and landscape scarring in general - Ensure effective rehabilitation of areas not needed during operation - Signage to be modest in size - Ensure that all maintenance vehicles stay within designated areas - Make use of motion sensors, downlighters, etc to minimise lighting impacts at night - Paint structures in earthy tones to reduce contrast where technically feasible - Minimise duration of decommissioning period - Ensure effective rehabilitation of all areas disturbed by decommissioning activities	Very low (5)	High
	Spatial extent	Regional				
	Duration	Long term				
	Consequence	Moderate				
	Probability	Very likely				
	Reversibility	Moderate				
	Irreplaceability	Moderate				

8.5. Evaluation of impacts relative to sustainable social and economic benefits

Section 38(3)(d) of the NHRA requires an evaluation of the impacts on heritage resources relative to the sustainable social and economic benefits to be derived from the development.

The proposed PV project would generate and feed electricity into the national grid. This is something very much needed for economic development in South Africa due to the historical and ongoing problems associated with electricity supply. Economic development has knock-on effects throughout society, but it is also noted that construction and operation phase jobs would be created. These are clear economic and social benefits and, if mitigation is applied as suggested above, then the socio-economic benefits outweigh the residual impacts.

8.6. Existing impacts to heritage resources

There are currently no obvious threats to heritage resources on the site aside from the natural degradation, weathering and erosion that will affect fossils and archaeological materials. Trampling from grazing animals and/or farm/other vehicles could also occur. Impacts to archaeological sites are of no concern and would be of **negligible negative** significance. There are no existing impacts to the cultural landscape and this aspect is thus **neutral**.

8.7. The No-Go alternative

Not constructing the facility will mean that the study area stays undeveloped and the status quo is retained. The impacts that occur will be as per the existing impacts described above. Importantly, electricity generation would not take place which means that this benefit would be lost to society. This suggests that the No-Go option is less desirable in heritage terms.

8.8. Levels of acceptable change

Any impact to an archaeological or palaeontological resource or a grave is deemed unacceptable until such time as the resource has been inspected and studied further if necessary. Impacts to the landscape are difficult to quantify but in general a development that visually dominates the landscape from many publicly accessible vantage points is undesirable. Because of the height of the majority of the proposed development and its remote location, such an impact to the landscape is not envisaged.

9. IMPACT ASSESSMENT SUMMARY

The overall impact significance essentially follows the most significant impact in each phase following the implementation of the proposed mitigation measures. These are shown in Table 5.

Table 5: *Overall Impact Significance (Post Mitigation)*

Phase	**Overall Impact Significance**
Construction	Low
Operational	Low
Decommissioning	Low
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Very Low
Cumulative - Operational	Very Low
Cumulative - Decommissioning	Very Low

10. LEGISLATIVE AND PERMIT REQUIREMENTS

This report and the proposed recommendations will need to be approved by HWC. There are no further legislative requirements for the approval process under the NHRA but if archaeological or palaeontological mitigation is needed then the appointed archaeologist or palaeontologist will need to submit a Workplan to HWC to do the work. This must be carried out well in advance of construction to ensure that there is enough time for HWC to approve the mitigation work before construction commences.

11. ENVIRONMENTAL MANAGEMENT PROGRAMME INPUTS

The actions recorded in Table 6 should be included in the environmental management program (EMPr) for the project.

Table 6: *Heritage considerations for inclusion in the EMPr.*

Impact	Mitigation / Management Objectives and Outcomes	Mitigation / Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
Impacts to archaeology, buildings and graves					
Damage or destruction of archaeological sites	Avoid impacts to sites at waypoint 222	Construction Phase: Place No-Go signage at waypoint 222.	Monitoring of No-Go areas (construction period only)	Ongoing basis	Construction Manager or Contractor
				Whenever on site (at least weekly)	ECO
Damage or destruction of archaeological sites or graves	Rescue information, artefacts or burials before extensive damage occurs	Construction Phase: Reporting chance finds as early as possible to HWC or archaeologist, protect *in situ* and stop work in immediate area.	Inform staff to be vigilant and carry out inspections of new excavations	Ongoing basis	Construction Manager or Contractor
				Whenever on site (at least weekly during construction period only)	ECO
Impacts to the cultural landscape					
Visible landscape scarring	Minimise landscape scarring	Construction Phase: Ensure disturbance is kept to a minimum and does not exceed project requirements. Rehabilitate areas disturbed during construction that are not needed during operation.	Monitoring of surface clearance relative to approved layout	Ongoing basis	Construction Manager or Contractor
				As required	ECO
Intrusion into cultural landscape	Minimise visual intrusion	Operation Phase: Ensure that all maintenance vehicles and operational activities stay within designated areas.	Undertake visual inspections and report non-compliance	As required	Environmental Manager
Intrusion into cultural landscape	Minimise contrast and light pollution	Operation Phase: Paint buildings in earthy colours to reduce contrast. Make use of motion detectors and downlighting to reduce night-time light pollution.	Monitor that this has been considered in the design and operation of the facility	Once off	Project Developer
Intrusion into cultural landscape	Minimise signage	All phases: Signage to be modest and no higher than normal road signage.	Monitor that this has been considered in the design and operation of the facility	Once off	Project Developer
Visible landscape scarring	Minimise landscape scarring	Decommissioning Phase: Ensure all areas are rehabilitated following the specialist rehabilitation plan.	Monitor compliance and success of rehabilitation	As required	ECO

12. CONSULTATION WITH HERITAGE CONSERVATION BODIES

As required by HWC in their comment, this report was submitted to the Beaufort West Municipality for comment.

13. CONCLUSIONS

There are no significant archaeological concerns for this project since no archaeological sites are under threat and no other heritage resources will be significantly impacted. Just one archaeological site was of concern but has been avoided by the proposed footprint with a buffer of 50 m (Figure 25). Table 7 lists the heritage indicators and the project responses.



Figure 25: *Aerial view of the engraving site at waypoint 222 showing that the project layout (blue shading) has been designed to avoid the site.*

The only potentially significant issue is the visibility of the substation and buildings owing to their placement near the edge of the scarp. Moving them further north on the site would screen them from view from the road and landscape to the southeast of the site.

Table 7: *Heritage indicators and project responses.*

Indicator	Project Response
Uncontrolled damage to fossils should be minimised as far as possible	No impacts are expected.
Archaeological sites should be protected with a buffer of at least 30 m if possible. Reusing of existing roads through the buffers is allowed but any widening must take place away from the site.	This has been done.
Direct damage to archaeological sites should be avoided as far as possible and, where some damage to significant sites is unavoidable, scientific/historical data should be rescued.	This has been done.
The facility should not dominate views from multiple publicly accessible locations.	The site is very remote and is unlikely to be prominently visible from public roads, other than very briefly.

13.1. Statement and reasoned opinion of the specialist

Given the very low sensitivity of the study area and the lack of impacts to heritage resources, the heritage specialist is of the opinion that the proposed Padloper Solar Facility 2 may be authorised in full.

14. RECOMMENDATIONS

It is recommended that the proposed Padloper Solar Facility 2 be authorised, but subject to the following recommendations which should be included as conditions of authorisation:

- The engraving site at waypoint 222 must be flagged as a no-go area;
- No stones may be removed from any archaeological site;
- The fossil Chance Finds Protocol must be included in the EMPr and implemented in the event that fossils are found;
- Lighting mitigation must be employed to ensure that light is directed only to where it is needed and, preferably, that it only switches on when needed;
- Buildings to be painted in earthy tones where technically feasible;
- Signage demarcating the entrance of the facility must be modest in nature and should not exceed the height of regular street signage;
- Consideration should be given to moving the substation and buildings northwards away from the scarp during the detailed design phase; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

Contact Details and personal information:

Address: 23 Dover Road, Muizenberg, 7945
Telephone: (021) 788 1025
Cell Phone: 083 272 3225
Email: jayson@asha-consulting.co.za

Birth date and place: 22 June 1976, Cape Town, South Africa
Citizenship: South African
ID no: 760622 522 4085
Driver's License: Code 08
Marital Status: Married to Carol Orton
Languages spoken: English and Afrikaans

Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science)	1997
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Professional Accreditation:

Association of Southern African Professional Archaeologists (ASAPA) membership number: 233
CRM Section member with the following accreditation:

- Principal Investigator: Coastal shell middens (awarded 2007)
  Stone Age archaeology (awarded 2007)
  Grave relocation (awarded 2014)
- Field Director: Rock art (awarded 2007)
  Colonial period archaeology (awarded 2007)

Association of Professional Heritage Practitioners (APHP) membership number: 43

- Accredited Professional Heritage Practitioner

➢ *Memberships and affiliations:*

South African Archaeological Society Council member	2004 – 2016
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
UCT Department of Archaeology Research Associate	2013 – 2017
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –
Kalk Bay Historical Association	2016 –
Association of Professional Heritage Practitioners member	2016 –

Fieldwork and project experience:

Extensive fieldwork and experience as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Feasibility studies:

- Heritage feasibility studies examining all aspects of heritage from the desktop

Phase 1 surveys and impact assessments:

- Project types
  - Notification of Intent to Develop applications (for Heritage Western Cape)
  - Desktop-based Letter of Exemption (for the South African Heritage Resources Agency)
  - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
  - Archaeological specialist studies
  - Phase 1 archaeological test excavations in historical and prehistoric sites
  - Archaeological research projects
- Development types
  - Mining and borrow pits
  - Roads (new and upgrades)
  - Residential, commercial and industrial development
  - Dams and pipe lines
  - Power lines and substations
  - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

- ESA open sites
  - Duinefontein, Gouda, Namaqualand
- MSA rock shelters
  - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
  - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
  - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
  - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
  - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
  - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
  - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
  - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

Awards:

Western Cape Government Cultural Affairs Awards 2015/2016: Best Heritage Project.

APPENDIX 2 - Site Sensitivity Verification

As required in Part A of the Government Gazette 43110, GN 320, a site sensitivity verification was undertaken in order to confirm the current land use and environmental sensitivity of the proposed project area as identified by the National Web-Based Environmental Screening Tool. The details of the site sensitivity verification are noted below:

Date of Site Visit	21 September 2022
Specialist Name	Dr Jayson Orton, Steve van den Heever, Joseph Matembo
Professional Registration Number	Association of Southern African Professional Archaeologists (ASAPA): 233 Association of Professional Heritage Practitioners (APHP): 043
Specialist Affiliation / Company	ASHA Consulting (Pty) Ltd

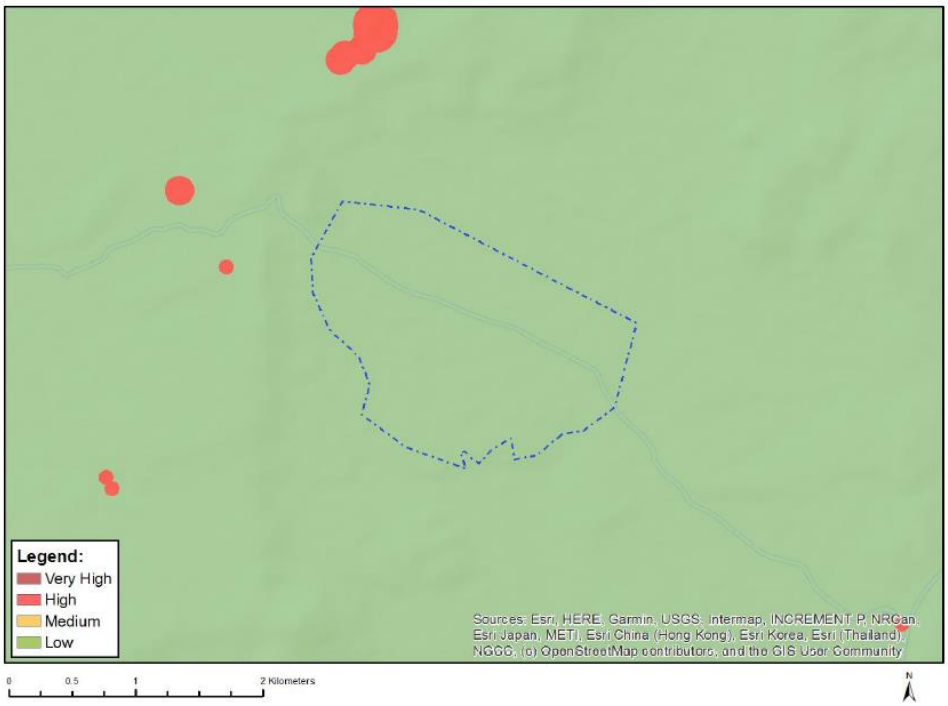
Method of the Site Sensitivity Verification

Initial work was carried out using satellite aerial photography in combination with the author's accumulated knowledge of the local landscape. This was used to determine sensitive areas. Subsequent fieldwork served to ground truth the site, including areas identified as potentially sensitive. Desktop research was also used to inform on the heritage context of the area. This information is presented in the report (Sections 5.2.1 and 5.4.1).

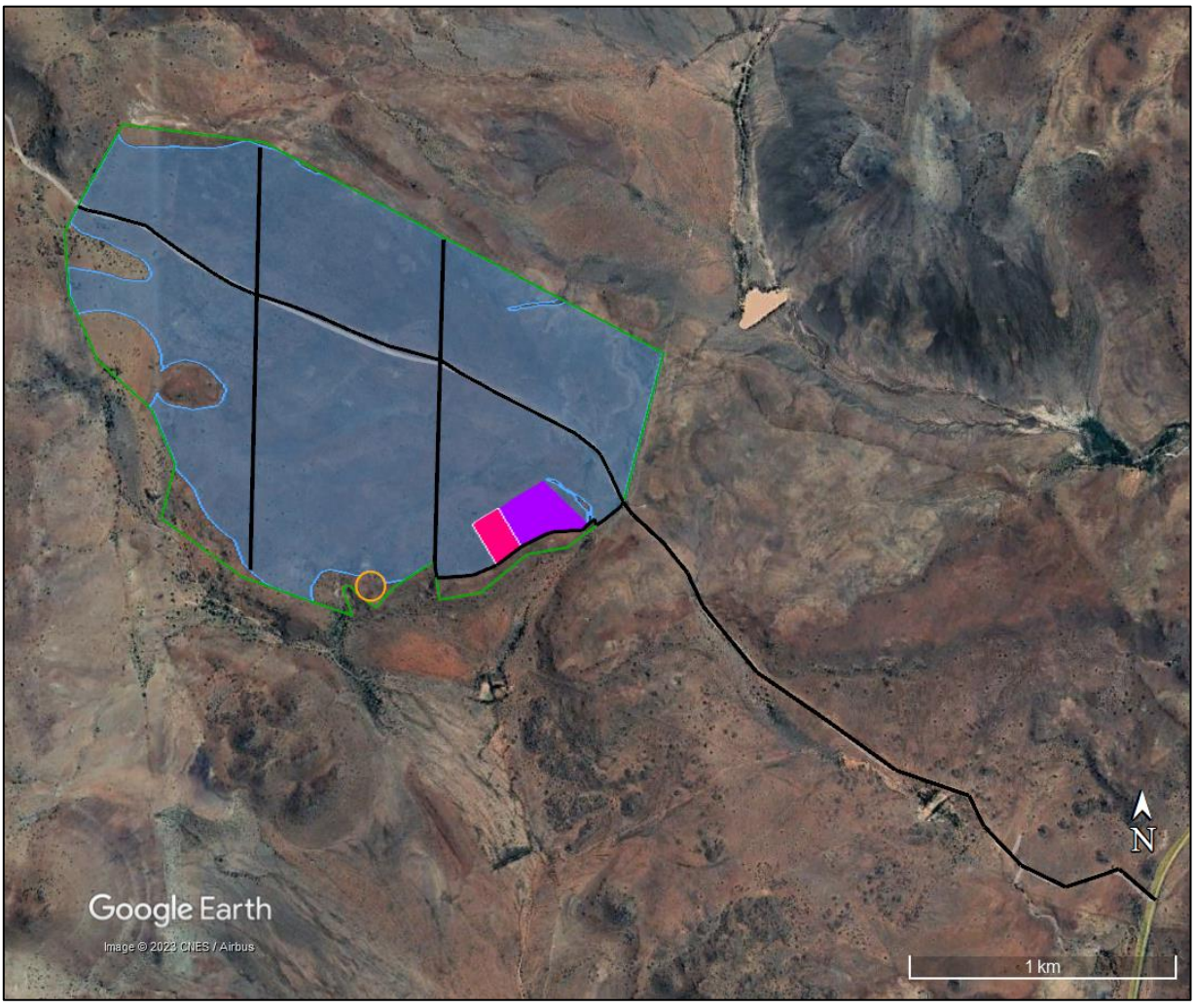
Outcome

The first map below is extracted from the screening tool report and shows the archaeological and heritage sensitivity to be low throughout the study area. The site visit confirmed that the solar facility area is mostly of low sensitivity but that an area of higher sensitivity occurs along its southern margin. This is an engraving site. The second map below shows the areas considered to be sensitive from a heritage point of view. Photographs and descriptions of all the heritage feature are included in the specialist report. The heritage specialist thus disputes the Screening Tool report.

Sites of Grade IIIA (high cultural significance) and IIIB (medium cultural significance) should be regarded as of high sensitivity. IIIC sites (low cultural significance) can be seen as medium, while NCW (very low significance) are low sensitivity.



Screening tool map for the Archaeology and Cultural Heritage Theme.



Heritage sensitivity map. The orange area can be regarded as high sensitivity.

APPENDIX 3 – Palaeontological study

APPENDIX 4 – Visual Impact Assessment

Refer to Appendix D.2 of this BA Report for the detailed Visual Impact Assessment.



PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED PADLOPER (PROJECTS 1, 2, 3 and 4) SOLAR PHOTOVOLTAIC (PV) FACILITIES AND THE ASSOCIATED 132 kV OVERHEAD POWER LINES AND ASSOCIATED INFRASTRUCTURE NEAR MURRAYSBURG, WESTERN CAPE AND NORTHERN CAPE PROVINCES

June 2023

COMPILED FOR: African Clean Energy Developments (Pty) Ltd

Applicant - Padloper PV (Pty) Ltd
Project Developer - African Clean Energy Developments (Pty) Ltd

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: info@banzai-group.com

SIGNATURE: 

This Palaeontological Impact Assessment report (as part of the Heritage Impact Assessment) (HIA), has been compiled considering the National Environmental Management Act 1998 (NEMA; Act No. 107) and Environmental Impact Regulations 2014 as amended, requirements for specialist reports, Appendix 6, as indicated in the table below.

Table 1: Checklist for specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended). – Applicable to the Padloper PV 1-4 projects

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
1.(1) (a) (i) Details of the specialist who prepared the report	Page ii and Section 2 of Report – Contact details and company and **Appendix 3**	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to **Appendix 3**	-
(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 4 – Methods and Terms of Reference (TOR)	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontological History	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9	-
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Sections 1, 8 & 10	-
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 4 – Methods and TOR	-
(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;	Sections 1 & 10	-

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
(g) An identification of any areas to be avoided, including buffers	Sections 1 & 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	-
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4. 1 – Assumptions and Limitations	-
(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	Sections 1 & 10	-
(k) Any mitigation measures for inclusion in the EMPr	Sections 1 & 10	-
(l) Any conditions for inclusion in the environmental authorisation	Section 11	-
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Sections 1 & 10	-
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Sections 1 & 10	-
(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	Sections 1 & 10	-
(o) A description of any consultation process that was undertaken during the course of carrying out the study	N/A	Not applicable. A public consultation process was handled as part of the Environmental Impact Assessment (EIA) and

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	The relevant section in the report	Comment where not applicable.
		Environmental Management Plan (EMPr) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	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.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental (Pty) Ltd (Banzai Environmental) was appointed by African Clean Energy Developments (Pty) Ltd (ACED) to conduct the Palaeontological Impact Assessment (PIA) to assess the proposed Padloper 7 X Solar Photovoltaic (PV) Facilities of between 100 and 250 MW generation capacity each (known as the Padloper Solar PV Cluster) and the associated 7 x 132 kV overhead power lines and associated Electrical Grid Infrastructure (EGI) near Murraysburg in the Western and Northern Cape Provinces. This report focuses on Projects 1, 2, 3 and 4 of the Padloper Solar Cluster.

Under the National Environmental Management Act No. 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No. 25 of 1999, section 38) (NHRA), this PIA is necessary to confirm if fossil material could potentially be present in the approved development area and to evaluate the potential impact of the proposed changes to the development on the Palaeontological Heritage.

Padloper Solar Facility 1 is entirely underlain by the Balfour Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup), while Padloper Solar Facility 2 is almost entirely underlain by Jurassic Dolerite with a small portion in the south underlain by the Balfour Formation and a small portion in the north underlain by the Teekloof Formation (Adelaide Subgroup, Beaufort Group). Padloper Solar Facility 3 is mostly underlain by the Balfour Formation while the south west margin is underlain by Jurassic dolerite. The PalaeoMap of the South African Heritage Resources Information System indicates that the Palaeontological Sensitivity of the Jurassic Dolerite is Zero as it is igneous in origin and thus fossiliferous while that of the Adelaide Subgroup is Very High (Almond and Pether, 2009; Almond *et al*., 2013). The DFFE screening tool for the study areas indicates that the proposed development has a Very High Palaeontological Sensitivity. Updated Geology compiled by the Council of Geosciences (Pretoria) indicates that the development is underlain by the Balfour and Middelton Formations of the Adelaide Subgroup as well as Jurassic dolerite.

In the last few decades extensive research and fossil collecting have been conducted by palaeontologists in this part of the Karoo basin. However, the National Palaeontological databases indicate that only one fossil has been uncovered in the footprint of Padloper Solar Facility 4 (this fossil has been collected and is now housed in a museum/university collection). A site-specific field survey of the development footprint was conducted on foot and by motor vehicle in January 2023. No fossiliferous outcrop was detected in the proposed development area (i.e., development footprints of the proposed Padloper Solar Facilities 1-4. This could be attributed to dolerite intrusions that metamorphized potentially fossiliferous Beaufort sediments, low relief of the development area as well as poor bedrock exposure and relative unfossiliferous superficial sediments. However, it must be emphasised that the presence of well-preserved fossils is not ruled out.

Based on the site investigation as well as desktop research it is concluded that fossil heritage of scientific and conservational interest in the overall development footprint for the solar facilities is rare. This is in contrast with the Very High Sensitivity allocated to the development area by the SAHRIS Palaeosensitivity Map and DFFE Screening Tool. A Medium Palaeontological Significance has been allocated for the construction phase of the solar PV development pre-mitigation and a Low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The cumulative impacts of the development near Murraysburg is Medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. 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.

Monitoring and Mitigation – Applicable to the Padloper PV 1-4 projects

The ECO for these projects (i.e., Padloper Solar Facilities 1-4) must be informed that the Balfour and Teekloof Formations (Adelaide Subgroup, Beaufort Group, Karoo Supergroup) has a Very High Palaeontological Sensitivity.

- The ECO/designated responsible person for these projects, must constantly monitor the Adelaide Subgroup outcrops during surface clearance and construction. If Palaeontological Heritage is uncovered during surface clearing and excavations, the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: Heritage Western Cape, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. 3rd floor Protea Assurance Building, 142 Longmarket St, Cape Town City Centre, Cape Town, 8000; Private Bag X9067, Cape Town, 8000 Tel: 021 483 9598. Fax: +27 (0) 21 483 9845. Web: www.hwc.org.za) so that mitigation (recording and collection) can be carried out.
- Before any fossil material can be collected from the development site, the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

These recommendations should be incorporated into the Environmental Management Programme (EMPr) for the Padloper Solar Cluster development.

