DRAFT BASIC ASSESSMENT REPORT

Basic Assessment for the proposed development of the Padloper Solar PV Facility 1 (i.e., Padloper PV 1), the proposed development of a 132 kV Overhead Power Line between the Padloper PV 1 and the proposed authorised Ishwati Emoyeni Collector Substation (i.e., Padloper EGI 1), and their associated infrastructure, near Murraysburg in the Northern Cape and Western Cape Provinces

APPENDIX D.3:

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

BANZAI ENVIRONMENTAL

PALAEONTOLOGICAL IMPACT ASSESSMENT

FOUR PROPOSED 132 kV OVERHEAD POWERLINES ASSOCIATED WITH PADLOPER SOLAR FACILITIES 1-4 NEAR MURRAYSBURG, WESTERN CAPE AND NORTHERN CAPE PROVINCES

July 2023

COMPILED FOR: 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) 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).

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	-
(g) An identification of any areas to be avoided, including buffers	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.**
(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 Environmental Management Plan (EMPr) process.

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**The relevant section in the report**	**Comment where not applicable.**
(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 was appointed by African Clean Energy Developments (Pty) Ltd (hereafter '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 (or Electrical Grid Infrastructure – EGI), as well as the associated infrastructure near Murraysburg in the Western and Northern Cape provinces. This PIA Report will focus on four of seven proposed powerlines, the Padloper EGIs 1-4.

Under the National Environmental Management Act (NEMA; Act No. 107 of 1998) and to comply with the National Heritage Resources Act (NHRA; Act No. 25 of 1999, section 38), 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.

The Padloper EGI 1-4 developments and associated 400m corridor is underlain by Quaternary alluvium, the Balfour and Middelton Formations of the Adelaide Subgroup as well as 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, that of the Ouaternary alluvium is moderate and the Adelaide Subgroup has a Very High Palaeontological Sensitivity (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 alluvium, colluvium, eluvium and gravel, 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 basin. Th National Palaeontological databases indicate that only one fossil has been uncovered very close to the Padloper EGIs 1-4. 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 EGIs 1-4 and 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 (Padloper EGIs 1-4 and 400m corridors) is relatively 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 are 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

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 this project, 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: +27 (0)21 483 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 EGIs 1-4.

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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
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources and
EA	Environmental Authorization
EIR	Environmental Impact Reporting
ECO	Environmental Control Officer
EGI	Electrical Grid Infrastructure
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
REIPPPP	Renewable Energy Independent Power Producer Procurement Program

SG	Surveyor General
SAHRA	South African Heritage Resources Agency
SEF	Solar Energy Facility
SAHRIS	South African Heritage Resources Information System
S&EIA	Scoping & Environmental Impact Assessment
SANBI	South African National Biodiversity Institute
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 their associated infrastructure, and their dedicated 7 x 132 kV overhead power lines (or Electrical Grid Infrastructure – EGI) 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 Collector Substation.

This report is a combined report for Padloper EGIs 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 (PV) 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
	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
	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
	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
	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 (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 (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 (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
	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
	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
	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

Table 3: Over Head 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				