TABLE OF CONTENTS

1 INTRODUCTION 16
1.1 General site description 25
1.2 EIA Study Phase 26
2 SPECIALIST CREDETIALS 27
3 LEGISLATION 30
3.1 National Heritage Resources Act (Act No. 25 of 1999) 30
4 METHODS AND TERMS OF REFERENCE 31
4.1 Assumptions and Limitations 33
5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY 34
6 GEOGRAPHICAL LOCATION OF THE SITE 57
7 ADDITIONAL INFORMATION CONSULTED 57
8 SITE INVESTIGATION 58
9 IMPACTS ASSESSMENT 60
9.1 Sensitivities identified by the DFFE National Web-Based Screening Tool. 60
9.1.1 Sensitivity Analysis Summary Statement 61
9.1.2 Impact Summary 68
9.2 Conclusion and Impact Statement 68
9.3 Legislative and Permit Requirements 68
10 FINDINGS AND RECOMMENDATIONS 68
11 CHANCE FINDS PROTOCOL 70
11.1 Chance Find Procedure 71
12 BIBLIOGRAPHY 71

Appendix 1: Impact Assessment Methodology

Appendix 2: Site Verification Report

Appendix 3: Curriculum Vitae

LIST OF FIGURES

***Figure 1**: Location of the affected farm portions on which the proposed seven Padloper Solar Facilities will be developed. These entire farm portions (outlined in brown) are the study area for the PV Facilities, including access roads.....20*

***Figure 2**: Regional locality of the Padloper Solar Facilities 1-4 as well as grid infrastructure near Murraysburg in the Western Cape. 28*

***Figure 3**: Regional topography of the Padloper Solar Facilities 1-4 as well as grid infrastructure near Murraysburg in the Western Cape. 29*

***Figure 4**. Extract of the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) indicating the geology of the Padloper Solar Projects 1-4 and associated grid infrastructure near Murraysburg in the Western Cape. The development is underlain by the Balfour Formation of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as Jurassic dolerite (Jd, red). 38*

***Figure 5**: Extract of the SAHRIS PalaeoMap (Council of Geosciences) indicates that Padloper Solar Projects 5-7 is underlain by sediments with a Very High (red) and Zero (grey) Palaeontological Sensitivity. Fossils finds recorded on the National Palaeontological Database is indicated in white triangles with red outlines. 40*

***Figure 6**: Palaeontological Sensitivity of the Padloper Solar Facility 1 by the National Environmental Web-bases Screening Tool. 42*

***Figure 7**: Palaeontological Sensitivity of the Padloper Solar Facility 2 by the National Environmental Web-bases Screening Tool. 43*

***Figure 8**: Palaeontological Sensitivity of the Padloper Solar Facility 3 by the National Environmental Web-bases Screening Tool. 44*

***Figure 9**: Palaeontological Sensitivity of the Padloper Solar Facility 4 by the National Environmental Web-bases Screening Tool. 45*

***Figure 10**: Updated Geology compiled by the Council of Geosciences (Council for Geoscience, Pretoria) indicates that the proposed Padloper Solar Projects 1-4 are underlain by the Karoo Dolerite Suite, Balfour Formation as well as the Middleton Formation (Adelaide Subgroup, Karoo Supergroup). 46*

***Figure 11**: Vertebrate biozonation range chart for the Main Karoo Basin of South Africa. 47*

***Figure 12**: Lateral and dorsal views of skull of the dicynodont Daptocephalus leoniceps, the main biozone defining fossil and dorsal views (Image taken from Viglietti, 2020). 48*

***Figure 13**: Skulls of the biozone defining fossils of the Dicynodon-Theriognathus Subzone in lateral and dorsal views. Dicynodon lacerticeps (top), Theriognathus microps (bottom) (Image taken from Viglietti, 2020). 49*

***Figure 14**: Biozone defining fossils of the Lystrosaurus maccaigi- Moschorhinus Subzone. The skulls of the Lystrosaurus maccaigi (top) and Moschorhinus kitchingi (bottom) in lateral. 50*

Figure 15: *Lateral and dorsal views of the index taxa defining the Lystrosaurus declivis Assemblage Zone. (top) Lystrosaurus declivis, (centre) Thrinaxodon liorhinus, (bottom) Procolophon trigoniceps (Image taken from Botha and Smith, 2020).* *51*
Figure 16: *Lateral and dorsal views of Lycosuchus vanderrieti (top), and Eunotosaurus africanus (bottom), the biozone defining taxa of the Lycosuchus – Eunotosaurus Subzone (Taken from Day and Smith, 2020).* *52*
Figure 17: *Endothiodon bathystoma, in lateral and dorsal views is the biozone defining fossil of the Endothiodon Assemblage Zone.* *53*
Figure 18: *Lateral and dorsal views of the index taxa of the Tropidostoma – Gorgonops Subzone namely (top) Tropidostoma dubium, (bottom) Gorgonops torvus.* *54*
Figure 19: *Renewable Energy Facilities in n 30km radius of the Padloper SEF Cluster.* *56*
Figure 20: *Dolerite outcrop in the development footprint on Padloper Solar Facility 2.* *58*
Figure 21: *Drainage line in potentially fossiliferous Adelaide Subgroup with calcrete and dolerite corestones.* *59*
Figure 22: *Mudrock exposure of potentially fossiliferous Middleton Formation in Padloper Solar Facility 2.* *59*
Figure 23: *Flat topography of the development area.* *60*

LIST OF TABLES

Table 1: Checklist for specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended). 4
Table 2: Padloper Solar Cluster 16
Table 3: SEF Site information. 17
Table 4: OHPL Site information. 19
Table 5: General information. 21
Table 6: EGI Projects. 25
Table 7: Legend to the 1:250 000 1:250 000 Victoria West 3122 (1966) Geological map (Council of Geoscience, Pretoria). 39
Table 8: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al., 2013; SAHRIS website. 41
Table 9: Renewable Energy Facilities in n 30km radius of the Padloper SEF Cluster. 56
Table 10: Rating of Impacts - Planning and Pre-construction Phase of Padloper Solar Facility 1 61
Table 11: Rating of Impacts - Construction Phase Padloper Solar 1 62
Table 12: Rating of Impacts - Operational Phase Padloper Solar Facility 1 62
Table 13: Rating of Impacts -Decommissioning Phase Padloper Solar Facility 1 62
Table 14: Rating of Impacts - Planning and Pre-construction Phase Padloper Solar Facility 2 63
Table 15: Rating of Impacts – Construction Phase Padloper Solar Facility 2. 63
Table 16: Rating of Impacts -Operational Phase Padloper Solar Facility 2. 63
Table 17: Rating of Impacts -Decommissioning Phase Padloper Solar Facility 2. 63
Table 18: Rating of Impacts - Planning and Pre-construction Phase Padloper Solar Facility 3. 64
Table 19: Rating of Impacts – Construction Phase Padloper Solar Facility 3. 64
Table 20: Rating of Impacts - Operational Phase Padloper Solar Facility 3. 64
Table 21: Rating of Impacts - Decommissioning Phase Padloper Solar Facility 3. 65
Table 22: Rating of Impacts - Planning and Pre-construction Phase Padloper Solar Facility 4. 65
Table 23: Rating of Impacts – Construction Phase Padloper Solar Facility 4. 66
Table 24: Rating of Impacts - Operational Phase Padloper Solar Facility 4. 66
Table 25: Rating of Impacts - Decommissioning Phase Padloper Solar Facility 4. 66
Table 26: No-go Impacts - Padloper Solar Facilities 1-4 67
Table 27: Cumulative Impact during Construction - Padloper Solar Facilities 1-4 67
Table 28: Overall Impact Significance (Post Mitigation) 68

GLOSSARY OF TERMS

Fossil

Mineralized bones of vertebrate and invertebrate animals, as well as plants. A trace fossil is the traces of animals/plants preserved in stone.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act No 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.

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 comprises of fossilised remains or traces of past life.

LIST OF ABBREVIATIONS

BA	Basic Assessment
BESS	Battery Energy Storage System
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
CA	National Competent Authority
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
ESO	Environmental Site Officer
HIA	Heritage Impact Assessment
Ma	Millions of years ago
MTS	Main Transmission Substation
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
OHL	Overhead Line
PIA	Palaeontological Impact Assessment
PSSA	Palaeontological Society of South Africa
PV	Photovoltaic
REDZ	Renewable Energy Development Zone
SAHRA	South African Heritage Resources Agency
SEF	Solar Energy Facility
SAHRIS	South African Heritage Resources Information System
S&EIA	Scoping & Environmental Impact Assessment
ToR	Terms of Reference

1 INTRODUCTION

The Project Applicant, Padloper PV (Pty) Ltd (hereinafter referred to as "the Applicant")[1], is proposing the development of 7 x Solar Photovoltaic (PV) Facilities with a capacity of between 100 and 250 MW each and the associated infrastructure, and the associated 7 x 132 kV overhead power lines and associated infrastructure near Murraysburg in the Northern and Western Cape provinces. Each solar PV facility will have a range of associated infrastructure, including, but not limited to, an on-site substation and Battery Energy Storage System (BESS) complex and will connect to the existing Gamma Main Transmission Substation (MTS) via dedicated 132 kV overhead power lines connecting to the proposed authorised Ishwati Emoyeni Substation.

This report is a combined report for Padloper Solar Projects 1-4 (indicated in red in Table 2). Please note that in tables and text the relevant information for this specific project is indicated in red.

Table 2: Padloper Solar Cluster

Names of the Individual Projects: Solar Photovoltaic Facilities	**Project 1**	Basic Assessment for the proposed development of the Padloper Solar Photovoltaic Facility 1 and associated infrastructure (i.e., Padloper Solar Facility 1), near Murraysburg in the Northern Cape Province
	Project 2	Basic Assessment for the proposed development of the Padloper Solar Photovoltaic Facility 2 and associated infrastructure (i.e., Padloper Solar Facility 2), near Murraysburg in the Western Cape Province
	Project 3	Basic Assessment for the proposed development of the Padloper Solar Photovoltaic Facility 3 and associated infrastructure (i.e., Padloper Solar Facility 3), near Murraysburg in the Western Cape Province
	Project 4	Basic Assessment for the proposed development of the Padloper Solar Photovoltaic Facility 4 and associated infrastructure (i.e., Padloper Solar Facility 4), near Murraysburg in the Western Cape Province
	Project 5	Basic Assessment for the proposed development of the Padloper Solar Photovoltaic Facility 5 and associated infrastructure (i.e., Padloper Solar Facility 5), as well as the proposed development of 132 kV Electrical Grid Infrastructure (i.e., overhead power line [EGI or OHL]) between the Padloper Solar Facility 4 and the proposed Padloper Solar Facility 5, near Murraysburg in the Western Cape Province (i.e., Padloper Solar EGI 5)
	Project 6	Basic Assessment for the proposed development of the Padloper Solar Photovoltaic Facility 6 and associated infrastructure (i.e., Padloper Solar Facility 6), as well as the proposed development of a 132 kV EGI between the Padloper

[1]It is important to note that Padloper PV (Pty) Ltd is the Project Applicant, whereas African Clean Energy Developments (Pty) Ltd (ACED) is the Project Developer.

		Solar Facility 4 and the proposed Padloper Solar Facility 6, near Murraysburg in the Western Cape Province (i.e. Padloper Solar EGI 6)
	Project 7	Basic Assessment for the proposed development of the Padloper Solar Photovoltaic Facility 7 and associated infrastructure (i.e. Padloper Solar Facility 7), as well as the proposed development of a 132 kV EGI between the Padloper Solar Facility 4 and the proposed Padloper Solar Facility 7, near Murraysburg in the Western Cape Province (i.e. Padloper Solar EGI 7)
Associated Power line and Electrical Grid Infrastructure	**Project 8**	Basic Assessment for the proposed development of a 132 kV Overhead Power line and associated EGI between the proposed Padloper Solar Facility 1 and the proposed authorised Ishwati Emoyeni Substation (i.e., Padloper EGI 1), near Murraysburg in the Northern Cape and Western Cape Provinces
	Project 9	Basic Assessment for the proposed development of a 132 kV Overhead Power line and associated EGI between the proposed Padloper Solar Facility 2 and the proposed authorised Ishwati Emoyeni Substation (i.e., Padloper EGI 2), near Murraysburg in the Western Cape Province
	Project 10	Basic Assessment for the proposed development of a 132 kV Overhead Power line and associated EGI between the proposed Padloper Solar Facility 2 and the proposed Padloper Solar Facility 3 (i.e., Padloper EGI 3), near Murraysburg in the Western Cape Province
	Project 11	Basic Assessment for the proposed development of a 132 kV Overhead Power line and associated EGI between the proposed Padloper Solar Facility 4 and the proposed authorised Ishwati Emoyeni Substation (i.e., Padloper EGI 4), near Murraysburg in the Northern Cape and Western Cape Provinces

The proposed solar PV facilities and overhead power lines (OHL) will be constructed on the following farm portions:

Table 3: SEF Site information.

Affected Farm Portion	**SG Code**	**Padloper (Pd) Solar Facilities 1 - 7**						
		Pd 1	**Pd 2**	**Pd 3**	**Pd 4**	**Pd 5**	**Pd 6**	**Pd 7**
Portion 7 of Farm Klipplaat No. 109	C0630000000001 0900007	✓						
Remainder of Farm Riet Poort No.9	C0520000000000 0900000		✓					
Portion 1 of Farm Klipplaat No. 109	C0630000000001 0900001			✓				
Portion 4 of Farm Klipplaat No. 109	C0630000000001 0900004							

Portion 6 of Farm Klipplaat No. 109	C0630000000001 0900006							
Portion 3 of Farm Angora No. 26	C0520000000000 2600003					✓		
Portion 2 of Farm Angora No. 26	C0520000000000 2600002				✓			
Portion 4 of Farm Angora No. 26	C0520000000000 2600004							
Portion 7 of Farm Angora No. 26	C0520000000000 2600007						✓	✓
Remainder of Farm No.8	C0520000000000 0800000							
Remainder of Farm No.6	C0520000000000 0600000							
Portion 2 of Farm No.6	C0520000000000 0600002							
Portion 4 of Farm No.7	C0520000000000 0700004							
Remainder of Farm No.7	C0520000000000 0700000							
Portion 2 of Farm No.7	C0520000000000 0700002							
Portion 5 of Farm Klein Los Kop No. 5	C0520000000000 0500005							
Remainder of Farm Schietkuil No. 3	C0520000000000 0300000							

Padloper Solar PV Facilities (Projects 1-4) are located on the following farms:

- Portion 7 of Farm Klipplaat No. 109
- Remainder of Farm Riet Poort No.9
- Portion 1 of Farm Klipplaat No. 109

Table 4: Overhead power line Site information.

Affected Farm portion	SG Code	Padloper EGIs 1-4			
		Padloper EGI 1	**Padloper EGI 2**	**Padloper EGI 3**	**Padloper EGI 4**
Portion 7 of Farm Klipplaat No. 109	C0630000000001 0900007	✓			
Remainder of Farm Riet Poort No.9	C0520000000000 0900000	✓	✓	✓	✓
Portion 1 of Farm Klipplaat No. 109	C0630000000001 0900001			✓	✓
Portion 4 of Farm Klipplaat No. 109	C0630000000001 0900004				✓
Portion 6 of Farm Klipplaat No. 109	C0630000000001 0900006				✓
Portion 3 of Farm Angora No. 26	C0520000000000 2600003				✓
Portion 2 of Farm Angora No. 26	C0520000000000 2600002				✓
Portion 4 of Farm Angora No. 26	C0520000000000 2600004				✓
Remainder of Farm No.8	C0520000000000 0800000	✓	✓		✓

Portion 7 of Farm Angora No. 26	C0520000000000 2600007				✓
Remainder of Farm Badfontein No. 10	C0520000000000 1000000				
Remainder of Farm Rood Zandheuvel No. 102	C0630000000001 0200000				

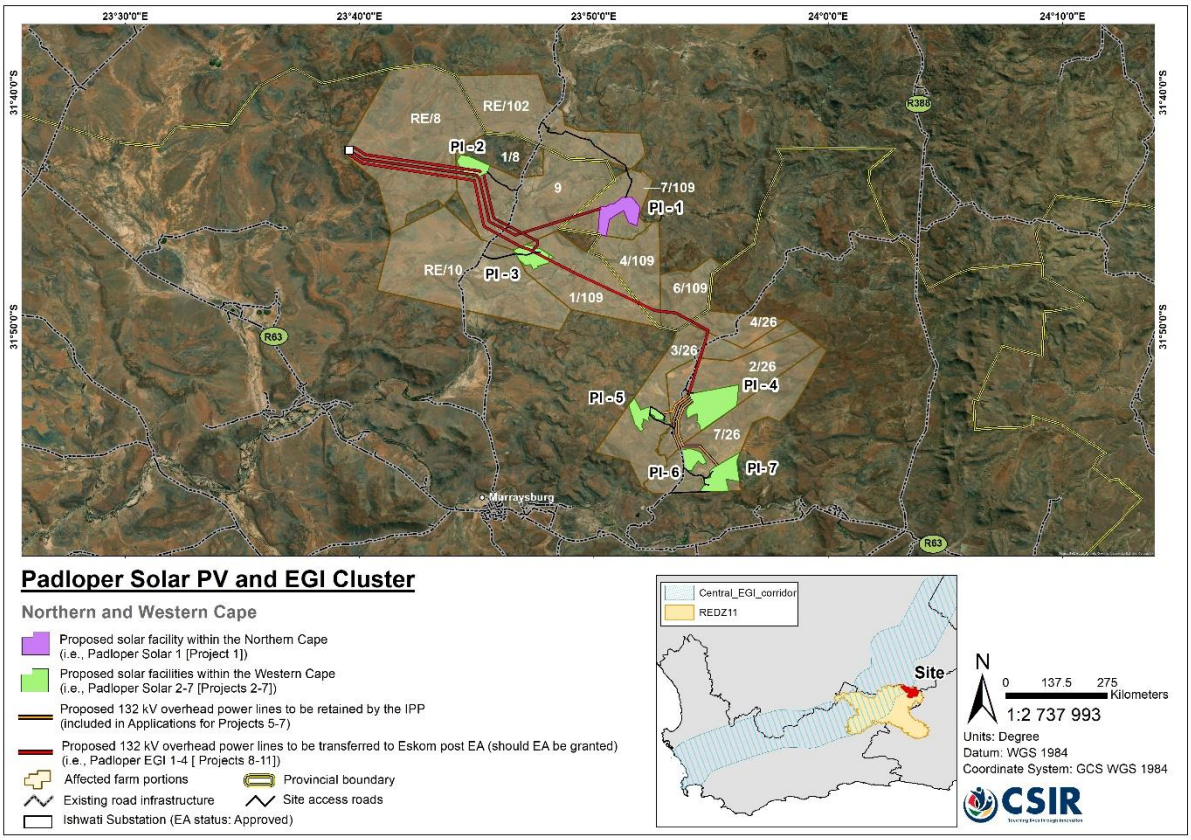


***Figure 1**: Location of the affected farm portions on which the proposed Padloper Solar Facilities 1-7 will be developed. These entire farm portions (outlined in brown) are the study area for the Padloper PV facilities, including access roads.*

The proposed Padloper solar PV and EGI projects will consist of the components listed below. It is important to note at the outset that the exact specifications of the proposed project components will only be determined during the detailed engineering phase prior to construction (subsequent to the issuing of an EA), should such an authorisation be granted for the proposed projects, but that the information provided below is seen as the worst-case scenario for the projects. The detail provided is to give specialists as much information as possible to inform the identification and assessment of potential impacts. It is however important to note that these specifications are subject to change as the BA process progresses. Any changes will be communicated to the specialists to update their specialist assessments and reports accordingly.

The Padloper Solar Facilities 1-4 will have the following project components (indicated in red):

Table 5: General information.

PV Facilities	
Component	**Description / dimensions**
Height of PV panels	Maximum of ± 4.5m.
MW of each PV Facility	Padloper Solar Facility 1: Up to 250 MW Padloper Solar Facility 2: Up to 150 MW Padloper Solar Facility 3: Up to 150 MW Padloper Solar Facility 4: Up to 150 MW Padloper Solar Facility 5: Up to 150 MW Padloper Solar Facility 6: Up to 100 MW Padloper Solar Facility 7: Up to 150 MW
Area of PV Array	Proposed area occupied by PV panel arrays: Padloper Solar 1: 429 ha (Total developable area: ± 420 ha) Padloper Solar 2: 249 ha (Total developable area: ± 222 ha) Padloper Solar 3: 293 ha (Total developable area: ± 233 ha) Padloper Solar 4: 747 ha (Total developable area: ±y 329 ha) Padloper Solar 5: 250 ha (Total developable area: ± 202 ha) Padloper Solar 6: 182 ha (Total developable area: ± 119 ha) Padloper Solar 7: 433 ha (Total developable area: ± 241 ha)

Table 5: General information.

PV Facilities	
Component	**Description / dimensions**
	Note that the total developable area referred to above includes all associated infrastructure within the fenced off area of the PV facility.
Number of inverters required	Preliminary number of 3.5 MW inverters across all the projects: 330
Area occupied by inverter-transformer stations and on-site substation and height	Inverter-Transformer stations: 0.022 ha each x 165 stations = 3.63 ha. The inverter stations will have a height of ± 3 m each (Excluding lightning rods. The lightning rods are expected to extend 10 m high. Each inverter station will have 1 – 2 lightning rods). A facility substation complex at **all seven PV facilities.** The on-site substation will be approximately 2 ha and will have a height of up to 18 m, thereby covering a total area of 14 ha.
Capacity of on-site substation	132 kV
Area occupied by both permanent and construction laydown areas	Temporary Laydown: up to 22 ha in total. There is one temporary laydown area proposed at each PV Facility (ranging from approximately 1 ha to 4 ha). Please note that the temporary laydown areas will be rehabilitated after construction and will not be retained for the operational phase.
Length of internal roads	Preliminary internal roads: ± 78 km long x 5 m wide = 39 ha (Note: This is rough estimate and will be confirmed during the final design phase of the projects prior to commencing construction).
Width of internal roads	Width: ± 4 – 5 m
Upgrading of existing access road/s	Yes. Existing roads will be used as far as practically achievable.
	Current width (m): ± 5 m
	Upgraded width (m): ± 8 m (6m wide road surface with 1m drain either side)
Site access points	Proposed to be on the Western side of Development areas, from existing farm road running further North (refer to attached KMZ file). Specialists are required to assess a 100 m wide corridor, i.e., 50 m on either side of the centreline, within which the 8 m wide road will be located. This will allow a bit of flexibility for future micro-siting.

Table 5: General information.

PV Facilities		
Component	**Description / dimensions**	
Internal transmission and/or distribution lines	All on-site medium voltage cabling (22 or 33kV) will be buried to a maximum depth of 1.5 m. Please refer to the separate section below for the 132 kV overhead lines within the PV areas.	
Site offices There will be 1 site office at each PV Facility which will include a warehouse/workshop and an operational and maintenance (O&M) control center. The details provided in this section is for one site office.	Number of buildings:	± 1
	Maximum height (m):	Up to 10 m
	Footprint (m²):	300 m^2
Guard houses There will be 2 guardhouses facilities at each PV Facility. The details provided in this section is for one guard house.	Maximum height (m):	Up to 3 m
	Footprint (m²):	Guard house and security: ± 6 m x 6 m ± 36 m²
Ablution facilities There will be 2 ablution facilities at each PV Facility included in site offices and guardhouse footprints. The details provided in this section is for one ablution facility	Maximum height (m):	Up to 10m
	Footprint (m²):	Staff lockers: ± 22 m x 11 m ± 242 m²
Battery storage	Battery technology type:	Lithium-ion technology
	Approx. footprint (ha):	± 5ha
	Maximum height (m):	Up to 10 m

Table 5: General information.

PV Facilities		
Component	**Description / dimensions**	
Each PV Facility will include 1 BESS facility. It is proposed that the BESS will be located at the project substation site and laydown area	Capacity:	Padloper PV 1: 250 MW (1 500 MWh) Padloper PV 2: 150 MW (900 MWh) Padloper PV 3: 150 MW (900 MWh) Padloper PV 4: 150 MW (900 MWh) Padloper PV 5: 150 MW (900 MWh) Padloper PV 6: 100 MW (600 MWh) Padloper PV 7: 150 MW (900 MWh)
Underground low voltage cables or cable trays	Maximum depth (m):	Up to 1.5 m
Water use requirements (per project)	Estimated quantity of water (litres) required for the construction phase:	Construction: ± 10,000 m^3 per project over a ± 18-month construction period. The largest site Padloper Solar PV 4 comprising 350 MW) will use up to ~50 000 m^3 per year during construction.
	Estimated quantity of water (litres) required for the operational phase:	Operation: ± 5,000 m^3 per annum per project for a minimum of 20-year operational lifespan of the solar energy facility. ~15 000m^3 per year during operations for the Padloper Solar Facility 4 project (comprising 350 MW).
	Estimated quantity of water (litres) required for the decommissioning phase:	Unknown
	Where will the water be sourced from e.g., borehole, dam, river, municipal, etc.:	In order of priority: i) A borehole drilled on site, which will be subject to complete geohydrological testing and the necessary water use authorisation obtained (as applicable). The need for a Water Use Licence (WUL) will be avoided and General Authorisation abstraction volumes will be adhered to as far as possible. ii) The Local Municipality (LM) - Specific arrangements will be agreed with the LM in a Service Level Agreement (SLA). Most likely the water will be either trucked in, or otherwise made available for collection at their Water Treatment Plant via a metered standpipe.

Table 5: General information.		
PV Facilities		
Component	**Description / dimensions**	
		iii) Investigation into a third-party water supplier which may include a nearby mine or other private services company.
Construction Period (months):	± 12 - 18 months per project (projects may be constructed in parallel).	

The following applies to all 7 x over-head power lines:

Table 6: EGI Projects.	
Component	**Description**
Foundation	The type of terrain will determine the choice of foundation. The size of the footprint area will range from 0.6 m x 0.6 m to 1.5 m x 1.5 m. The minimum working area required around a structure position is 20 m x 20 m.
Pylon	132 kV steel monopole or lattice towers
Tower type	Self-supporting and Angle Strain towers
Height	17.4 - 21 m
Span length	200, 250 or 375 m
Servitude width	A 400 m wide corridor (i.e., 200 m on either side of centreline) for all the overhead power lines listed above to be assessed by specialists, in order to identify sensitivities and features that need to be avoided.

The assessment area for the specialists includes the above-mentioned affected farm portions to identify sensitivities and features that need to be avoided and to identify potential buildable areas. The specialists are required to assess the total study area and the entire 400 m wide corridors for the power lines and infrastructure upgrades to generate sensitivity maps that will be used to identify the best locations for the PV areas and power lines. The location of the proposed facilities and the citing of the project infrastructure within the assessed larger study areas will be informed by the recommendations of the specialists and field work.

Depending on which projects win preferred bidder status in the Renewable Energy Independent Power Producer Procurement Program (REIPPPP) (i.e., the issuing of a Power Purchase Agreement (PPA) from the Department of Mineral Resources and Energy (DMRE)) or a private procurement process, the number of power lines may be changed/reduced (however all corridors and lines must be assessed based on the worst-case scenario).

1.1 General site description– Applicable to the Padloper PV 1-4 projects

The landscape of the Padloper Solar Projects 1-4 study area consists of flat flood plains, hills, ridges, gullies and rocky outcrops. The flood planes were mantled by vegetation (normally sparce to moderately

vegetated but with the rainfall this season vegetation was dense). Rainfall varies between 500 mm in the eastern mountain regions (Sneeuberge) to 200 mm in the western parts area. In wintertime snow occurs in the mountains. The summers are hot while the winters are cold and windy.

The vegetation type is Upper Karoo Hardeveld and Eastern Upper Karoo (Mucina & Rutherford, 2006; Sanbi, 2022). Sour grass and fynbos are present in the mountains while karooveld is typical in most of the region. Shrubs and *Acasia karoo* (thorn trees) are present along watercourses.

The Upper Karoo Hardeveld vegetation consist of "Steep slopes of Koppies, butts, mesas and parts of the Great Escarpment covered with large boulders and stones supporting sparse dwarf Karoo scrub with drought-tolerant grasses of genera such as Aristida, Eragrostis and Stipagrostis" (Mucina & Rutherford, 2006).

And the Eastern Upper Karoo vegetation is characterised by "Flats and gently sloping plains (interspersed with hills and rocky areas of Upper Karoo Hardeveld in the west, Besemkaree Koppies Shrubland in the northeast and Tarkastad Montane Shrubland in the southeast), dominated by dwarf microphyllous shrubs, with 'white' grasses of the genera Aristida and Eragrostis (these become prominent especially in the early autumn months after good summer rains). The grass cover increases along a gradient from southwest to northeast" (Mucina & Rutherford, 2006; Sanbi, 2022).



1.2 EIA Study Phase

EIA Regulations determines that several aspects of the proposed development may have an impact on the environment and are considered to be listed activities. The National Competent Authority (CA), is the Department of Forestry, Fisheries and the Environment (DFFE), and is responsible for Environmental Authorisation (EA) for the proposed development, thus leading to the commencement thereof.

These Specialist studies commissioned in the EIR phase include those outlined in the National Screening Tool Report (to be confirmed by DEDEAT). Specialist Studies will adhere to related protocols published by DFFE (March 2020). These specialist studies will obtain baseline information in their fields of expertise, assess the possible impacts and make recommendations to mitigate negative impacts optimising benefits.

2 SPECIALIST CREDETIALS

This study has been conducted by Mrs Elize Butler. She has conducted approximately 400 palaeontological impact assessments for developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga. She has an MSc (*cum laude*) in Zoology (specializing in Palaeontology) from the University of the Free State, South Africa and has been working in the field of palaeontology for more than twenty-eight years. She has 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 (PSSA) since 2006 and has been conducting PIAs since 2014.

Her *Curriculum Vitae* is included in Appendix 1 of this specialist input report.

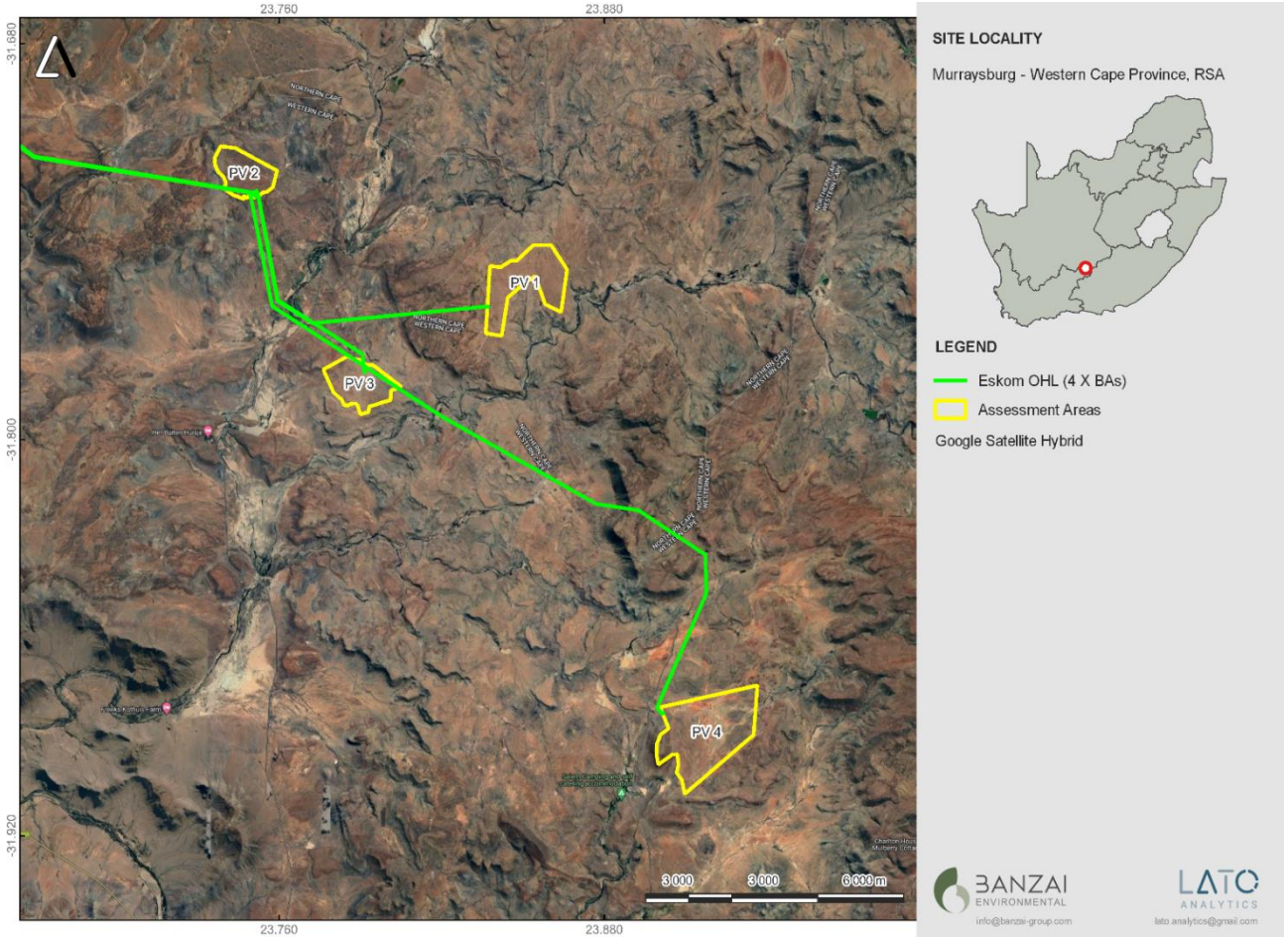


***Figure 2**: Regional locality of the Padloper Solar Facilities 1-4 near Murraysburg in the Northern Cape and Western Cape.*

The Padloper EGI 1-4 projects are included in this image but will be subjected to a separate PIA and BA process.

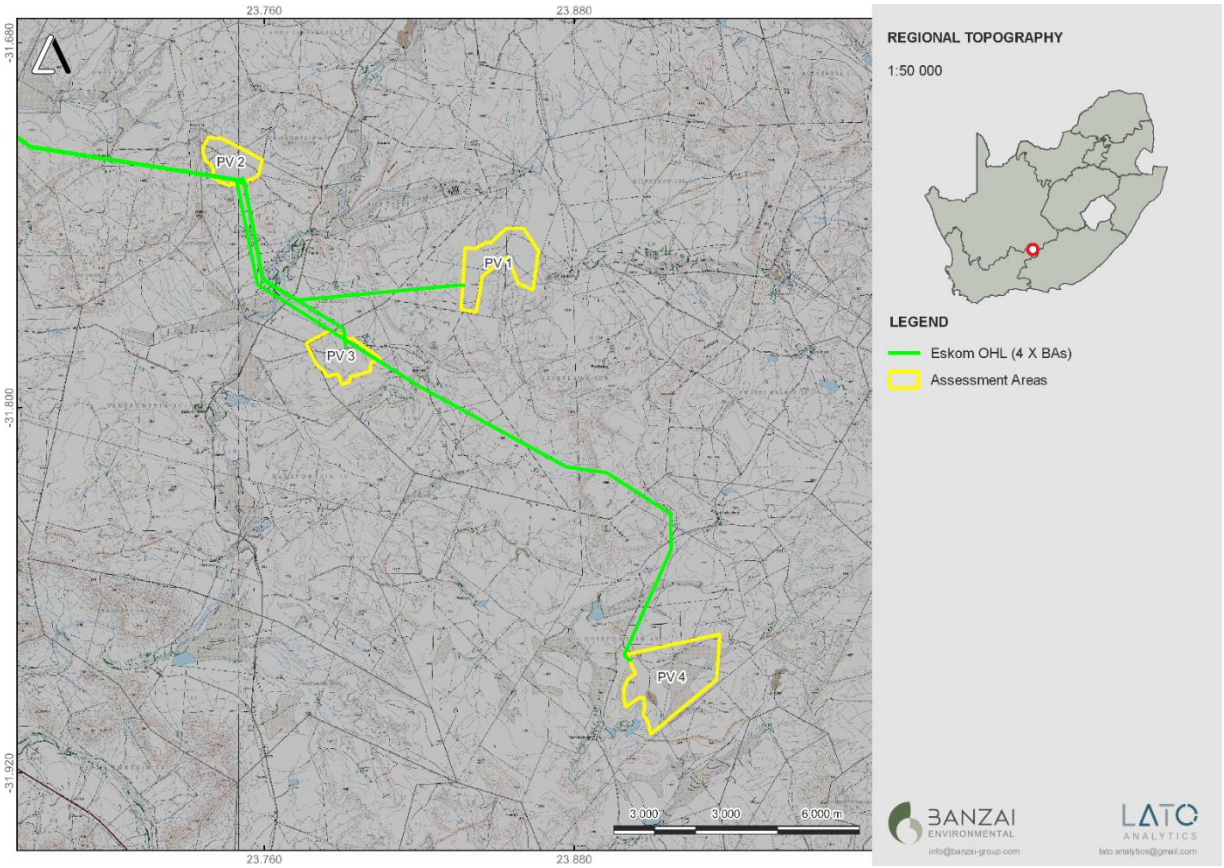


Figure 3: Regional topography of the Padloper adloper EGIs 1-4 near Murraysburg in the Northern Cape and Western Cape.

The Padloper EGI 1-4 projects are included in this image but will be subjected to a separate PIA and BA process.

3 LEGISLATION – APPLICABLE TO THE PADLOPER PV 1-4 PROJECTS

3.1 National Heritage Resources Act (Act No. 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".

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

- National Environmental Management Act (NEMA) Act No. 107 of 1998
- National Heritage Resources Act (NHRA) Act No. 25 of 1999
- Minerals and Petroleum Resources Development Act (MPRDA) Act No. 28 of 2002
- Notice 648 of the Government Gazette 45421- general requirements for undertaking an initial site sensitivity verification where no specific assessment protocol has been identified.

The next section in each Act is directly applicable to the identification, assessment, and evaluation of cultural heritage resources.

GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998

- Basic Assessment Report (BAR) – Regulations 19 and 23
- Environmental Impacts Assessment (EIA) – Regulation 23
- Environmental Scoping Report (ESR) – Regulation 21
- Environmental Management Programme (EMPr) – Regulations 19 and 23

National Heritage Resources Act (NHRA) Act No. 25 of 1999

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

The NEMA (No. 107 of 1998) states that an integrated EMP should (23:2 (b)) "*…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*".

In agreement with legislative requirements, EIA rating standards as well as SAHRA policies the following comprehensive and legally compatible PIA report have been compiled.

Palaeontological heritage is exceptional and non-renewable and is protected by the NHRA. Palaeontological resources and 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 Palaeontological Impact assessment 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 m² in extent.
    - or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

4 METHODS AND TERMS OF REFERENCE– APPLICABLE TO THE PADLOPER PV 1-4 PROJECTS

The present field-based PIA assesses the potential impacts on fossil heritage on the development. footprint. This study forms part of the Heritage Impact Assessment Report. According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the purpose of the PIA is: 1) to identify the palaeontological importance of the rock formations in the footprint; 2) to evaluate the palaeontological magnitude of the formations; 3) to clarify the impact on fossil heritage; and 4) to suggest how the developer might protect and lessen possible damage to fossil heritage.

The palaeontological status of each rock section is calculated as well as the possible impact of the development on fossil heritage by a) the palaeontological importance of the rocks, b) the type of development and c) the quantity of bedrock removed.

All possible information is consulted to compile a report, and this includes the following: Provisional DFFE Screening Tool, SAHRIS Palaeosensitivity map, all Palaeontological Impact Assessment reports in the same area; aerial photos and Google Earth images, topographical and geological maps as well as scientific articles of specimens from the development area and Assemblage Zones.

When the development footprint has a moderate to high palaeontological sensitivity a field-based assessment is necessary. The desktop and the field survey of the exposed rock determine the impact significance of the planned development and recommendations for further studies or mitigation are made. Destructive impacts on palaeontological heritage usually only occur during the construction phase while the excavations will change the current topography and destruct or permanently seal-in fossils at or below the ground surface. Fossil Heritage will then no longer be accessible for scientific research.

During a site investigation the palaeontologist does not only survey the development but also tries to determine the density and diversity of fossils in the development area. This is confirmed by examining representative exposures of fossiliferous rocks (sedimentary rocks contain fossil heritage whereas igneous and metamorphic rocks are mostly unfossiliferous). Rock exposures that are investigated usually contains a large portion of the stratigraphic unit, can be accessed easily and comprise of unweathered (fresh) exposed rock. These exposures may be natural (rocky outcrops in stream or river banks, cliffs, dongas) but could also be artificial (quarries, open building excavations and even railway and road cuttings). It is common practice for palaeontologist to log well-preserved fossils (GPS, and stratigraphic data) during field assessment studies.

Mitigation usually precedes construction or may occur during construction when potentially fossiliferous bedrock is exposed. Mitigation comprises the collection and recording of fossils. Preceding excavation of any fossils, a permit from SAHRA must be obtained and the material will have to be housed in a permitted institution. When mitigation is applied correctly, a positive impact is possible as knowledge of local palaeontological heritage may be increased.

The fossil potential of the Padloper Solar Facilities 1-4 development area was determined by criss-crossing the development footprint and by physically investigating all bedrock outcrops to determine the lithology and fossil content of the outcrops. Fossils occurring at the surface is very unpredictable and a representative sample size of the area has been investigated. However, it is important to note that the absence of fossils in a development footprint does not necessarily mean that palaeontological significant material is not present on site (on or beneath ground surface).

The terms of reference of a PIA are as follows:

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 applicable best practice recommendations, appropriate legislation and authority requirements;
- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Describe of the proposed project and provide information regarding the developer and consultant who commissioned the study,
- Describe location of the proposed development and provide geological and topographical maps
- Provide palaeontological and geological history of the affected area.
- Identify sensitive areas to be avoided (providing shapefiles/kmls) in the proposed development;
- Evaluate the significance of the planned 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:
    a. 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.
    b. Indirect impacts of an activity are indirect or induced changes that may occur as a result of the activity.
    c. 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.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Detail the implications of specialist findings for the proposed development (such as permits, licenses etc).

4.1 Assumptions and Limitations– Applicable to the Padloper PV 1-4 projects

The focal point of geological maps is the geology of the area and the sheet explanations of the Geological Maps were not meant to focus on palaeontological heritage. Many inaccessible regions of South Africa have never been reviewed by palaeontologists and data is generally based on aerial photographs alone.

Locality and geological information of museums and universities databases have not been kept up to date or data collected in the past have not always been accurately documented.

Comparable Assemblage Zones in other areas is also used to provide information on the existence of fossils in an area which has not documented in the past. When using similar Assemblage Zones and geological formations for Desktop studies it is generally assumed that exposed fossil heritage is present within the footprint. A field-assessment will thus improve the accuracy of the desktop assessment.

5 GEOLOGICAL AND PALAEONTOLOGICAL HISTORY– APPLICABLE TO THE PADLOPER PV 1-4 PROJECTS

The proposed Padloper (Facilities 1-4) Solar PV Projects near Murraysburg in the Western Cape and Norther Cape provinces is depicted on the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) (Figure 4; Table 7). This map indicates that Padloper Solar Facility 1 is entirely underlain by the Balfour (Pb, green) of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup), while Padloper Solar Facility 2 is almost entirely underlain by Jurassic Dolerite (Jd, red) with a small portion in the south underlain by the Balfour Formation (Pb, bright green) and a small portion in the north underlain by the Middleton/Teekloof Formation (Pth, pale green) (Adelaide Subgroup, Beaufort Group). Padloper Solar Facility 3 is underlain by a large area underlain by the Balfour Formation (Pb) while the south west margin is underlain by Jurassic dolerite (Jd). The PalaeoMap of the South African Heritage Resources Information System indicates that the Palaeontological Sensitivity of the Jurassic Dolerite is Zero as it is igneous in origin and thus fossiliferous while that of the Adelaide Subgroup is Very High (Almond and Pether, 2009; Almond *et al*., 2013, Figure 5, Table 8). The DFFE screening took for the study areas is indicated in Figures 6-9 and indicates that the proposed development has a Very High (dark red) Palaeontological Sensitivity. Updated Geology compiled by the Council of Geosciences (Pretoria) is depicted in Figure 10 and indicates that the development is underlain by the Balfour and Middelton Formations of the Adelaide Subgroup.

The Jurassic dolerite present in the development form part of the Karoo Igneous Province is one of the world's classic continental flood basalt (CFB) provinces. This Suite was formed approximately 183 million years ago and consists of intrusive and extrusive rocks that occur over a large area (Duncan *et al*., 2006). Generally, the flood basalts do not contribute to prominent volcanic structures but instead are formed by successive eruptions from a set of fissures that form sub-horizontal lava flows (sills and dikes) varying in thickness. This lava caps the landscape on which they erupted. As the Karoo is an old flood basalt province it is today preserved as erosional fragments of a more extensive lava cap that covered much of southern Africa in the geological past. It is estimated that the Karoo lava outcrop currently covering at least 140 000 km^2, was larger in the past [~2 000 000 km^2 (Cox 1970, 1972)]. The Karoo Igneous Province

can be divided into the Lebombo and the Drakensberg Groups. This Igneous Province contains a large volume of flood basalts as well as silicic volcanic rocks. These units consist of hyodacite and rhyolitic magma and crops out along the Lebombo monocline. Individual units span up to 60 km and sometimes show massive pyroclastic structures and are thus classified as rheoignimbrites. The basal lavas lie conformably on the Clarens Formation but in specific localities, sandstone erosion occurred before the volcanic eruptions took place. Lock *et al.* (1974) described evidence in the Eastern Cape that in the early stages of volcanism magma interacted with ground water to produce volcaniclastic deposits as well as phreatic and phreatomagmatic diatremes. Eales *et al.* (1984) also found evidence of aqueous environments during early volcanism by the existence of pillow lavas and associated hyaloclastite breccias and thin lenses of fluviatile sandstones interbedded with the lowermost magmas.

The proposed development 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 (Figure 11). The Beaufort Group is the third of the main subdivisions of the Karoo Supergroup. 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 and is divided into the Adelaide subgroup and the overlying Tarkastad subgroup. The Adelaide subgroup rocks are 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 Adelaide Subgroup is approximately 5 000 m thick in the southeast, but this decreases to about 800 m in the centre of the basin which decreases to about 100 to 200 m in the north.

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 crossbedding as well as current ripple lamination. The bases of the sandstone units are extensive beds, while ripple lamination is usually confined to thin sandstones towards the top of the thicker units. The mudrocks of the Adelaide Subgroup usually have massive and blocky weathering. Sometimes desiccation cracks and impressions of raindrops are present. In the mudstones of the Beaufort Group calcareous nodules and concretions occur throughout.

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 Beaufort Group is subdivided into a series of biostratigraphic units based on its faunal content (Kitching1977, 1978; Keyser *et al.*, 1977, Rubidge 1995, Smith *et al.,* 2020; Viglietti 2020). The south-western portion of the proposed development is underlain by the Balfour Formation which is

divided in the *Daptocephalus* (DAZ) which in turn is divided in the upper (younger) *Lystrosaurus maccaigi - Moschorhinus* and lower (older) *Dicynodon-Theriognathus* Subzones (Viglietti, 2020).

The dicynodont, *Daptocephalus leoniceps* (Figure 12) is the main biozone defining fossil of the D*aptocephalus Assemblage Zone*. The *Daptocephalus* Assemblage Zone (DaAZ) is characterised by the co-occurrence of the dicynodontoid *Daptocephalus leoniceps*, the therocephalian Theriognathus microps, and the cynodont *Procynosuchus delaharpeae*. The DaAZ comprise of two subzones representing the two distinct faunal assemblages in this assemblage zone. The Dicynodon -Theriognathus Subzone (in co-occurrence with Daptocephalus) is present in the lower Daptocephalus Assemblage Zone while the Lystrosaurus maccaigi – Moschorhinus kitchingi Subzone is present in the upper DaAZ. The defining taxa of the latter subzone is *L. maccaigi, Daptocephalus* and *Moschorhinus* (Figure 13). This Zone is characterized by the co-occurrence of the two therapsids namely *Dicynodon* and *Theriognathus* (Figure 13). The *Daptocephalus* Assemblage Zone of the Beaufort Group shows the greatest vertebrate diversity and includes numerous well-preserved genera and species of dicynodonts, biarmosuchians, gorgonopsian, therocephalian and cynodont therapsid Synapsida. Captorhinid Reptilia are also present while eosuchian Reptilia, Amphibia and Pisces are rarer in occurrence. Trace fossils of vertebrates and invertebrates as well as *Glossopteris* flora plants have also been described.

The *Daptocephalus* Assemblage Zone (AZ) expands into the lower Palingkloof of the Upper Balfour Formation (Figure 11). 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. The lower *Lystrosaurus* declivis AZ forms part of the Katberg Formation. Fauna and flora from this assemblage zone is rare as few genera survived the Permo-Triassic Extinction Event. The *Lystrosaurus* declivis AZ is characterized by the dicynodont, *Lystrosaurus (*Figure 14-15*)*, and captorhinid reptile, *Procolophon,* biarmosuchian and gorgonopsian Therapsida that did not survive into the *Lystrosaurus* Assemblage Zone although the therocephalian and cynodont Therapsida are present in moderate quantities. Captorhinid Reptilia is reduced, but this interval is characterised by a unique diversity of oversize amphibians while fossil fish, millipedes and diverse trace fossils have also been recorded.

The Teekloof Formation is present in the development area. The stratigraphically younger Poortjie Formation is biostratigraphically represented by the Endothiodon Assemblage Zone (AZ). This biozone is subdivided by the *Tropidostoma-Gorgonops and* the *Lycosuchus-Eunotosaurus* Subzones) (Figure 16), while the *Abrahamskraal* Formation is represented by the *Tapinocephalus* and upper Eodicynodon AZ.

Day and Smith (2020) proposed a subdivision of the Endothiodon AZ in the *lower Lycosuchus - Eunotosaurus* Subzone and the upper *Tropidostoma - Gorgonops* Subzone (Figure 18). The contact between these subzones is represented by the first appearance of Tropidostoma dubium. The first appearance of *Aulacephalodon bainii* terminates the Endothiodon AZ

The *Endothiodon* AZ is comparable with much of the Middleton Formation (east of 24°E) as well as the lower Teekloof Formation (west of 24°E). Day *et al* (2015) found that the *Endothiodon* Assemblage Zone

(Figure 17) West of 24°E is present in the upper two thirds of the Poortjie Member (Day *et al*., 2015) overlying the Hoedemaker Member except in the upper strata. Near Victoria West the lithostratigraphy may vary due to thinning of lithostratigraphic units (Day and Rubidge, 2019) (Day and Rubidge, 2019).
The dicynodont genera *Endothiodon* (Figure 11), *Emydops, Diictodon, Pristerodon* and the gorgonopsian Gorgonops characterizes the *Endothiodon* AZ. In South Africa, *Endothiodon* is most probably represented by the single species *Endothiodon bathystoma* (Brink, 1986; Cox and Angielczyk, 2015; Maharaj, 2018) that becomes abundant after the Capitanian mass extinction. Endothiodon is very rarely recovered from other intervals.

Characterizing taxa of the *Lycosuchus – Eunotosaurus* Subzone is *Eunotosaurus africanus* and the lycosuchid theroceohalian *Lycosuchus vanderrieti* (Figure 11) that co-occur with Endothiodon. This Subzone represents the first stage of ecological recovery after the Capitanian mass extinction. (Day *et al*., 2013; Kammerer *et al*., 2015) and records the stratigraphically lowest occurrence of large gorgonopsians and bauroid therocephalians. Basal therocephalians include the scylacosaurid *Glanosuchus macrops* while the small gorgonopsian *Eriphostoma microdon* is also present in this Subzone. This Subzone mostly corresponds with the arenaceous Poortjie Member with a sandstone mudrock ratio of 1:2. A sudden increase of sandstone bodies is present at the base of this member and the change from single-storied to multi-storied channel sandstone geometries. Mudrocks are represented by subordinate dark-reddish brown mudstone and greenish-grey siltstone. Roussouw and De Villiers [1952) describes calcareous nodular horizons that weathers to a brown colour as well as thin sheets of pink-weathering silicified siltstone.

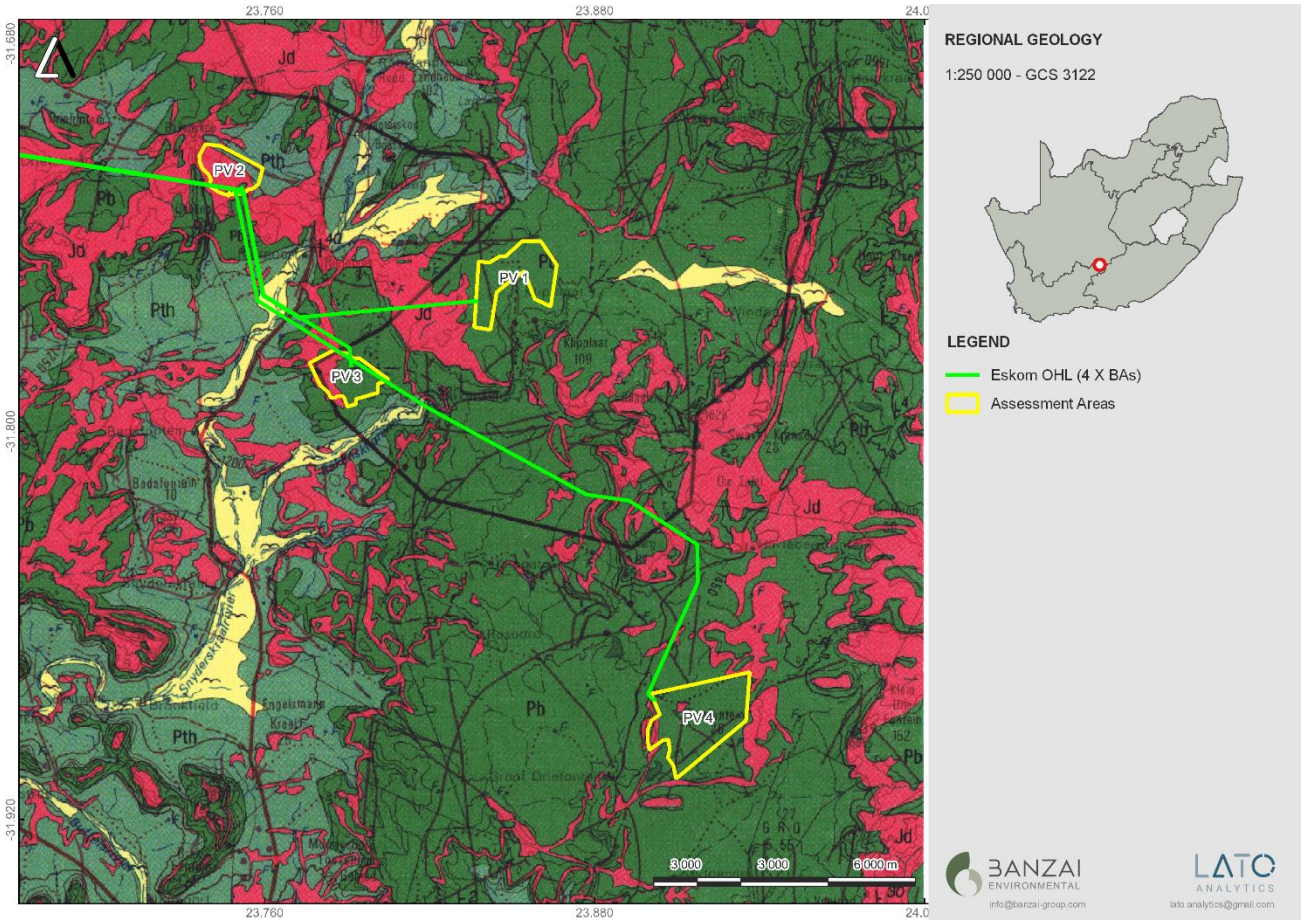
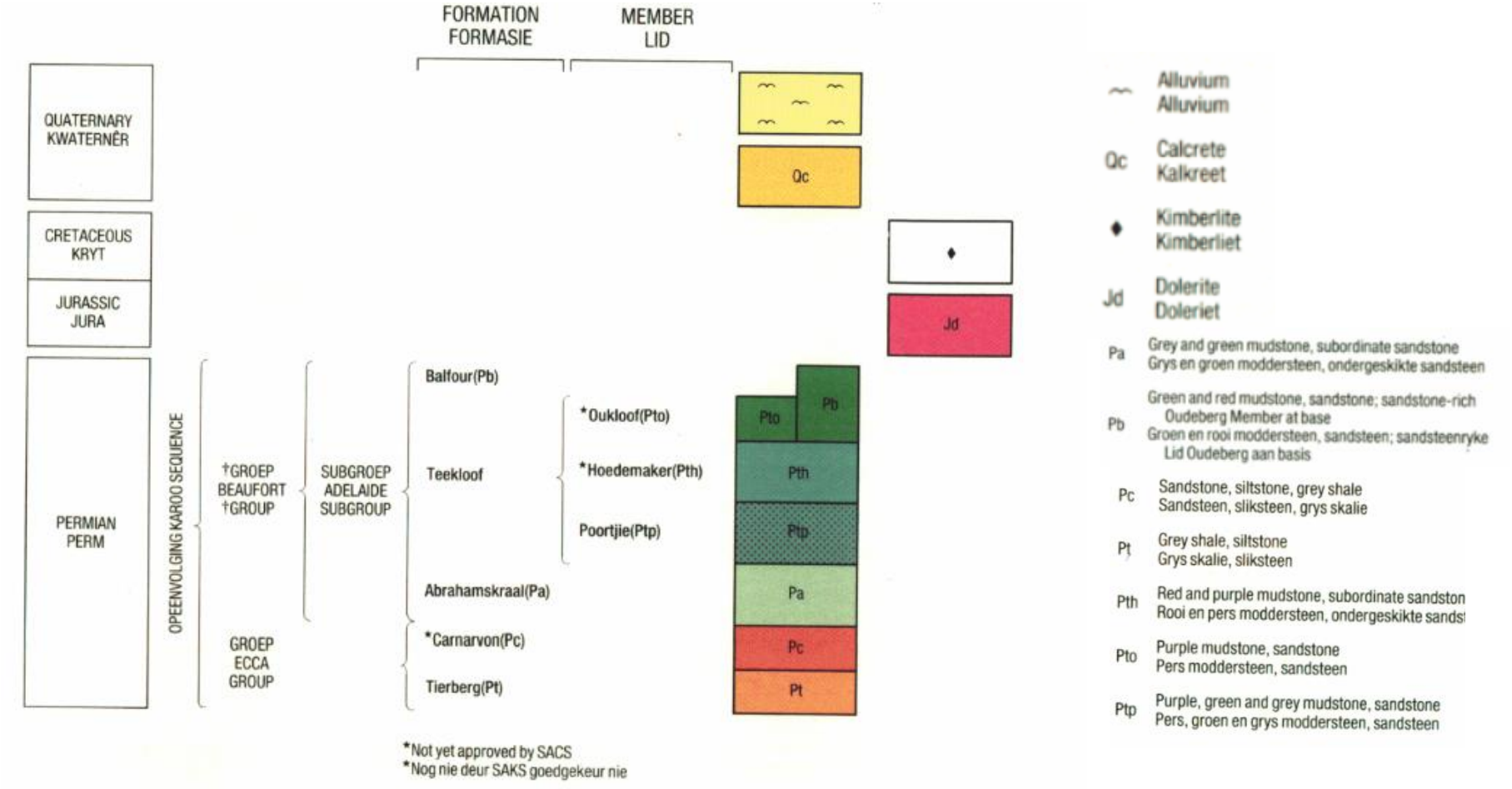


***Figure 4**. Extract of the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) indicating the geology of the Padloper Solar Facilities 1-4 and associated grid infrastructure near Murraysburg in the Western Cape. The development is underlain by the Balfour (Pb, green) and Teekloof/Middelton (Pth, pale green) Formations of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as Jurassic dolerite (Jd, red).*

Table 7: Legend to the 1:250 000 1:250 000 Victoria West 3122 (1966) Geological map (Council of Geoscience, Pretoria).



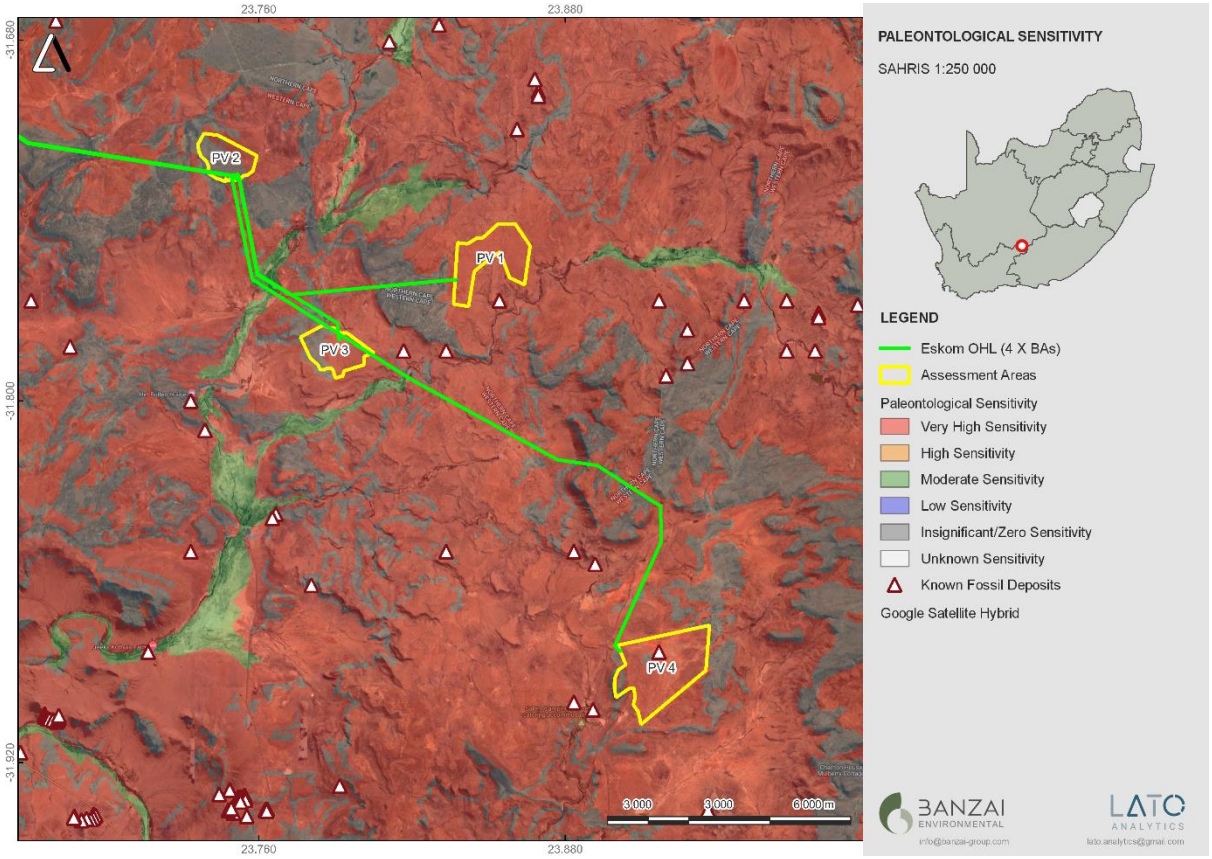


Figure 5: *Extract of the SAHRIS PalaeoMap (Council of Geosciences) indicates that* Padloper Solar Facilities 5-7 is *underlain by sediments with a Very High (red) and Zero (grey) Palaeontological Sensitivity. Fossils finds recorded on the National Palaeontological Database is indicated in white triangles with red outlines.*

The National Palaeontological Databases is a combined database of all fossils collected by the different research institutions in South Africa. Only one fossil was recovered from the study area is indicated by the white triangles with red outlines (PV 4, Figure 5). This fossil was collected and is housed in a museum/university collection.

Table 8: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al., 2013; SAHRIS website.

Colour	Sensitivity	Required Action
RED	**VERY HIGH**	**Field assessment and protocol for finds is required**
ORANGE/YELLOW	**HIGH**	**Desktop study is required and based on the outcome of the desktop study; a field assessment is likely.**
GREEN	MODERATE	Desktop study is required.
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required.
GREY	**INSIGNIFICANT/ZERO**	**No palaeontological studies are required.**
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

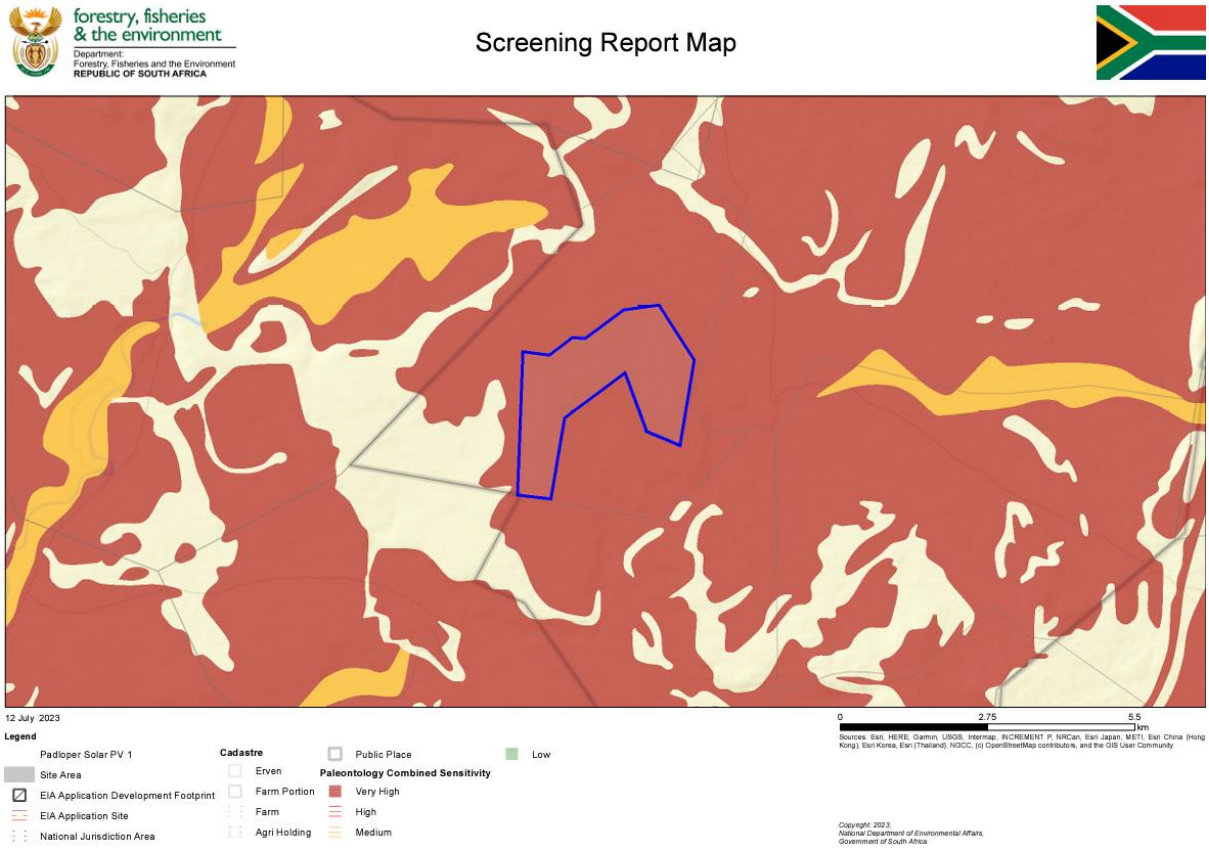


***Figure 6**: Palaeontological Sensitivity of the Padloper Solar Facility 1 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper Solar Facility 1 is Very High (dark red).

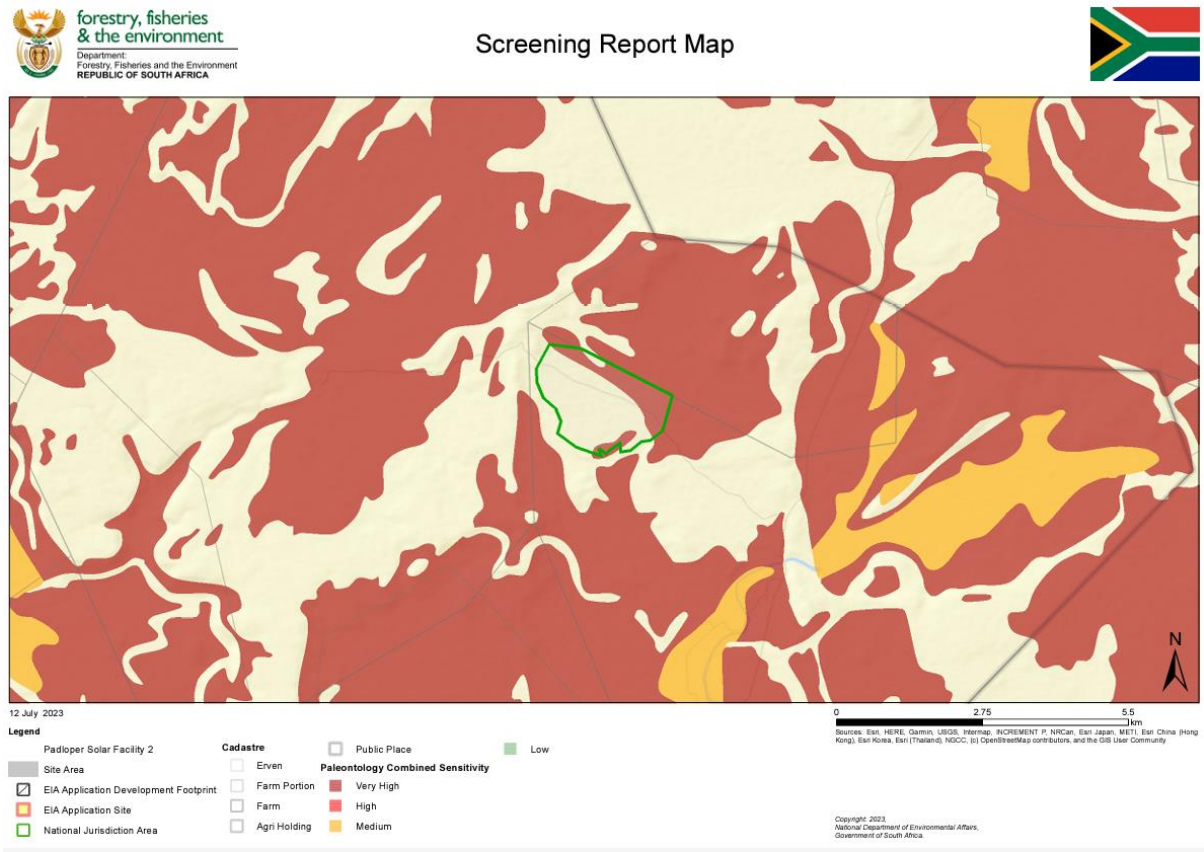


***Figure 7**: Palaeontological Sensitivity of the Padloper Solar Facility 2 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of a small portion of the northern section of the Padloper Solar Facility 2 is Very High (dark red). No sensitivities have been allocated for majority of the footprint

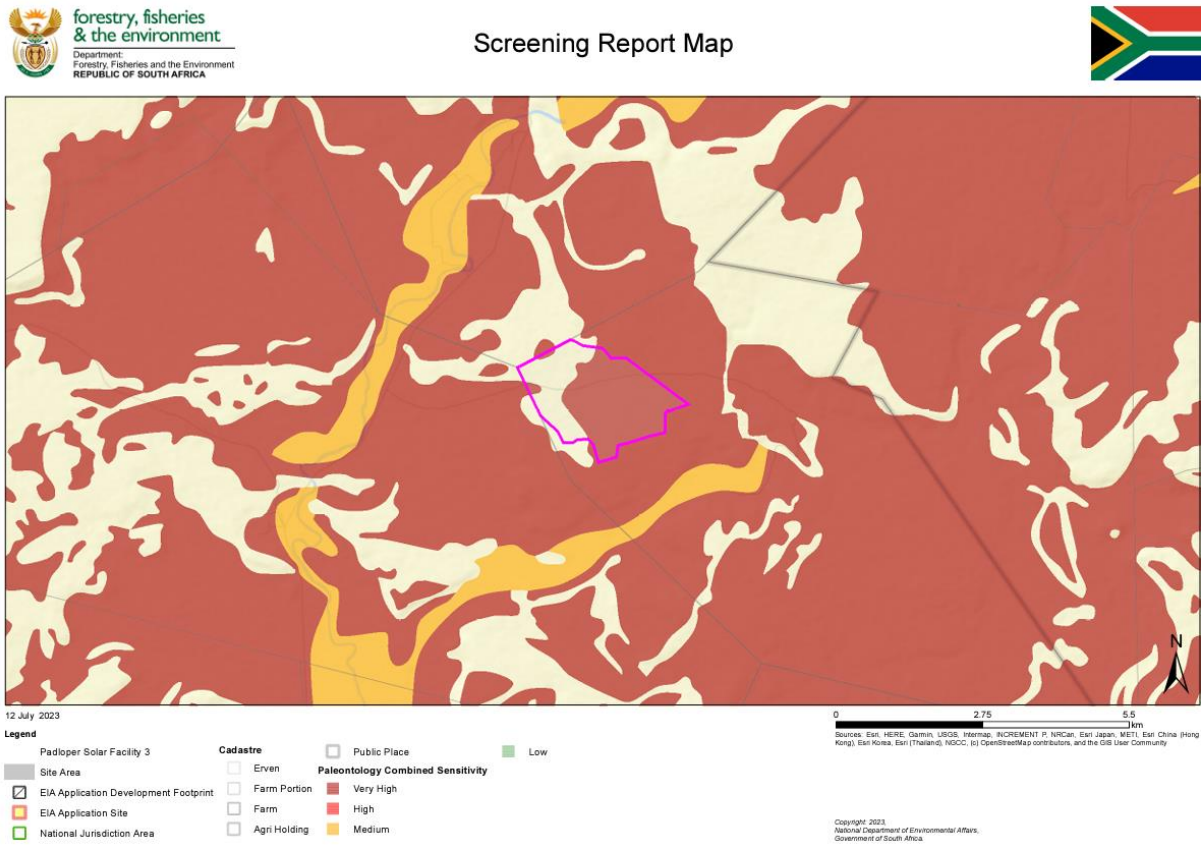


***Figure 8**: Palaeontological Sensitivity of the Padloper Solar Facility 3 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper Solar Facility 3 is Very High (dark red) while no sensitivity has been allocated to the white areas on the map.

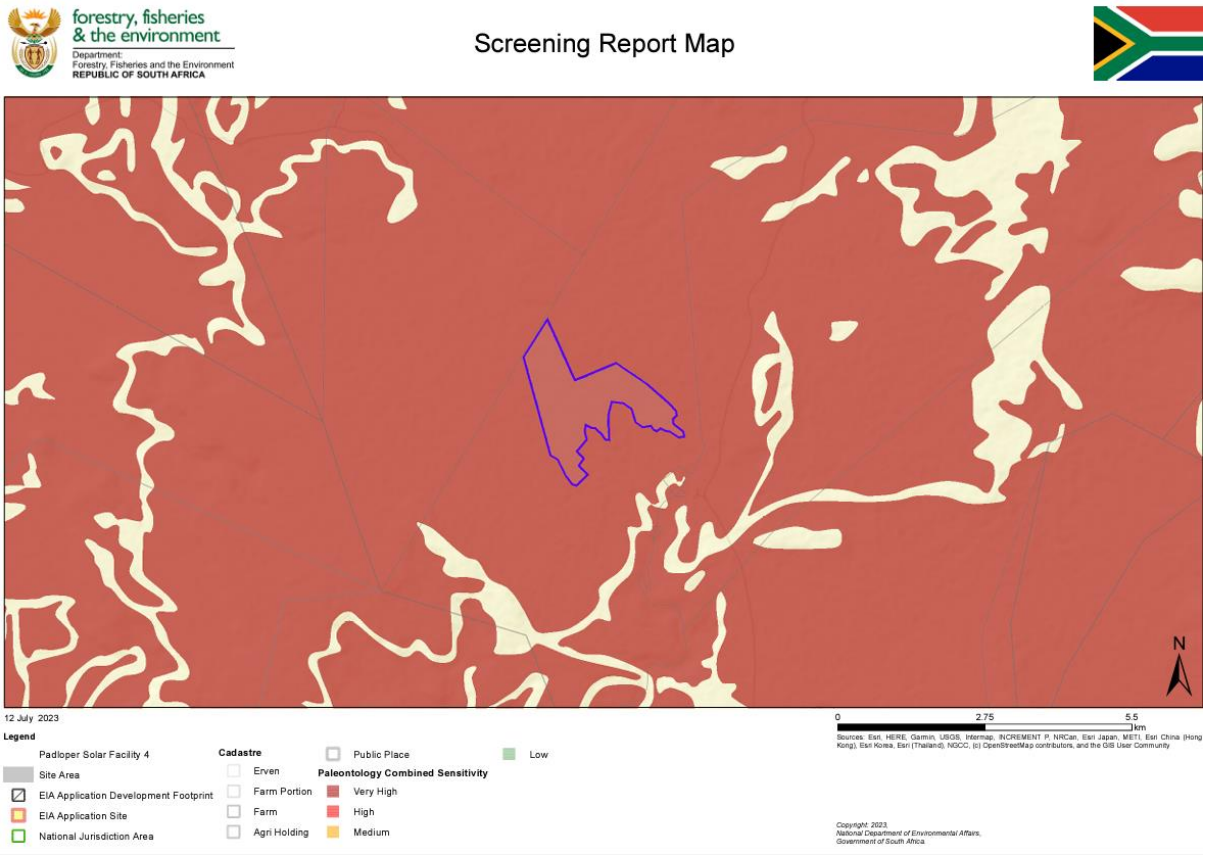


***Figure 9**: Palaeontological Sensitivity of the Padloper Solar Facility 4 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper Solar Facility 4 is Very High (dark red).

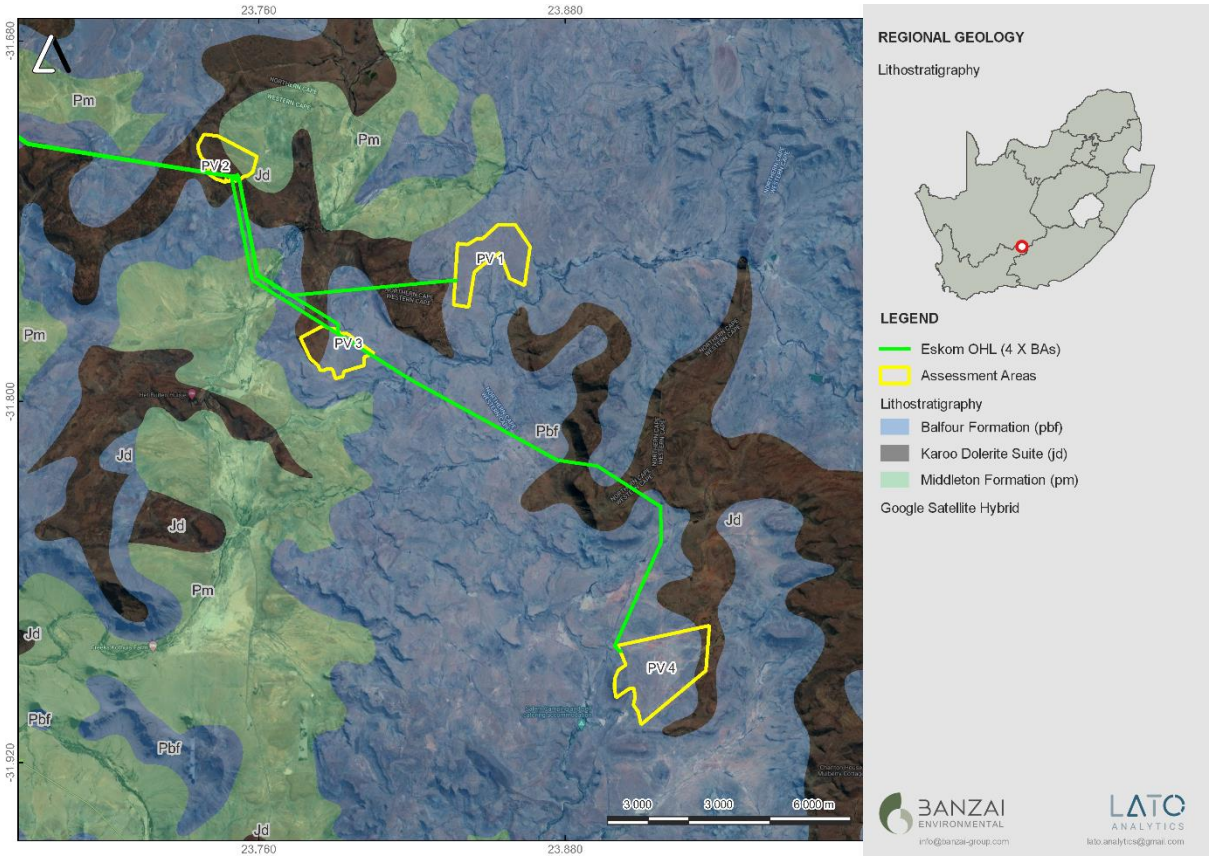


***Figure 10**: Updated Geology compiled by the Council of Geosciences (Council for Geoscience, Pretoria) indicates that the proposed Padloper Solar Facilities 1-4 are underlain by the Karoo Dolerite Suite, Balfour Formation as well as the Middleton Formation (Adelaide Subgroup, Karoo Supergroup).*

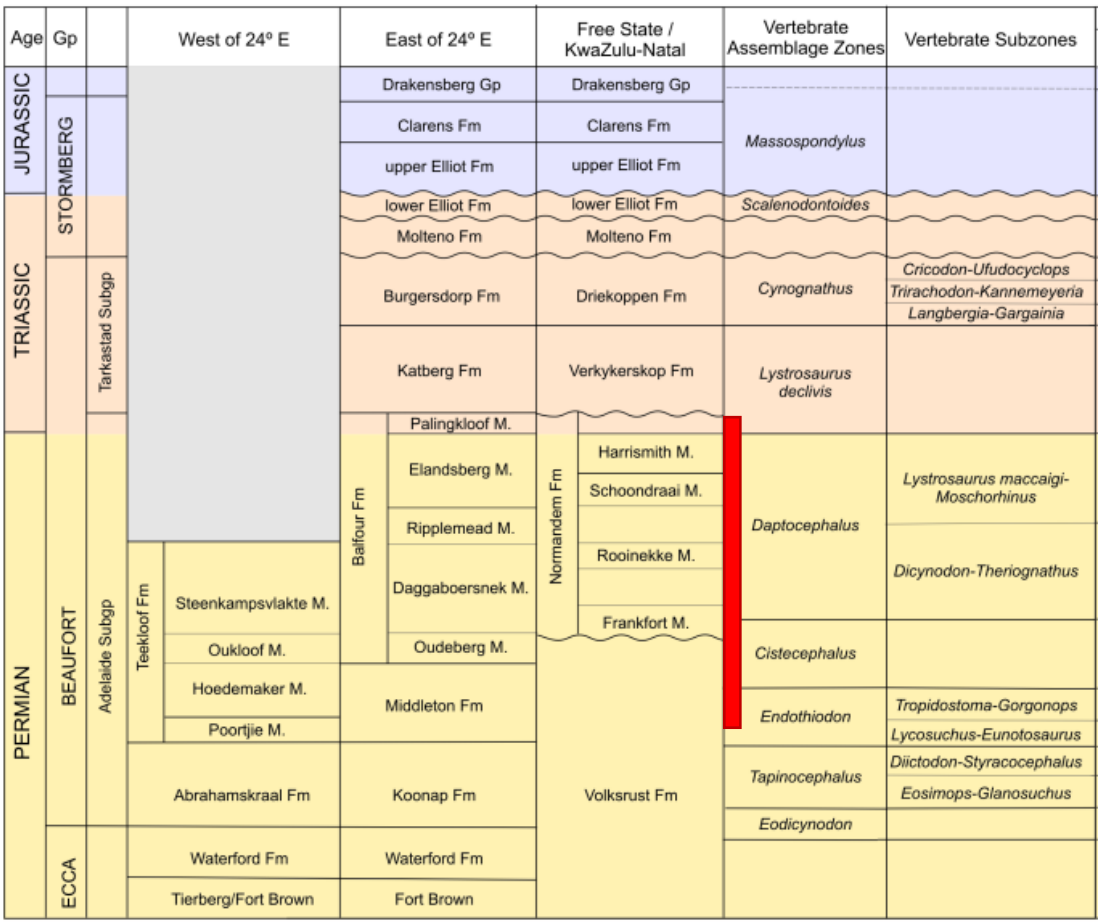


***Figure 11**: Vertebrate biozonation range chart for the Main Karoo Basin of South Africa.*

Solid lines indicate known ranges, dotted lines indicate suspected but not confirmed ranges, single dot represents the stratigraphic position of the taxa that have only been recovered from a single bed. Wavy lines indicate unconformities. (PLYCSR=Pelycosauria and MAMMFMES+Mammaliaformes. Gp=group, Subgp-Supbroup, Fm=Formation, M=Member. The biozones present in the proposed Solar development footprints are indication by the red polygon.

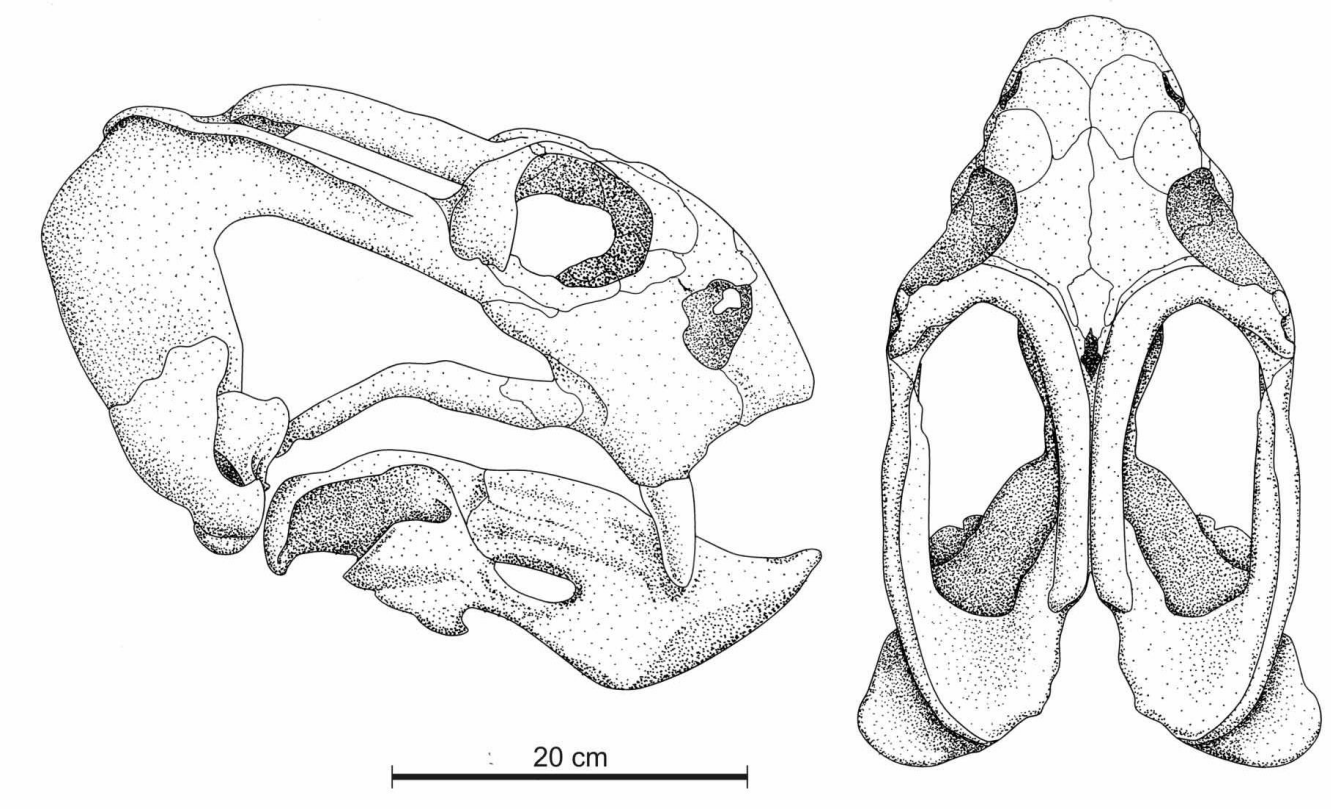


***Figure 12**: Lateral and dorsal views of skull of the dicynodont Daptocephalus leoniceps, the main biozone defining fossil and dorsal views (Image taken from Viglietti, 2020).*

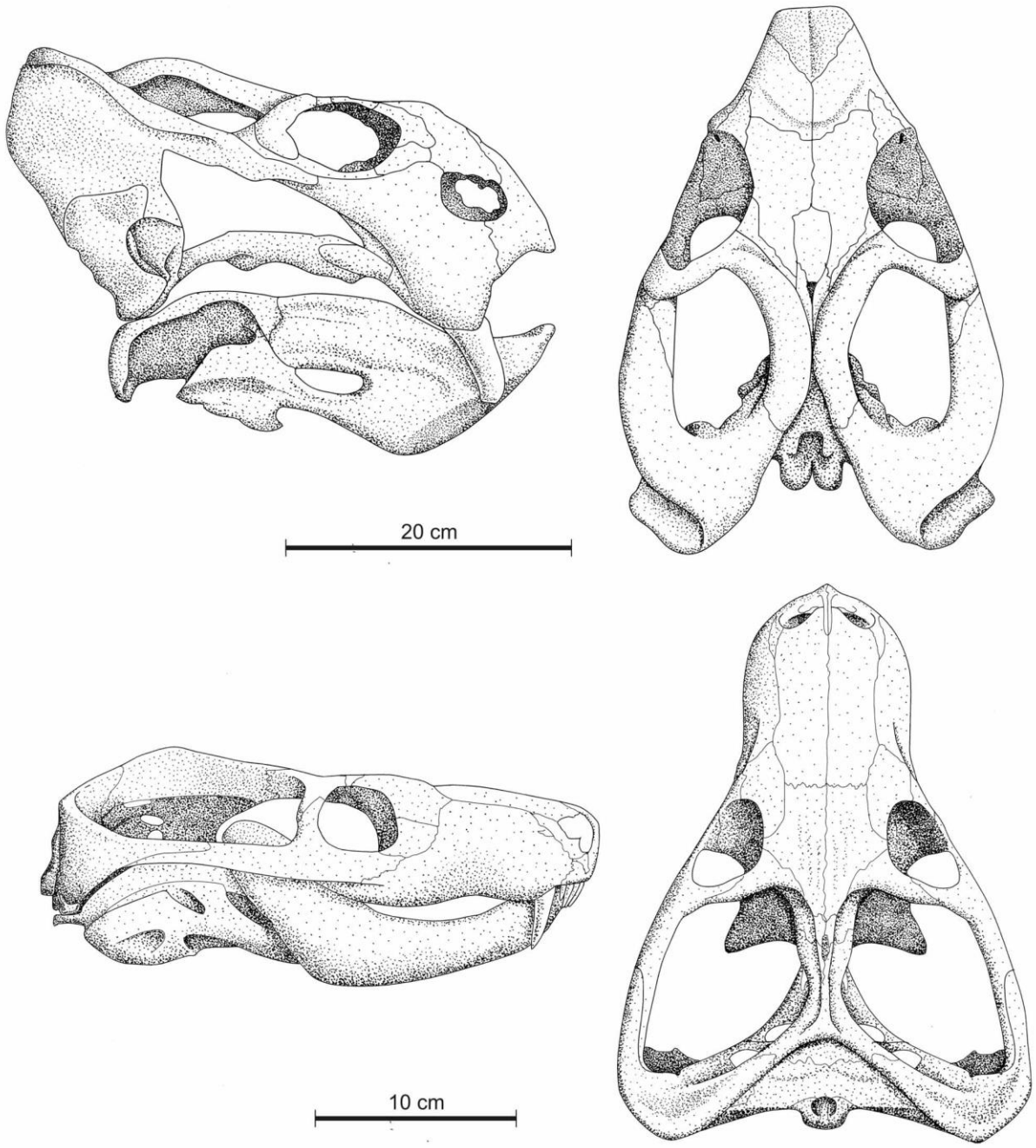


***Figure 13**: Skulls of the biozone defining fossils of the Dicynodon-Theriognathus Subzone in lateral and dorsal views. Dicynodon lacerticeps (top), Theriognathus microps (bottom) (Image taken from Viglietti, 2020).*

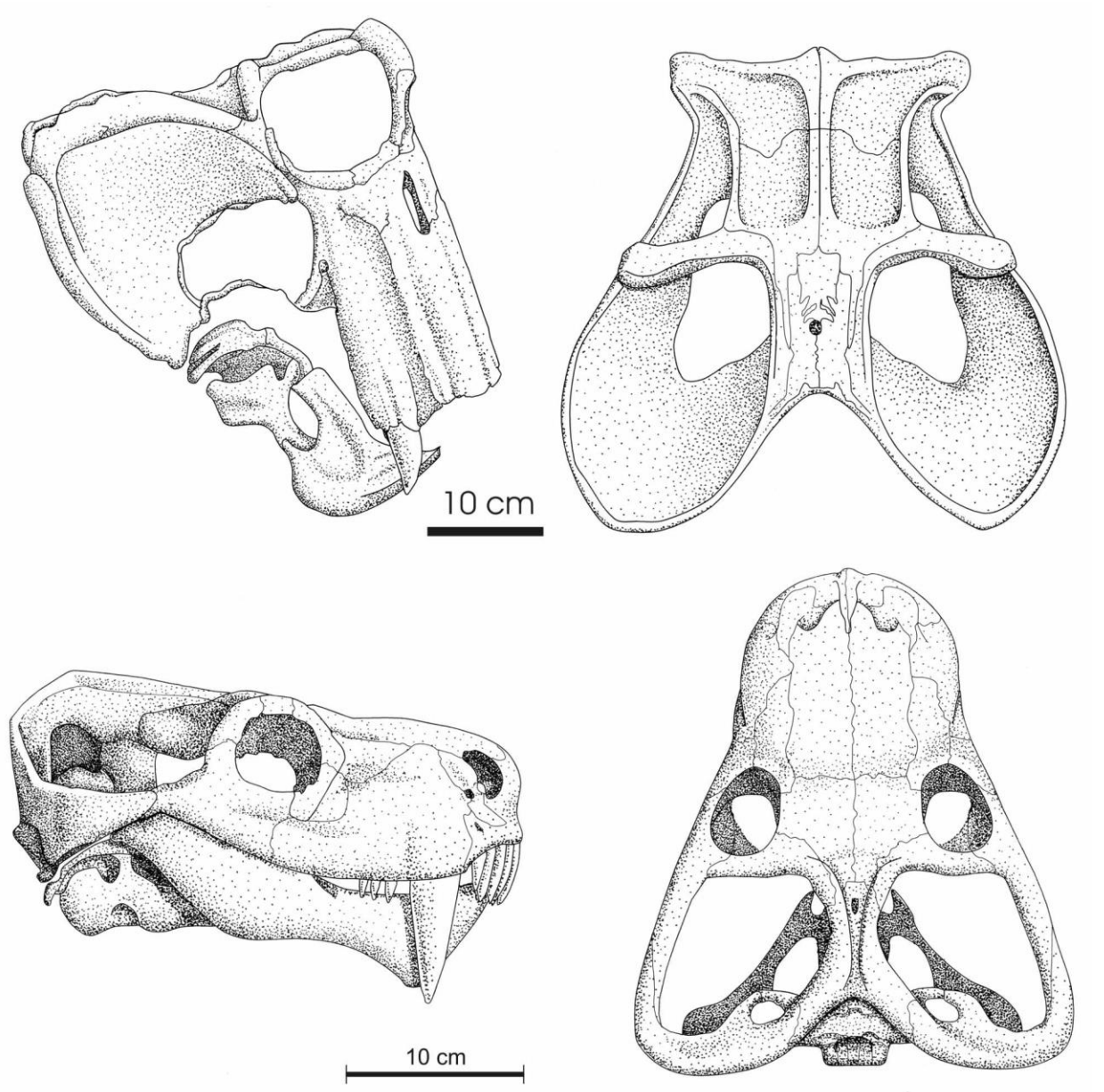


Figure 14: *Biozone defining fossils of the Lystrosaurus maccaigi- Moschorhinus Subzone. The skulls of the Lystrosaurus maccaigi (top) and Moschorhinus kitchingi (bottom) in lateral.*

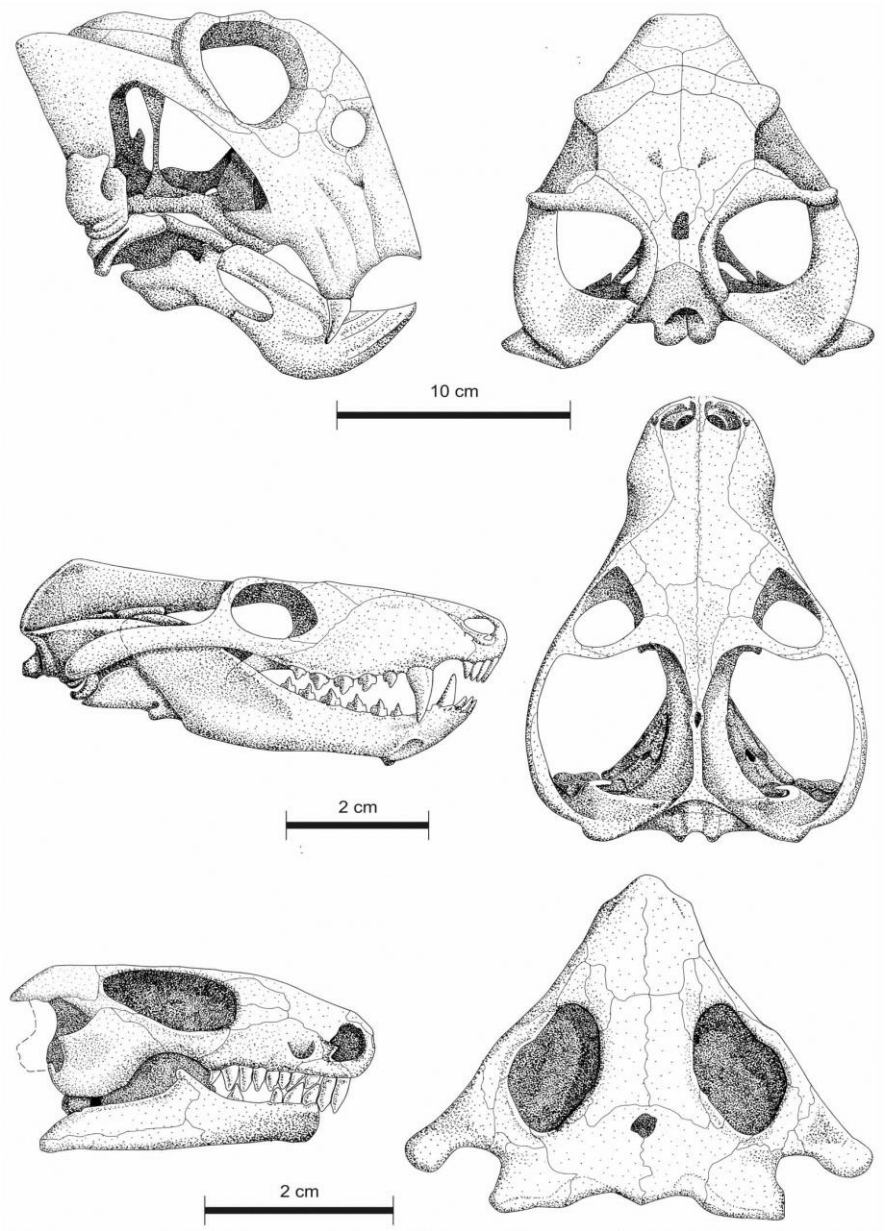


***Figure 15**: Lateral and dorsal views of the index taxa defining the Lystrosaurus declivis Assemblage Zone. (top) Lystrosaurus declivis, (centre) Thrinaxodon liorhinus, (bottom) Procolophon trigoniceps (Image taken from Botha and Smith, 2020).*

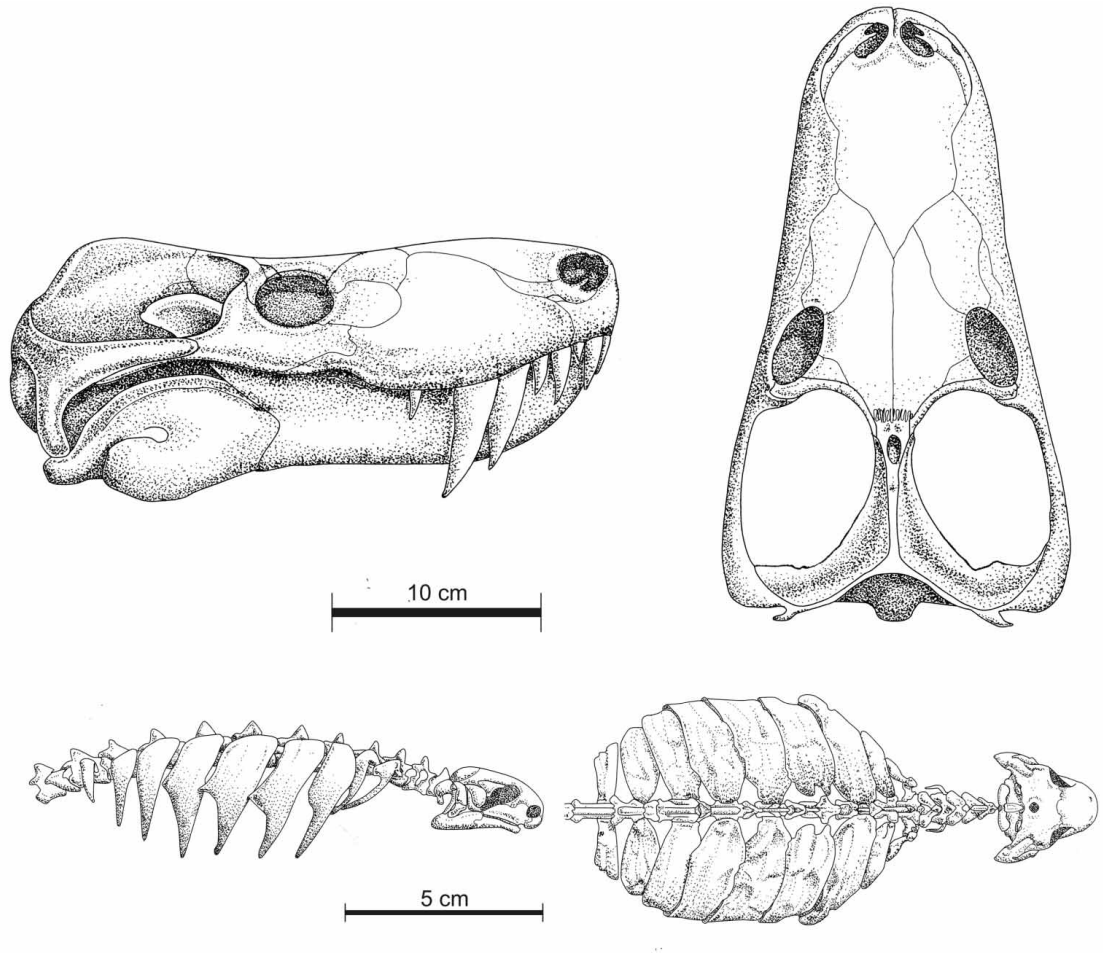


***Figure 16**: Lateral and dorsal views of Lycosuchus vanderrieti (top), and Eunotosaurus africanus (bottom), the biozone defining taxa of the Lycosuchus – Eunotosaurus Subzone (Taken from Day and Smith, 2020).*

A renewed uplift in the Gondwanides (about 260 Mya) caused a variety of sand-dominated braided streams flowing northeasterly and crossing the southern Karoo alluvial plains in the direction of an intracontinental sea (Rubidge, 2005). The arenaceous Poortjie Member preserves these channels. Renewed tectonism is indicated by the presence of various laterally continuous thin sheets of silicified mudrocks (Rossouw and De Villiers, 1952). These sediments are rich in in volcanic ash (Ho Tun, 1979). The *Abrahamskraa*l and *Teekloof* Formations contains these tuffaceous horizons. Radiometric dates indicate that the base of the Poortjie Member is about 260 260 My while the upper boundary is about 259 and 258 Ma (Day *et al*., 2015, Lucas and Shen, 2018).

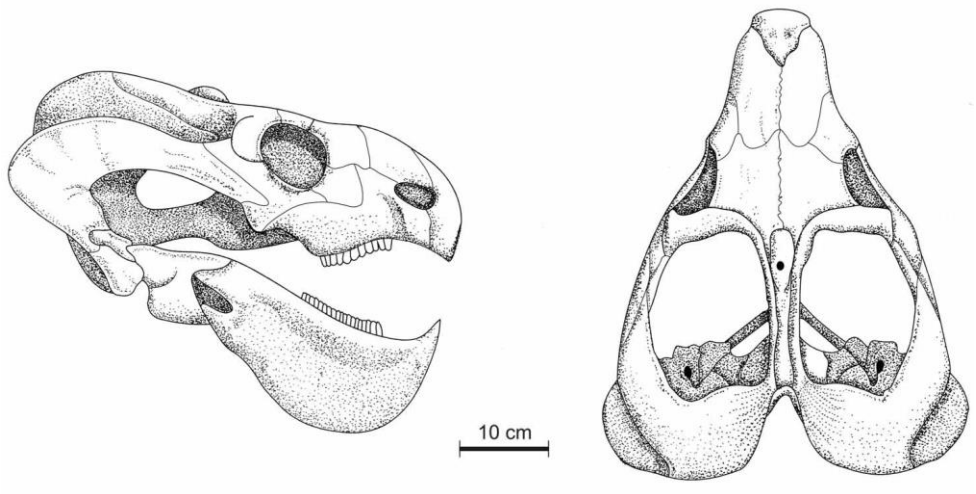


***Figure 17**: Endothiodon bathystoma, in lateral and dorsal views is the biozone defining fossil of the Endothiodon Assemblage Zone.*

The predominantly mudrock *Tropidostoma-Gorgonops* Subzone is a sequence of fluvio-lacustrine strata. Vertebrate fossils are mostly found in massively bedded thick greenish-grey siltstone with minor mudstone intercalations occurring between the main channel sandstones. These sediments are thick coarsening upwards sequences of between 5 to 10m thick and is understood to be prograding crevasse splay complexes. The latter was deposited by repeated overbank flood events originating from the channel banks and accumulating in lowland flood basins. Scattered oblate pedogenic carbonate nodules forming horizons is present in massive siltstones. This is interpreted to be calcic vertisols that were deposited under a seasonally dry humid-temperate climate (Smith, 1993) at the base of meanderbelt slopes.

The *Tropidostoma - Gorgonops* Subzone has a greater abundance of taxons than the *Lycosuchus - Eunotosaurus* Subzone. This Subzone is characterised by the presence of rare basal cynodonts. large gorgonopsians, basal baurioid therocephalians, cryptodont dicynodonts, and small pareiasaurs. Fossils in this Subzone is predominately found in overbank facies

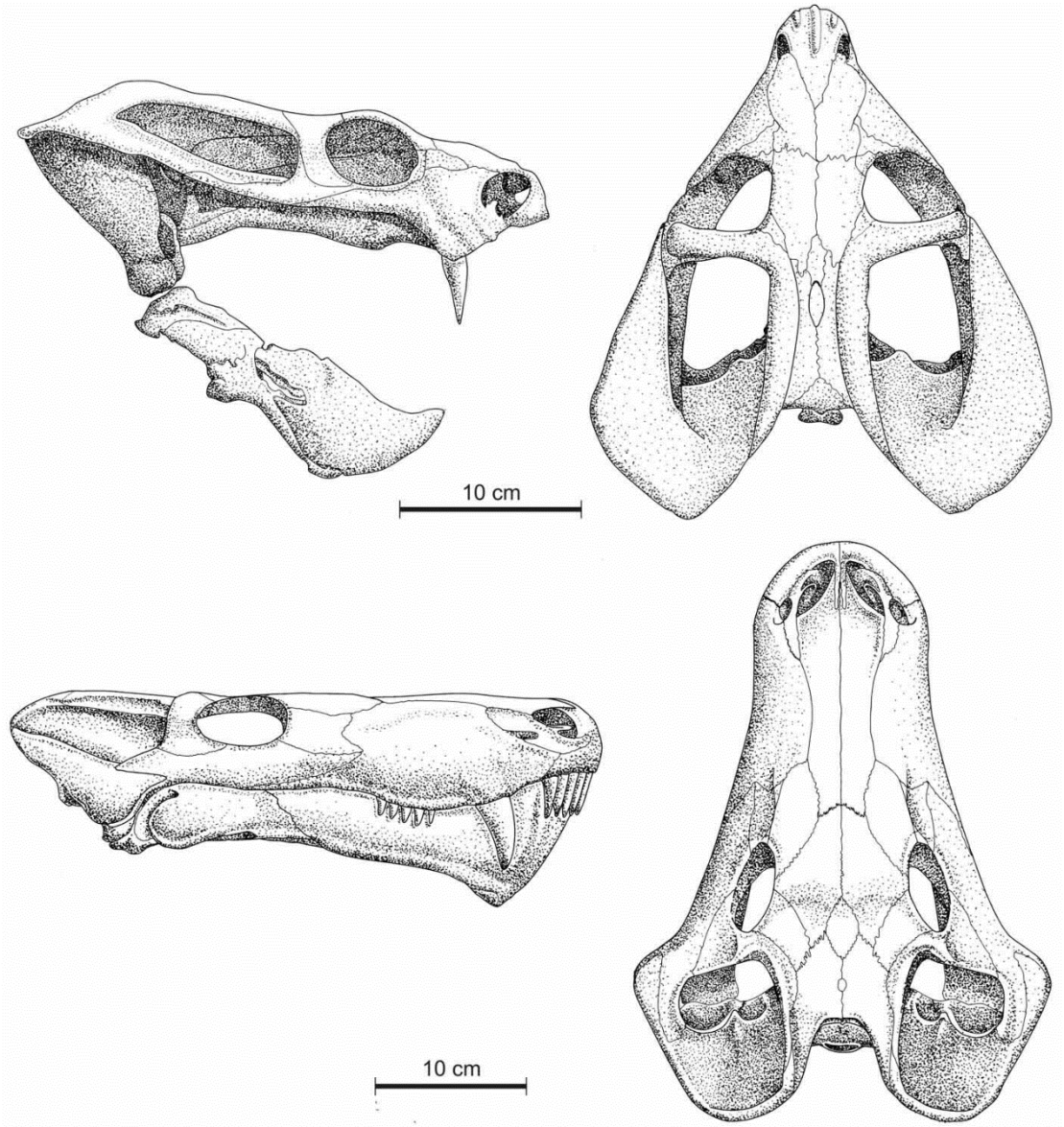


***Figure 18**: Lateral and dorsal views of the index taxa of the Tropidostoma – Gorgonops Subzone namely (top) Tropidostoma dubium, (bottom) Gorgonops torvus.*

Fossils of the *Tropidostoma-Gorgonops* Subzone (Figure 18) are mainly found in the overbank facies — particularly in the fine-grained sandstone and massive siltstone sheets of the proximal floodplain facies (Smith, 1993). This subzone is known for its dense cluster of *Diictodon* skulls that are found in a patch of 20 to 50m. *Diictodon* (Smith, 1993) and *Youngina* (Smith and Evans, 1995) juvenile aggregations has been described in the literature.

Fossils are usually disarticulated unweathered, well-preserved specimens while fully articulated specimens are usually intercurled paired skeletons. Fossils bones are usually enclosed in smooth-surfaced calcareous pedogenic nodular material. Rare burrow casts accredited to the digging activity of dicynodonts is present in the in the lower part of the subzone but absent in the upper section. Coprolites comprising of bones has also been recovered. The *Tropidostoma - Gorgonops* Subzone reaches a thickness of between 130 and 150m along the Nuweveld escarpment and becomes thinner in the north (Day and Rubidge, 2019).

As elsewhere in the country superficial deposits mantle underlying sediments but is not always indicated on the 1:250 000 geological maps. Superficial sediments are represented by the Pleistocene to Recent superficial deposits and comprise of alluvium, downwasted surface gravels, pedocretes, and sandy soils. These sediments are most probably of Low Palaeontological Significance but could contain mammalian teeth, bones and horn corns, reptile skeletons and fragments of ostrich eggs. Microfossils, non-marine mollusc shells are also known from Quaternary deposits. Plant material such as foliage, wood, pollens, and peats are recovered as well as trace fossils like vertebrate tracks, burrows, termitaria (termite heaps/ mounds) and rhizoliths (root casts). Reworked Stone Age artifacts have been found in Quaternary alluvium.

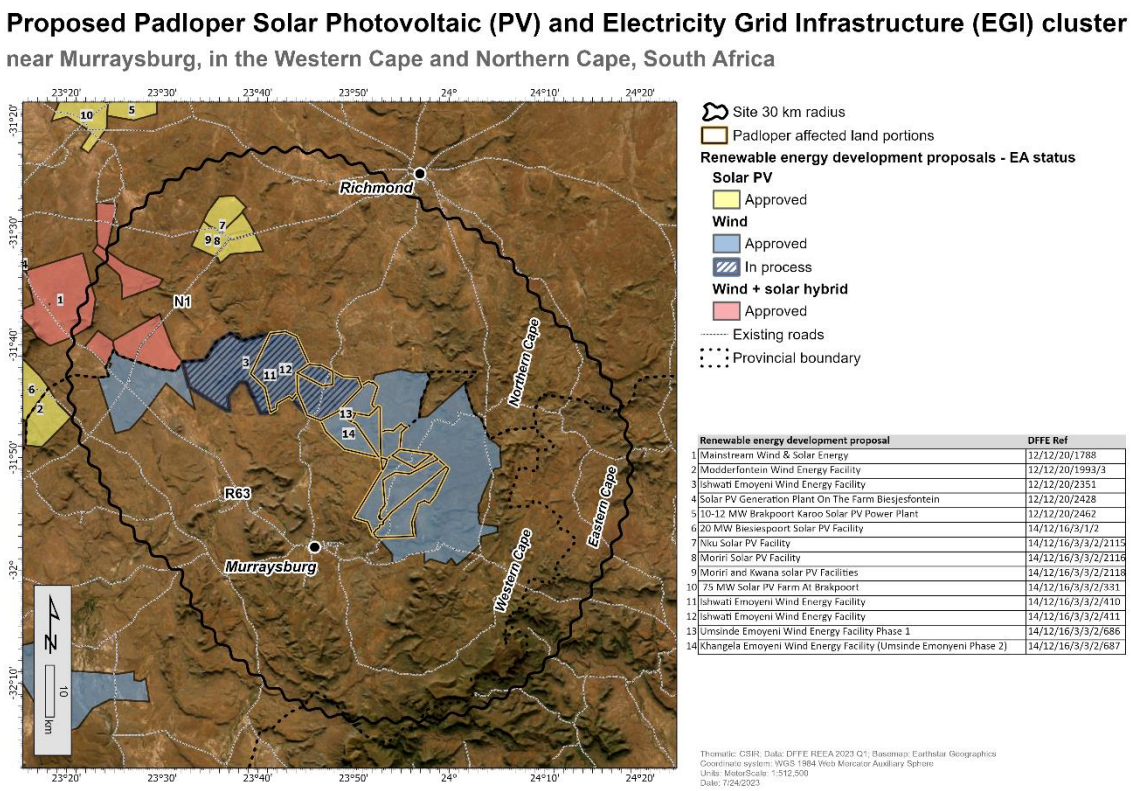


***Figure 19**: Renewable Energy Facilities in n 30km radius of the Padloper SEF Cluster.*

The general Palaeontological Sensitivity of the area is Low to Very High (see SAHRIS Palaeomap, Figure 5). However, it is important to note that the quality of preservation of these different sites will most probably vary and it is thus difficult to allocate a Cumulative Sensitivity to the projects. If all the mitigation measures are carried out, a conservative estimate of the Cumulative impacts on fossil Heritage will vary between Zero and Very High.

Table 9: Renewable Energy Facilities in n 30km radius of the Padloper SEF Cluster.

DFFE REFERENCE	SHORTENED PROJECT TITLE	TECHNOLOGY	MEGAWATT	EA STATUS
12/12/20/1788	Mainstream Wind and Solar Energy Facility at Victoria West	Wind and Solar PV	700	Approved
12/12/20/1788/AM1	Mainstream Wind and Solar Energy Facility at Victoria West	Wind and Solar PV	-	Approved
12/12/20/1788/AM2	Mainstream Wind and Solar Energy Facility at Victoria West	Wind and Solar PV	-	Approved
12/12/20/1788/AM3	Mainstream Wind and Solar Energy Facility at Victoria West	Wind and Solar PV	-	Approved
12/12/20/2351	Ishwati Emoyeni Wind Energy Facility And Supporting Eskom Transmission And Distribution Grid Connection Infrastructure	Wind	280	Approved
12/12/20/2351/AM2	Ishwati Emoyeni wind energy facility (WEF) and its associated infrastructure	Wind	-	Approved
14/12/16/3/3/2/410	Ishwati Emoyeni Wind Energy Facility And Supporting Eskom Transmission And Distribution Grid Connection Infrastructure	Wind	115	Approved

14/12/16/3/3/2/686	Umsinde Emoyeni wind energy facility phase 1 and its associated electrical grid connection	Wind	147	Approved
14/12/16/3/3/2/687	Umsinde Emoyeni wind energy facility phase 2 and its associated electrical grid connection phase 2	Wind	147	Approved
14/12/16/3/3/2/686/AM2	Umsinde Emoyeni WEF	Wind	-	Approved
14/12/16/3/3/2/687/AM2	Khangela Emoyeni WEF	Wind	-	Approved
14/12/16/3/3/2/411	Ishwati Emoyeni Wind Energy Facility and Supporting Eskom Transmission and Distribution Grid Connection Infrastructure	Wind	-	In process
14/12/16/3/3/2/2115	Nku solar PV facility, Northern Cape Province	PV	100	Approved
14/12/16/3/3/2/2116	Moriri solar PV facility, Northern Cape Province	PV	100	Approved
14/12/16/3/3/2/2118	The establishment of the Moriri and Kwana solar PV facilities, Northern Cape Province	PV	100	Approved

6 GEOGRAPHICAL LOCATION OF THE SITE

Padloper Solar Projects 1-4 are located 20 km from the town of Murraysburg in the Western Cape (Figures 1-3).

7 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- Geological map 1:100 000, Geology of the Republic of South Africa (Visser 1984)
- Palaeosensitivity map on SAHRIS (South African Heritage Resources Information System) website
- A Google Earth kmz files, background information as well as screening report of the proposed development was obtained from CSIR Environmental Management Services
- Google Earth© satellite imagery
- 1:250 000 Beaufort West 3222 (1979) Geological Map (Council for Geosciences, Pretoria) including 1:250 000 geological map (3122 Victoria West) and the relevant sheet explanations (Le Roux & Keyser 1988)
- Published geological and palaeontological literature
- Relevant PIAs in the area (see references) and
- A four day-comprehensive site-specific field survey of the development footprint for the combined projects was conducted on foot and motor vehicle in January 2023.

8 SITE INVESTIGATION

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle between 15-19 January 2023. No fossiliferous outcrops were identified during the site visit. This could be attributed to the lack of outcrops. The area has been utilized for agriculture over the past years.

From a Palaeontological perspective the season of the site visit investigation will not affect the fossil findings.



Figure 20**: Dolerite outcrop in the development footprint on **Padloper Solar Facility 2.



Figure 21: Drainage line in potentially fossiliferous Adelaide Subgroup with calcrete and dolerite corestones.



Figure 22: Mudrock exposure of potentially fossiliferous Middleton Formation in **Padloper Solar Facility 2.**



***Figure 23**: General flat topography present in the development area.*

9 IMPACTS ASSESSMENT

9.1 Sensitivities identified by the DFFE National Web-Based Screening Tool – Applicable to the Padloper PV 1-4 projects

As indicated in Section 5 (Figures 6-9) the Screening Tool shows that the study areas fall in an area of Very High (dark red) Palaeontological Sensitivity. This is in contrast with this report that has allocated a Low Significance to the proposed Padloper Solar Facilities 1-4.

9.1.1 Sensitivity Analysis Summary Statement– Applicable to the Padloper PV 1-4 projects

The Very High Palaeontological Sensitivity of the DFFE Screening Tool is challenged here as no fossils were identified in the development footprint during the site investigation conducted for the Padloper Solar Facilities 1-4 in January 2023. Refer to Appendix 2 for the site sensitivity verification report for further details.

It is important to note that: Potential impact on fossil heritage will only occur during the construction phase of the development. Surface clearing and excavation may cause

- disturbance of fossils and could lead to
- damage and even
- destruction to fossils at or below ground surface.

*Table 10: Rating of Impacts - Planning and Pre-construction Phase of **Padloper Solar Facility 1***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
PLANNING AND PRE-CONSTRUCTION – Padloper Solar Facility 1						
NO IMPACT	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 11: Rating of Impacts - Construction Phase **Padloper Solar 1***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
SUMMARY OF ASSESSMENTS OF IMPACTS TO PALAEONTOLOGICAL RESOURCES DURING THE CONSTRUCTION PHASE– Padloper Solar Facility 1						
Loss of fossil Heritage Disturbance /damage and destruction of fossils at /below surface	*Status*	*Negative*	*Medium*	*Chance Find Protocol*	*Very Low*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Permanent*				
	Consequence	*Moderate Risk*				
	Probability	*Unlikely*				
	Reversibility	*Non-reversable*				
	Irreplaceability	*Irreplaceable*				

*Table 12: Rating of Impacts - Operational Phase **Padloper Solar Facility 1***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL – Padloper Solar Facility 1						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 13: Rating of Impacts -Decommissioning Phase **Padloper Solar Facility 1***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING – Padloper PV 5 Solar Facility						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 14: Rating of Impacts - Planning and Pre-construction Phase **Padloper Solar Facility 2***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
PLANNING AND PRE-CONSTRUCTION – Padloper Solar Facility 2						
NO IMPACT	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 15: Rating of Impacts – Construction Phase **Padloper Solar Facility 2.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
SUMMARY OF ASSESSMENTS OF IMPACTS TO PALAEONTOLOGICAL RESOURCES DURING THE CONSTRUCTION PHASE– Padloper Solar Facility 2						
Loss of fossil Heritage Disturbance /damage and destruction of fossils at /below surface	*Status*	*Negative*	*Medium*	*Chance Find Protocol*	*Very Low*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Permanent*				
	Consequence	*Moderate Risk*				
	Probability	*Unlikely*				
	Reversibility	*Non-reversable*				
	Irreplaceability	*Irreplaceable*				

*Table 16: Rating of Impacts -Operational Phase **Padloper Solar Facility 2.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL – Padloper Solar Facility 2						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 17: Rating of Impacts -Decommissioning Phase **Padloper Solar Facility 2.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING – Padloper Solar Facility 2						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 18: Rating of Impacts - Planning and Pre-construction Phase **Padloper Solar Facility 3.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
PLANNING AND PRE-CONSTRUCTION – Padloper Solar Facility 3						
NO IMPACT	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 19: Rating of Impacts – Construction Phase **Padloper Solar Facility 3.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
SUMMARY OF ASSESSMENTS OF IMPACTS TO PALAEONTOLOGICAL RESOURCES DURING THE CONSTRUCTION PHASE– Padloper Solar Facility 3						
Loss of fossil Heritage Disturbance /damage and destruction of fossils at /below surface	*Status*	*Negative*	*Medium*	*Chance Find Protocol*	*Very Low*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Permanent*				
	Consequence	*Moderate Risk*				
	Probability	*Unlikely*				
	Reversibility	*Non-reversable*				
	Irreplaceability	*Irreplaceable*				

*Table 20: Rating of Impacts - Operational Phase **Padloper Solar Facility 3.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL – Padloper Solar Facility 3						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 21: Rating of Impacts - Decommissioning Phase **Padloper Solar Facility 3.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING – Padloper Solar Facility 3						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 22: Rating of Impacts - Planning and Pre-construction Phase **Padloper Solar Facility 4.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
PLANNING AND PRE-CONSTRUCTION – Padloper Solar Facility 4						
NO IMPACT	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 23: Rating of Impacts – Construction Phase **Padloper Solar Facility 4.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
SUMMARY OF ASSESSMENTS OF IMPACTS TO PALAEONTOLOGICAL RESOURCES DURING THE CONSTRUCTION PHASE– Padloper Solar Facility 4						
Loss of fossil Heritage Disturbance /damage and destruction of fossils at /below surface	*Status*	*Negative*	*Medium*	*Chance Find Protocol*	*Very Low*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Permanent*				
	Consequence	*Moderate Risk*				
	Probability	*Unlikely*				
	Reversibility	*Non-reversable*				
	Irreplaceability	*Irreplaceable*				

*Table 24: Rating of Impacts - Operational Phase **Padloper Solar Facility 4.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL – Padloper Solar Facility 4						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 25: Rating of Impacts - Decommissioning Phase **Padloper Solar Facility 4.***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
DECOMMISSIONING – Padloper Solar Facility 4						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

*Table 26: No-go Impacts - **Padloper Solar Facilities 1-4***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential mitigation measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
NO-GO – Padloper Solar Facilities 1-4						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

Cumulative Impacts - applicable to each of the proposed Padloper PV 1-4 projects

Energy facilities in the Padloper Solar Cluster development area (30 km radius range) will have a Medium Palaeontological Sensitivity. If all the mitigation measures are carried out, a conservative estimate of the cumulative impacts on fossil heritage will be Low.

*Table 27: Cumulative Impact during Construction - **Padloper Solar Facilities 1-4***

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
CUMULATIVE IMPACT DURING CONSTRUCTION PHASE						
Loss of fossil Heritage	*Status*	*Negative*	*Medium*	*Chance Find Protocol*	*Low*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Permanent*				
	Consequence	*Moderate Risk*				
	Probability	*Unlikely*				
	Reversibility	*Non-reversable*				
	Irreplaceability	*Irreplaceable*				

Overall Impact Rating Padloper Solar Projects 1-4

Post mitigation the overall significance will be Low.

*9.1.2 Impact Summary- **applicable to each of the proposed Padloper PV 1-4 projects***

Table 28: Overall Impact Significance (Post Mitigation)	
Phase	**Overall Impact Significance**
Construction	Very Low
Operational	No impact
Decommissioning	No Impact
Nature of Impact	**Overall Impact Significance**
Cumulative - Construction	Low
Cumulative - Operational	No Impact
Cumulative - Decommissioning	No Impact

9.2 **Conclusion and Impact Statement**- applicable to each of the proposed Padloper PV 1-4 projects

The significance of the impact occurring will be negative Low before mitigation. The post mitigation the Significance of the Impact will be Very Low.

9.3 **Legislative and Permit Requirements**- applicable to each of the proposed Padloper PV 1-4 projects

It is required to submit a Palaeontological Impact assessment as part of a Heritage Impact Assessment (HIA) to SAHRA. The costs for submitting a review of an impact assessment report related to an application for Environmental Authorisation made in terms of legislation other than NHRA will be R 2000 as of 1 January 2023.

10 FINDINGS AND RECOMMENDATIONS- APPLICABLE TO EACH OF THE PROPOSED PADLOPER PV 1-4 PROJECTS

Padloper Solar Facility 1 is entirely underlain by the Balfour Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup), while Padloper Solar Facility 2 is almost entirely underlain by Jurassic Dolerite with a small portion in the south underlain by the Balfour Formation and a small portion in the north underlain by the Middleton Formation (Adelaide Subgroup, Beaufort Group). Padloper Solar Facility 3 is underlain by a large area underlain by the Balfour Formation while the south west margin is underlain by Jurassic dolerite. The PalaeoMap of the South African Heritage Resources Information System indicates that the Palaeontological Sensitivity of the Jurassic Dolerite is Zero as it is igneous in origin and thus fossiliferous while that of the Adelaide Subgroup is Very High (Almond and Pether, 2009; Almond *et al*., 2013). The DFFE screening tool for the study areas indicates that the proposed development has a Very

High (dark red) Palaeontological Sensitivity. Updated geology compiled by the Council of Geosciences (Pretoria) indicates that the development is underlain by the Balfour, Middelton Formations of the Adelaide Subgroup as well as Jurassic dolerite.

In the last few decades extensive research and fossil collecting have been conducted by palaeontologists in this part of the basin. However, the National Palaeontological databases indicate that only one fossil have been uncovered in the footprint of Padloper Solar Facility 4 (this fossil has been collected and is now housed in a museum). A site-specific field survey of the development footprint was conducted on foot and by motor vehicle in January 2023. No fossiliferous outcrop was detected in the proposed development area (i.e., development footprints of the proposed Padloper Solar Facilities 1-4 and respective 400 m power line corridors). This could be attributed to dolerite intrusions that metamorphized potentially fossiliferous Beaufort sediments, low relief of the development area as well as poor bedrock exposure and relative unfossiliferous superficial sediments. However, it must be emphasised that the presence of well-preserved fossils is not ruled out.

Based on the site investigation as well as desktop research it is concluded that fossil heritage of scientific and conservational interest in the overall development footprint of the solar facilities (is rare. This is in contrast with the Very High Sensitivity allocated to the development area by the SAHRIS Palaeosensitivity Map and DFFE Screening Tool. A Medium Palaeontological Significance has been allocated for the construction phase of the PV development pre-mitigation and a Low significance post mitigation. The construction phase will be the only development phase impacting Palaeontological Heritage and no significant impacts are expected to impact the Operational and Decommissioning phases. As the No-Go Alternative considers the option of 'do nothing' and maintaining the status quo, it will have a Neutral impact on the Palaeontological Heritage of the development. The cumulative impacts of the development near Murraysburg is Medium pre- mitigation and Low post mitigation and falls within the acceptable limits for the project. It is therefore considered that the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The construction of the development may thus be permitted in its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources. 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.

Monitoring and Mitigation - applicable to each of the proposed Padloper PV 1-4 projects

The ECO for this project must be informed that the Balfour Formation (Adelaide Subgroup, Beaufort Group, Karoo Supergroup) has a Very High Palaeontological Sensitivity.

- The ECO/designated responsible person for these facilities must constantly monitor the Adelaide Subgroup outcrops during surface clearance and construction. If Palaeontological Heritage is uncovered during surface clearing and excavations, the Chance find Protocol attached should be implemented immediately. Fossil discoveries ought to be protected and the

ECO/site manager must report to South African Heritage Resources Agency (SAHRA) (Contact details: Heritage Western Cape, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. 3rd floor Protea Assurance Building, 142 Longmarket St, Cape Town City Centre, Cape Town, 8000; Private Bag X9067, Cape Town, 8000 Tel: 021 483 9598. Fax: +27 (0) 21 483 9845. Web: www.hwc.org.za) so that mitigation (recording and collection) can be carried out.

- Before any fossil material can be collected from the development site, the specialist involved would need to apply for a collection permit from SAHRA. Fossil material must be housed in an official collection (museum or university), while all reports and fieldwork should meet the minimum standards for palaeontological impact studies proposed by SAHRA (2012).

These recommendations should be incorporated into the EMPr for the Padloper Cluster development.

11 CHANCE FINDS PROTOCOL- APPLICABLE TO EACH OF THE PROPOSED PADLOPER PV 1-4 PROJECTS

The following procedure will only be followed if fossils are uncovered during the excavation phase of the development.

Legislation

Cultural Heritage in South Africa (includes all heritage resources) is protected by the National Heritage Resources Act (Act No. 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.

A fossil is the naturally preserved remains (or traces thereof) of plants or animals embedded in rock. These organisms lived 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.

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 Site Officer (ESO) or site manager 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 ESO, 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.

11.1 Chance Find Procedure- applicable to each of the proposed Padloper PV 1-4 projects

- If a chance find is made the person responsible for the find must immediately stop working and all work that could impact that finding 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 ESO or Site Manager. The ESO or Site Manager 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 ESO (or 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.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. 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 the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

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Appendix 1: Impact Assessment Methodology

The impact assessment includes:

- the nature, status, significance and consequences of the impact and risk;
- the extent and duration of the impact and risk;
- the probability of the impact and risk occurring;
- the degree to which impacts and risks can be mitigated;
- the degree to which the impacts and risks can be reversed; and
- the degree to which the impacts and risks can cause loss of irreplaceable resources.

Terminology used in impact assessment can overlap. To avoid ambiguity, please note the following clarifications (that are based on NEMA and the EIA Regulations):

- The term environment is understood to have a broad interpretation that includes both the natural (biophysical) environment and the socio-economic environment. The term socio-ecological system is also used to describe the natural and socio-economic environment and the interactions amongst these components.
- Significance = Consequence x Probability, which means that significance is equivalent to risk.

- The impact can have a positive or negative status. The significance of a negative impact may be called a risk, and the significance of a positive impact may be called an opportunity.

The following principles are to underpin the application of this methodology:

- Transparent and repeatable process - specialists are to describe the thresholds and limits they apply in their assessment, wherever possible.
- Adapt parameters to context (where justified) – the methodology proposes some thresholds (e.g. for spatial extent, in Step 3 below), however, if the nature of the impact requires a different definition of the categories of spatial extent, then this can be provided and described.
- Combination of a quantitative and qualitative assessment – where possible, specialists are to provide quantitative assessments (e.g. areas of habitat affected, decibels of noise, number of jobs), however, it is recognised that not all impacts can be quantified, and then qualitative assessments are to be provided.

As per the DFFE Guideline 5: Assessment of Alternatives and Impacts, the following methodology is applied to the prediction and assessment of impacts and risks. Potential impacts and risks have been 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.

The impact assessment methodology includes the aspects described below.

- Step 1: Nature of impact/risk - The type of effect that a proposed activity will have on the environment.

- Step 2: Status - Whether the impact/risk on the overall environment will be:
    - Positive - environment overall will benefit from the impact/risk;
    - Negative - environment overall will be adversely affected by the impact/risk; or
    - Neutral - environment overall not be affected.

- Step 3: Qualitatively determine the consequence of the impact/risk by identifying the a) SPATIAL EXTENT; b) DURATION; c) REVERSIBILITY; AND d) IRREPLACEABILITY.

    - A) Spatial extent – The size of the area that will be affected by the impact/risk:
        - Site specific;
        - Local (<10 km from site);
        - Regional (<100 km of site);
        - National; or
        - International (e.g., Greenhouse Gas emissions or migrant birds).

    - B) Duration – The timeframe during which the impact/risk will be experienced:
        - Very short term (instantaneous);
        - Short term (less than 1 year);

- Medium term (1 to 10 years);
- Long term (the impact will cease after the operational life of the activity (i.e., the impact or risk will occur for the project duration)); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e., the impact will occur beyond the project decommissioning)).

- C) Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):
  - High reversibility of impacts (impact is highly reversible at end of project life i.e., this is the most favourable assessment for the environment);
  - Moderate reversibility of impacts;
  - Low reversibility of impacts; or
  - Impacts are non-reversible (impact is permanent, i.e., this is the least favourable assessment for the environment).

- D) Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e., this is the least favourable assessment for the environment);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e., this is the most favourable assessment for the environment).

Some of the criteria are quantitative (e.g., spatial extent and duration) and some may be described in a quantitative or qualitative manner (e.g., reversibility and irreplaceability). The specialist then combines these criteria in a qualitative manner to determine the consequence.

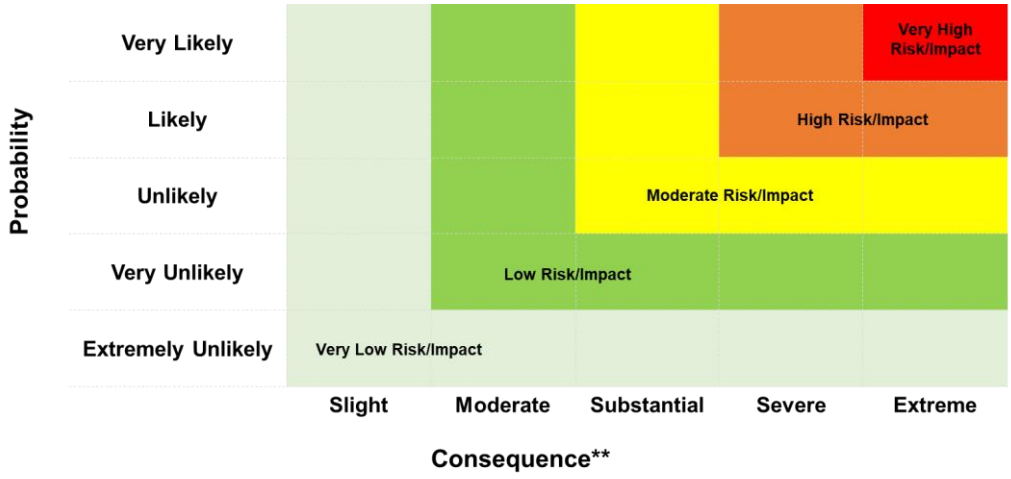
The consequence terms ranging from slight to extreme must be calibrated per Specialist Study so that there is transparency and consistency in the way a risk/impact is measured. For example, from a biodiversity and ecology perspective, the consequence ratings could be defined according to a reduction in population or occupied area in relation to Species of Conservation Concern (SCC) status, ranging from slight consequence for defined areas of Least Concern, to extreme consequence for defined areas that are Critically Endangered. For example, from a social perspective, a slight consequence could refer to small and manageable impacts, or impacts on small sections of the community; a moderate consequence could refer to impacts which affect the bulk of the local population negatively or may produce a net negative impact on the community; and an extreme consequence could refer to impacts which could result in social or political violence or institutional collapse.

- Consequence – The anticipated consequence of the risk/impact is generally defined as follows:
  - Extreme (extreme alteration of natural or socio-economic systems, patterns or processes, i.e., where environmental or socio-economic functions and processes are altered such that, they permanently cease);
  - Severe (severe alteration of natural or socio-economic systems, patterns or processes, i.e., where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease);

- Substantial (substantial alteration of natural or socio-economic systems, patterns or processes, i.e., where environmental or socio-economic functions and processes are altered such that they temporarily or permanently cease;
- Moderate (notable alteration of natural or socio-economic systems, patterns or processes, i.e., where the natural or socio-economic environment continues to function but in a modified manner; or
- Slight (negligible and transient alteration of natural or socio-economic systems, patterns or processes, i.e., where natural systems/environmental or socio-economic functions, patterns, or processes are not affected in a measurable manner, or if affected, that effect is transient and the system recovers).

- Step 4: Rate the probability of the impact/risk using the criteria below:
  - Probability – The probability of the impact/risk occurring:
    - Extremely unlikely (little to no chance of occurring);
    - Very unlikely (<30% chance of occurring);
    - Unlikely (30-50% chance of occurring)
    - Likely (51 – 90% chance of occurring); or
    - Very Likely (>90% chance of occurring regardless of prevention measures).

- Step 5: Use both the consequence and probability to determine the significance of the identified impact/risk (qualitatively as shown in Figure 1). Significance definitions and rankings are provided below:



[Qualitatively determined based on Spatial Extent, Duration, Reversibility and Irreplaceability]

Figure 1. Guide to assessing risk/impact significance as a result of consequence and probability.

- *Significance – Will the impact cause a notable alteration of the environment?*
  - *Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
  - *Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);*
  - *Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated);*
  - *High (the risk/impact will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making); and*
  - *Very high (the risk/impact will result in very major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).*

With the implementation of mitigation measures, the residual impacts/risks are ranked as follows in terms of significance:

- *Very low = 5;*
- *Low = 4;*
- *Moderate = 3;*
- *High = 2; and*
- *Very high = 1.*

The specialists must provide a written supporting motivation of the assessment ratings provided.

- *Step 6: Determine the Confidence Level – The degree of confidence in predictions based on available information and specialist knowledge:*
  - *Low;*
  - *Medium; or*
  - *High.*

Appendix 2: Site Sensitivity Verification

CONTENTS

1.	**INTRODUCTION**	54
2.	**SITE SENSITIVITY VERIFICATION METHODOLOGY**	57
3.	**OUTCOME OF SITE SENSITIVITY VERIFICATION**	847
4.	**CONCLUSION**	92

1 INTRODUCTION

The Project Applicant, Padloper PV (Pty) Ltd (hereinafter referred to as "Padloper Solar" or "the Applicant")[2], is proposing to develop 7 x Solar Photovoltaic (PV) Facilities with a capacity of between 100 and 250 MW each and the associated infrastructure, and the associated 7 x 132 kV overhead power lines and associated infrastructure i near Murraysburg in the Western and Northern Cape Provinces. Each solar PV facility will have a range of associated infrastructure, including, but not limited to, an on-site substation and Battery Energy Storage System (BESS) complex and will connect to the existing Gamma Main Transmission Substation (MTS) via dedicated 132 kV overhead power lines.

This report focusses on the Padloper Solar Projects 1, 2, 3 and 4 (i.e., the facilities and their associated overhead power lines).

[2]It is important to note that Padloper PV (Pty) Ltd is the Project Applicant, whereas African Clean Energy Developments (Pty) Ltd (ACED) is the Project Developer.

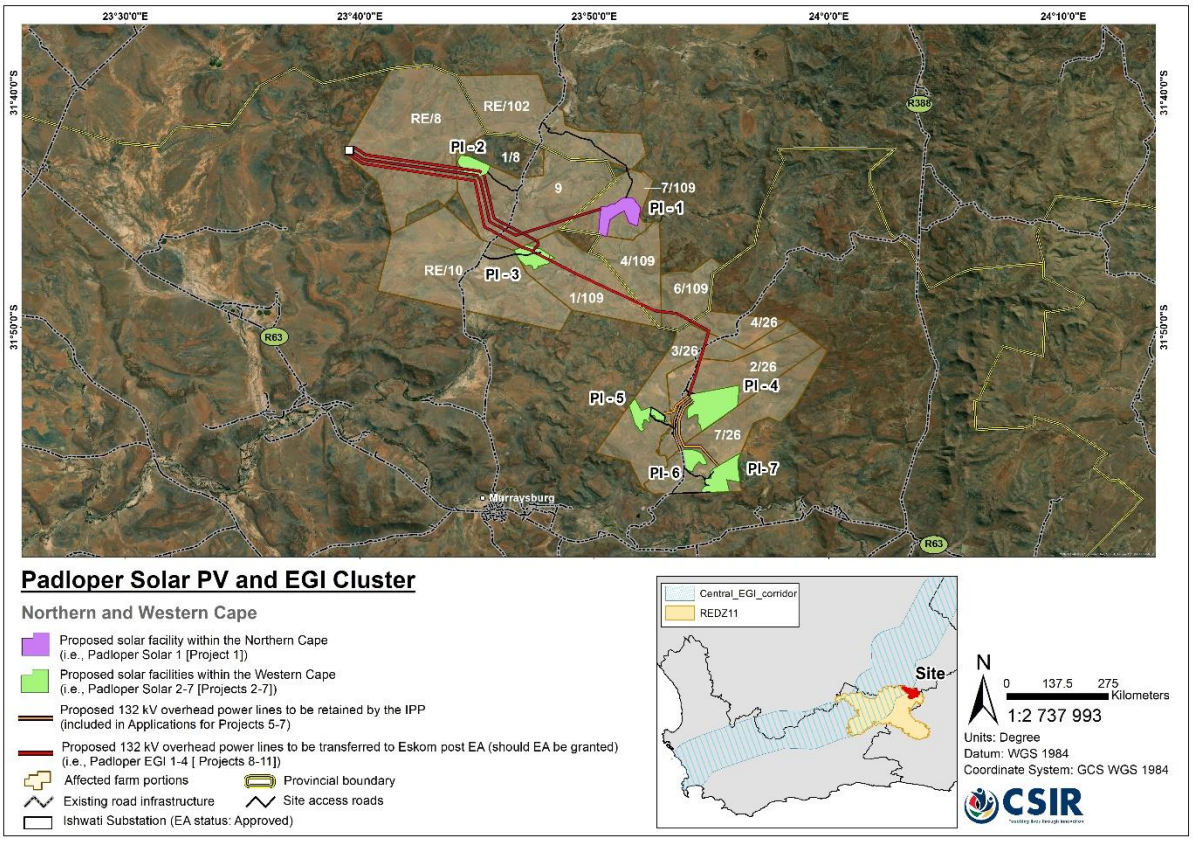


Figure 24: *Location of the affected farm portions on which the proposed seven Padloper Solar PV Facilities will be constructed. These entire farm portions (outlined in brown) are the study area for the PV Facilities, including access roads.*

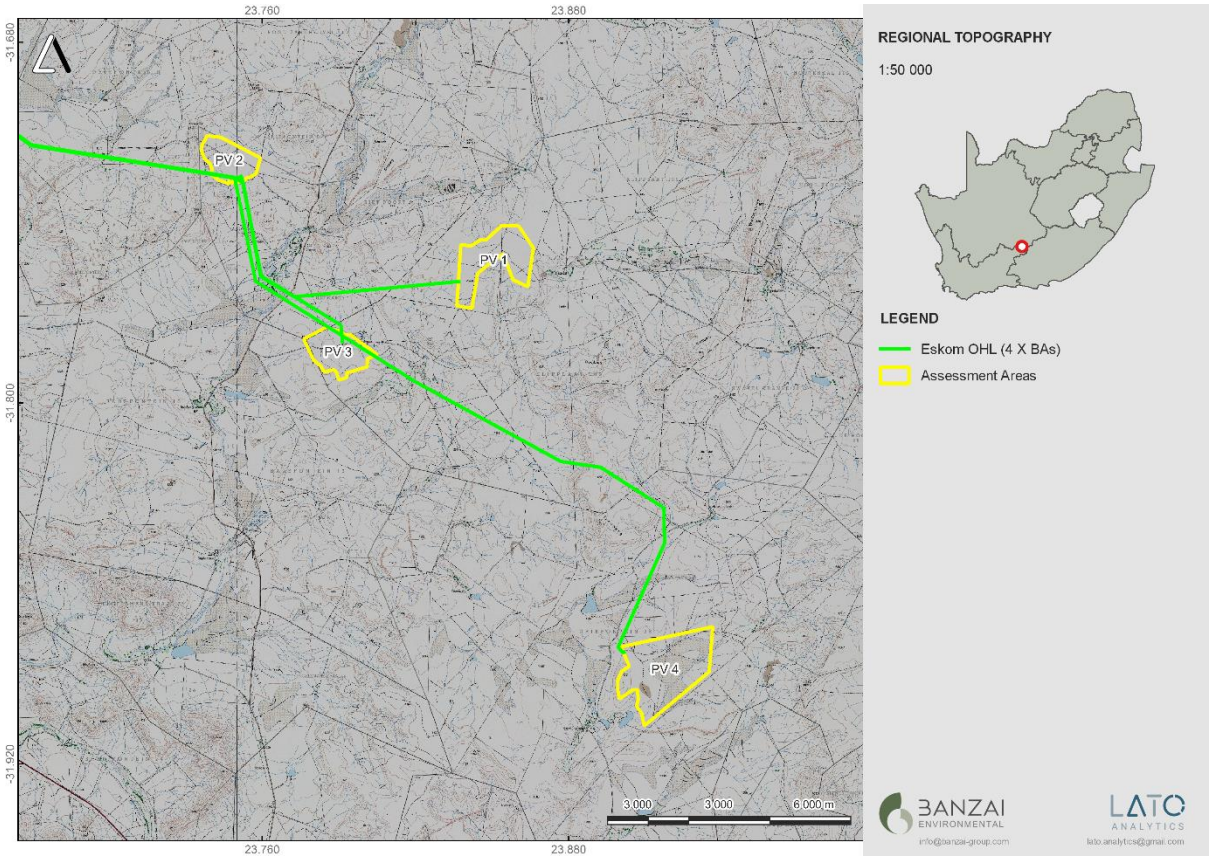


Figure 25: *Locality Map of Padloper Solar Projects 1-4.*

In terms of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations [4 December 2014, Government Notice (GN) R982, R983, R984 and R985, as amended], various aspects of the proposed developments may have an impact on the environment and are considered to be listed activities. These activities require authorisation from the National Competent Authority (CA), namely the Department of Forestry, Fisheries and the Environment (DFFE), prior to the commencement thereof. Further to this as per GN R. 2313 : Adoptions of the standard for the development and expansion of powerlines and substation with identified geographical areas and the exclusion of this infrastructure from the requirements to obtain Environmental Authorisation , the Standard was adopted in terms of section 24(10)(a) of the Act for the purpose of excluding the activities contemplated in paragraph 5.1 and 5.2 of the Schedule from the requirement to obtain environmental authorisation prior to commencement. In terms of the procedural requirement set out in the standard, screening tool reports have been undertaken for the grid corridor and associated infrastructure and site sensitivity verifications have been undertaken by the relevant specialists in accordance with the sensitivity themes. As per 6.1. of the GNR .2313, "Where any part of the infrastructure occurs on an area for which the environmental sensitivity for any environmental theme is identified as being very high or high by the national web based environmental screening tool and confirmed to be such through the application of the procedures set out in the Standard", the site sensitivity verifications have been performed as per the procedural requirements set out.

In accordance with GN 320 and GN 1150 (20 March 2020)[3] of the NEMA EIA Regulations of 2014 (as amended), prior to commencing with a specialist assessment, a site sensitivity verification must be undertaken to confirm the current land use and environmental sensitivity of the proposed project areas as identified by the National Web-Based Environmental Screening Tool (i.e., Screening Tool). Elize Butler, as palaeontology specialist, have been commissioned to verify the sensitivity of the project sites under these specialist protocols.

[1] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

2 SITE SENSITIVITY VERIFICATION METHODOLOGY for each of the proposed Padloper PV 1-4 projects

The following information sources were consulted to compile this report:

The Palaeontology Sensitivity Verification was undertaken by the following methodology:

- The site sensitivity is established through the National Environmental Web-Based Screening Tool
- The site is mapped on the relevant Geological Map to determine the underlying geology of the development
- Then the site is mapped on the South African Heritage Resources Information System (SAHRIS) PalaeoMap, and the Sensitivity of the proposed development established
- Other information is obtained by using satellite imagery
- Palaeontological Impact Assessments and Desktop Assessments of projects in the same area are studied
- A four day-comprehensive site-specific field survey of the development footprint for the combined projects was conducted on foot and motor vehicle in January 2023.

[3] GN 320 (20 March 2020): Procedures for The Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(A) and (H) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation

3 OUTCOME OF SITE SENSITIVITY VERIFICATION – applicable to each of the proposed Padloepr PV 1-4 projects

The proposed Padloper Solar Projects 1-4 near Murraysburg in the Western Cape and Norther Cape Provinces is depicted on the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) (Figure 26; Table 29). Padloper Solar Facility 1 is entirely underlain by the Balfour (Pb, green) of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup), while Padloper Solar Facility 2 is almost entirely underlain by Jurassic Dolerite (Jd, red) with a small portion in the south underlain by the Balfour Formation (Pb, bright green) and a small portion in the north underlain by the Middleton Formation (Pth, pale green) (Adelaide Subgroup, Beaufort Group). Padloper Solar Facility 3 is underlain by a large area underlain by the Balfour Formation (Pb, Adelaide Subgroup, Beaufort Group) while the south west margin is underlain by Jurassic dolerite (Jd). Padloper Solar Facility 4 is largely underlain by the Balfour (Pb, bright green) (Adelaide Subgroup, Beaufort Group) while small portions of Jurassic dolerite (Jd) are present in the east and west of the development.

The PalaeoMap of the South African Heritage Resources Information System indicates that the Palaeontological Sensitivity of the Jurassic Dolerite is Zero as it is igneous in origin and thus fossiliferous while that of the Adelaide Subgroup is Very High (Almond and Pether, 2009; Almond *et al*., 2013, Figure 27, Table 29).

The outcomes of the DFFE screening tool for each for the study areas (i.e., Padloper PV 1-4) is indicated in Figures 6-9 and indicates that each of the proposed four sites has a Very High (dark red) Palaeontological Sensitivity. Updated Geology compiled by the Council of Geosciences (Pretoria) is depicted in Figure 28 and indicates that the development is underlain by the Balfour and Middelton Formations of the Adelaide Subgroup.

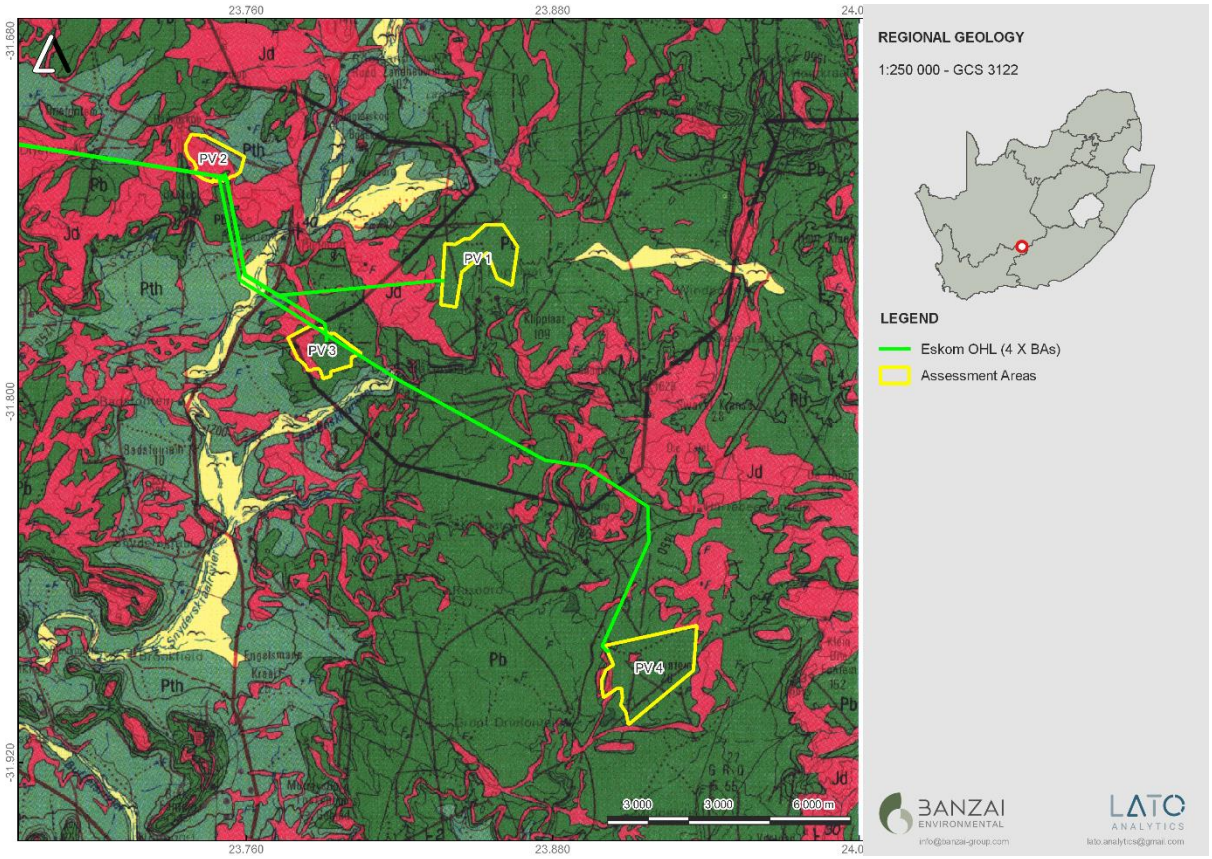


Figure 26: *Extract of the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) indicating the geology of the Padloper Solar Facilities 1-4 and associated grid infrastructure near Murraysburg in the Western and Northern Cape Province. The development is underlain by the Balfour and Middelton Formations of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup).*

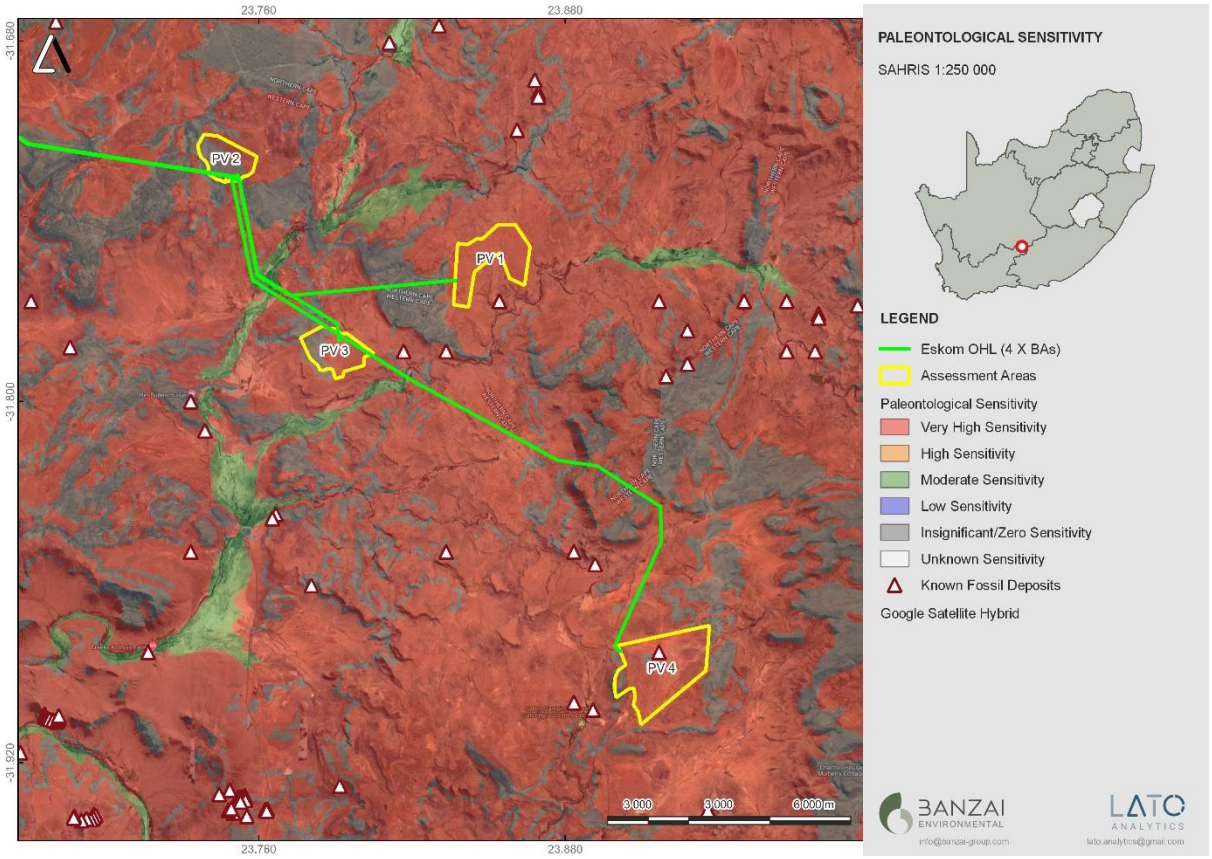


Figure 27: *Extract of the SAHRIS PalaeoMap (Council of Geosciences) indicates that* Padloper Solar Projects 1-4 is *underlain by sediments with a Very High (red) and Zero (grey) Palaeontological Sensitivity. Fossils finds recorded on the National Palaeontological Database is indicated in white triangles with red outlines.*

Table 29: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al*., 2013; SAHRIS website).*		
Colour	**Sensitivity**	**Required Action**
RED	**VERY HIGH**	**field assessment and protocol for finds is required**
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	**INSIGNIFICANT/ZERO**	**no palaeontological studies are required**
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

The PalaeoMap of the South African Heritage Resources Information System (Figure 27, Table 29) indicates that the Palaeontological Sensitivity of the Jurassic Dolerite is Zero as it is igneous in origin and thus unfossiliferous while that of the Adelaide Subgroup is Very High (Almond and Pether, 2009; Almond *et al*., 20134.

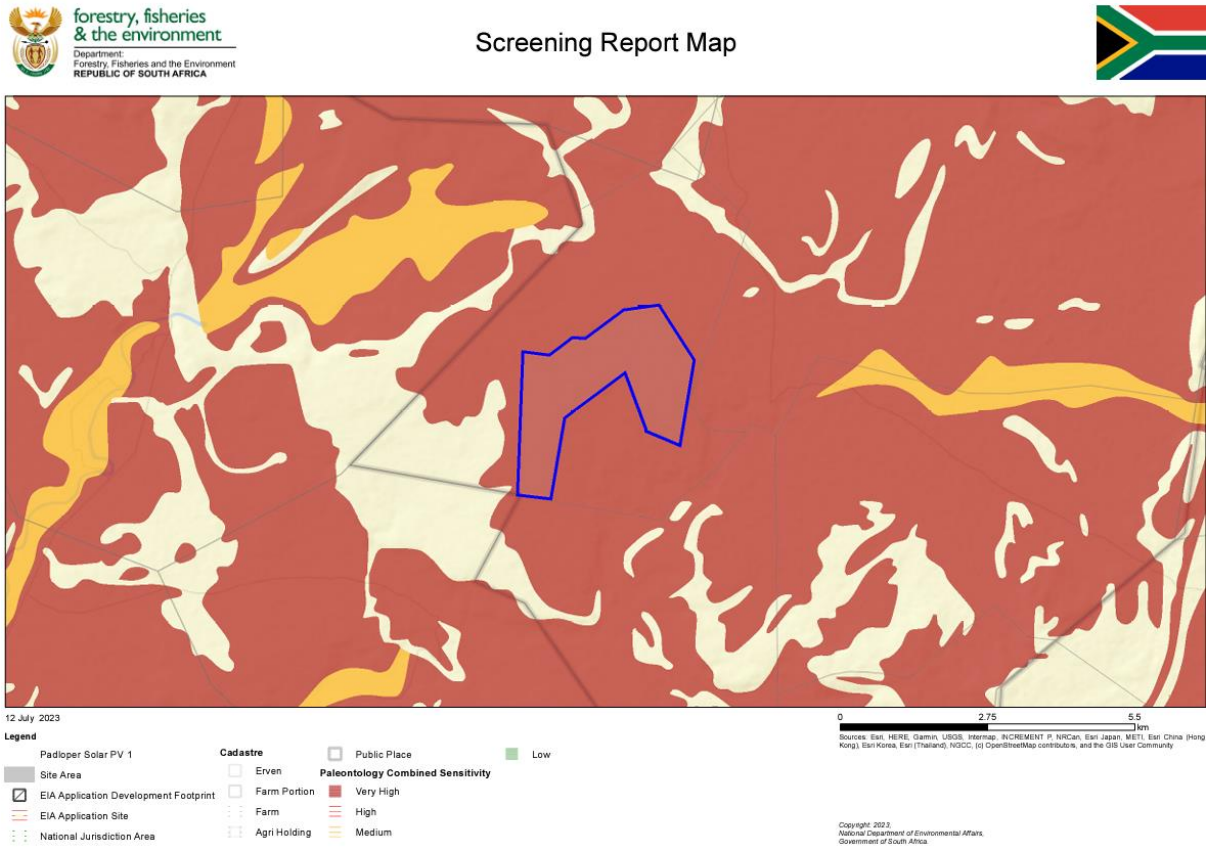


***Figure 28**: Palaeontological Sensitivity of the Padloper Solar Facility 1 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper Solar Facility 1 is Very High (dark red).

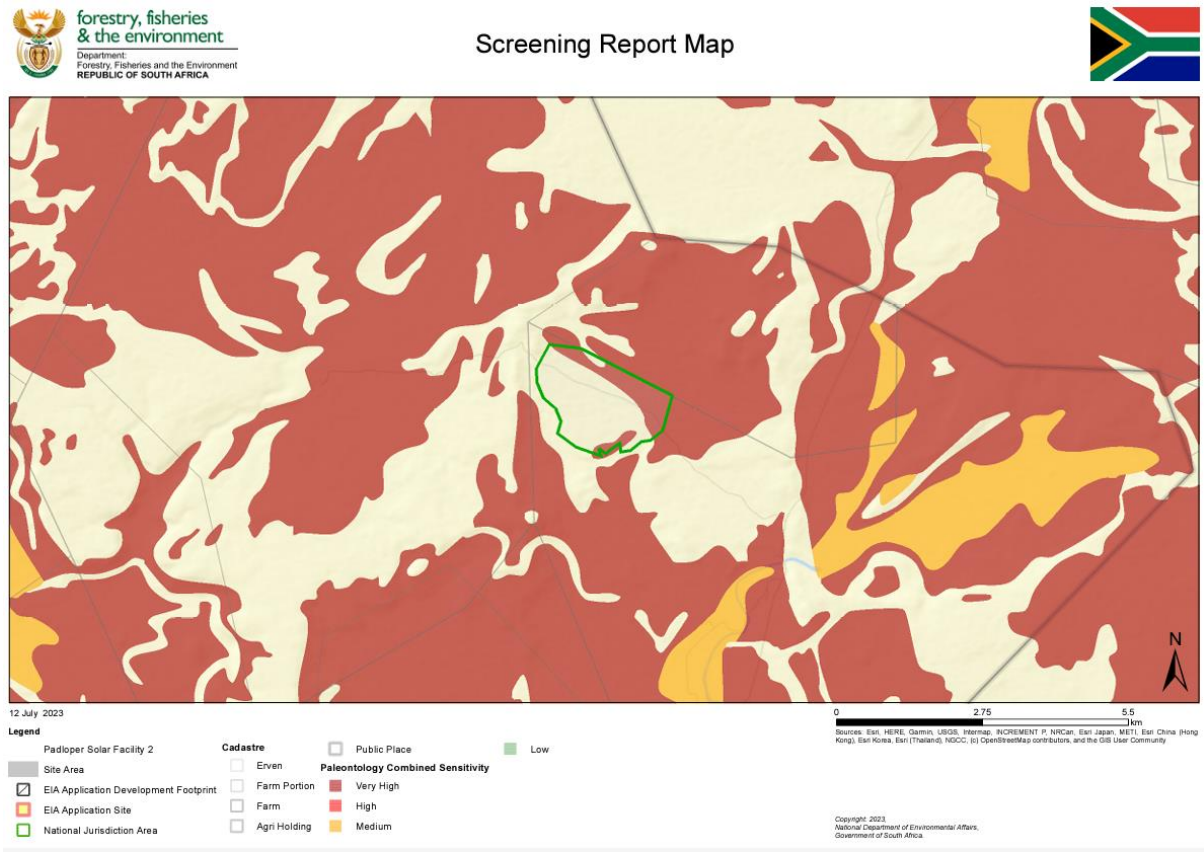


***Figure 29**: Palaeontological Sensitivity of the Padloper Solar Facility 2 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of a small portion of the northern section of the Padloper Solar Facility 2 is Very High (dark red). No sensitivities have been allocated for majority of the footprint

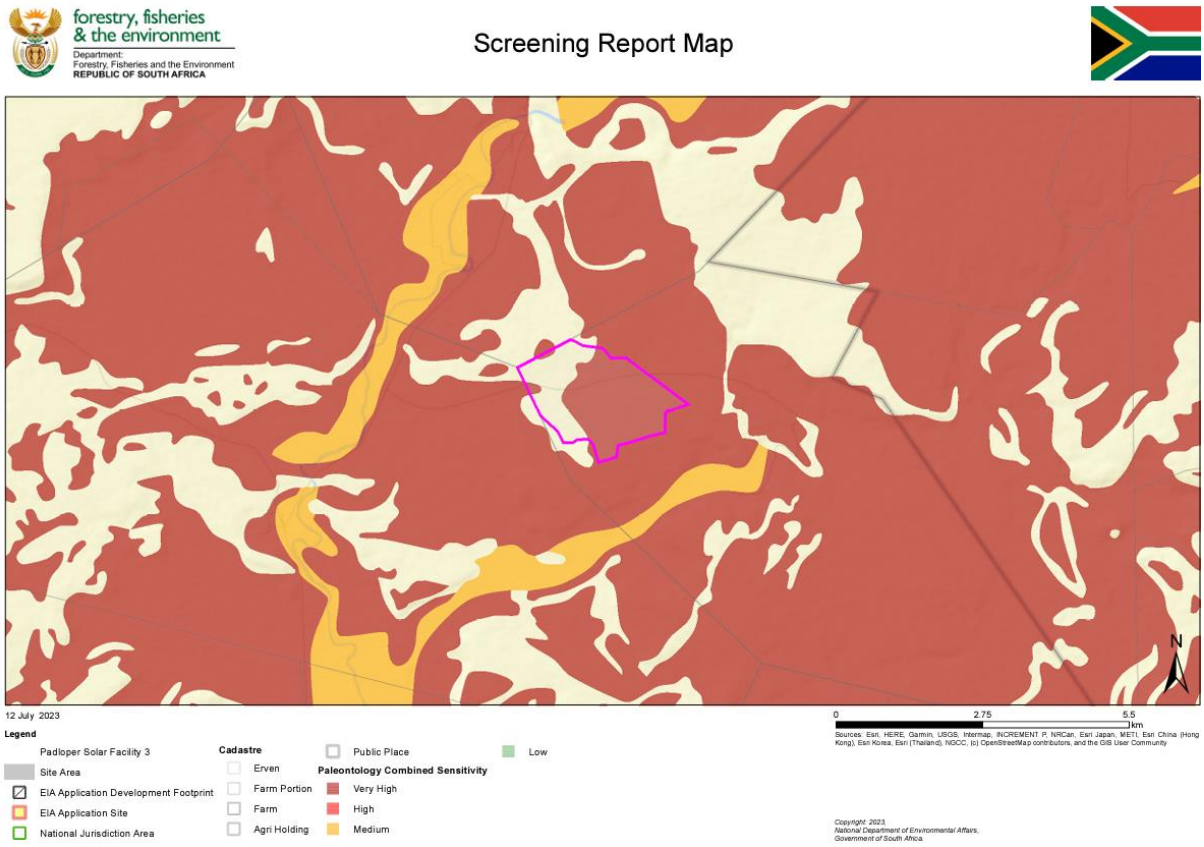


***Figure 30**: Palaeontological Sensitivity of the Padloper Solar Facility 3 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper Solar Facility 3 is Very High (dark red).

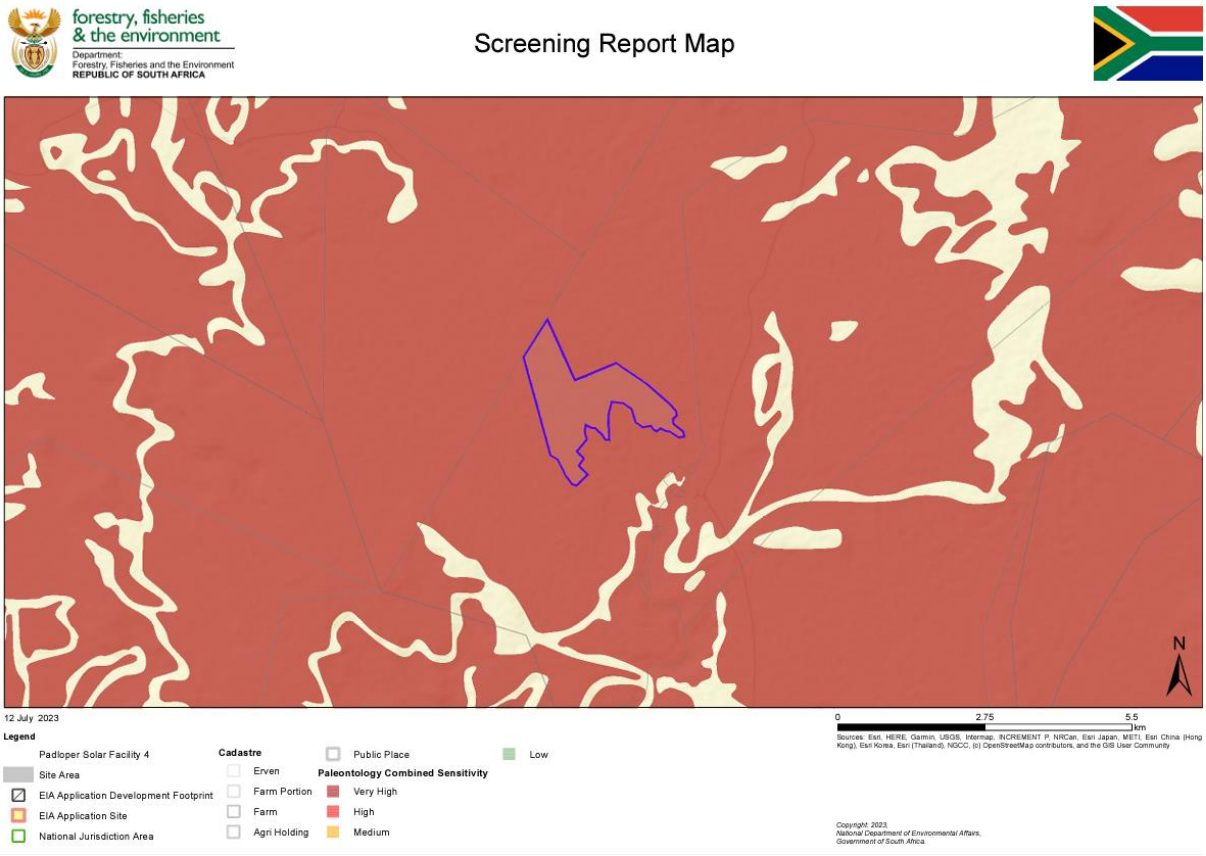


***Figure 31**: Palaeontological Sensitivity of the Padloper Solar Facility 4 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper Solar Facility 4 is Very High (dark red).

4 CONCLUSION

The Site Sensitivities of the proposed Padloper Projects 1-4 have been verified and it was found that:

The SAHRIS Palaeosensitivity map indicates that the Palaeontological Sensitivity of the development is Very High.

And

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the development is Very High (dark red).

These maps indicate that each of the four proposed PV development sites are highly Sensitive from a Palaeontological point of view. However, the site investigation undertaken in January of 2023 did not report any fossiliferous outcrops. Therefore, the outcome of the DFFE Screening Tool is thus contested (National Environmental Web-bases Screening Tool and SAHRIS) as far as the impact of the Padloper Solar Projects 1, 2, 3 and 4 is concerned, based on actual conditions recorded on the ground during the site visit in January 2023.

APPENDIX 3 CURRICULUM VITAE

PROFESSION:	Palaeontologist
YEARS' EXPERIENCE:	30 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

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 1998–2022

TECHNICAL REPORTS

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

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

Private Bag X447, Pretoria, 0001, Environment House, 473 Steve Biko Road, Pretoria, 0002 Tel: +27 12 399 9000, Fax: +27 86 625 1042

SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE

Basic Assessment for the proposed development of the Padloper Solar PV Facility 2 and associated infrastructure (i.e., Padloper PV 2), near Murraysburg in the Western Cape Province

Kindly note the following:

1. This form must always be used for assessment that are in support of applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting, where this Department is the Competent Authority.
2. This form is current as of August 2023. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.dffe.gov.za/documents/forms.
3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with *'the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

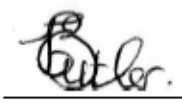
Title of Specialist Assessment	Palaeontology Assessment
Specialist Company Name	Banzai Environmental
Specialist Name	Elize Butler
Specialist Identity Number	[redacted]
Specialist Qualifications:	MSc
Professional affiliation/registration:	PSSA
Physical address:	[redacted]
Postal address:	
Postal address	
Telephone	
Cell phone	
E-mail	

SPECIALIST DECLARATION FORM – AUGUST 2023

2. DECLARATION BY THE SPECIALIST

I, Elize Butler declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, 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 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;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.



Signature of the Specialist

Banzai Environmental (Pty) Ltd

Name of Company:

08 Aug 2023

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ Elize Butler_____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Banzai Environmental;

Name of Company

08 August 2023

Date

Signature of the Commissioner of Oaths

08 Aug 2023

Date

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HUMAN RESOURCE MANAGEMENT
2023 -08- 08
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Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

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SPECIALIST DECLARATION FORM – AUGUST 2023

Specialist Declaration form for assessments undertaken for application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

REPORT TITLE

Basic Assessment for the proposed development of the Padloper Solar PV Facility 2 and associated infrastructure (i.e., Padloper PV 2), near Murraysburg in the Western Cape Province

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3. An electronic copy of the signed declaration form must be appended to all Draft and Final Reports submitted to the department for consideration.
4. The specialist must be aware of and comply with *'the Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the act, when applying for environmental authorisation - GN 320/2020)'*, where applicable.

1. SPECIALIST INFORMATION

Title of Specialist Assessment	Heritage Assessment
Specialist Company Name	ASHA Consulting (Pty) Ltd
Specialist Name	Dr Jayson Orton
Specialist Identity Number	[redacted]
Specialist Qualifications:	PhD Archaeology, Oxford UK; MA Archaeology, UCT
Professional affiliation/registration:	ASAPA CRM section (Member 233) APHP (Member 43)]
Physical address:	[redacted]
Postal address:	
Postal address	
Telephone	
Cell phone	
E-mail	

2. DECLARATION BY THE SPECIALIST

I, Click or tap here to enter text. JAYSON ORTON declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, 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 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;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

Click or tap here to enter text. ANVA CONSULTING (PTY) LTD

Name of Company:

Click or tap here to enter text. 04-09-2023

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, _ JARROD ORTON _____, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is ~~true~~ and correct.

Signature of the Specialist

ARIA CONSULTING (PTY) LTD

Name of Company

04-09-2023

Date

Signature of the Commissioner of Oaths

2023-09-04

Date

SOUTH AFRICAN POLICE SERVICE
KIRSTENHOF SAPS
04 SEP 2023
CSC
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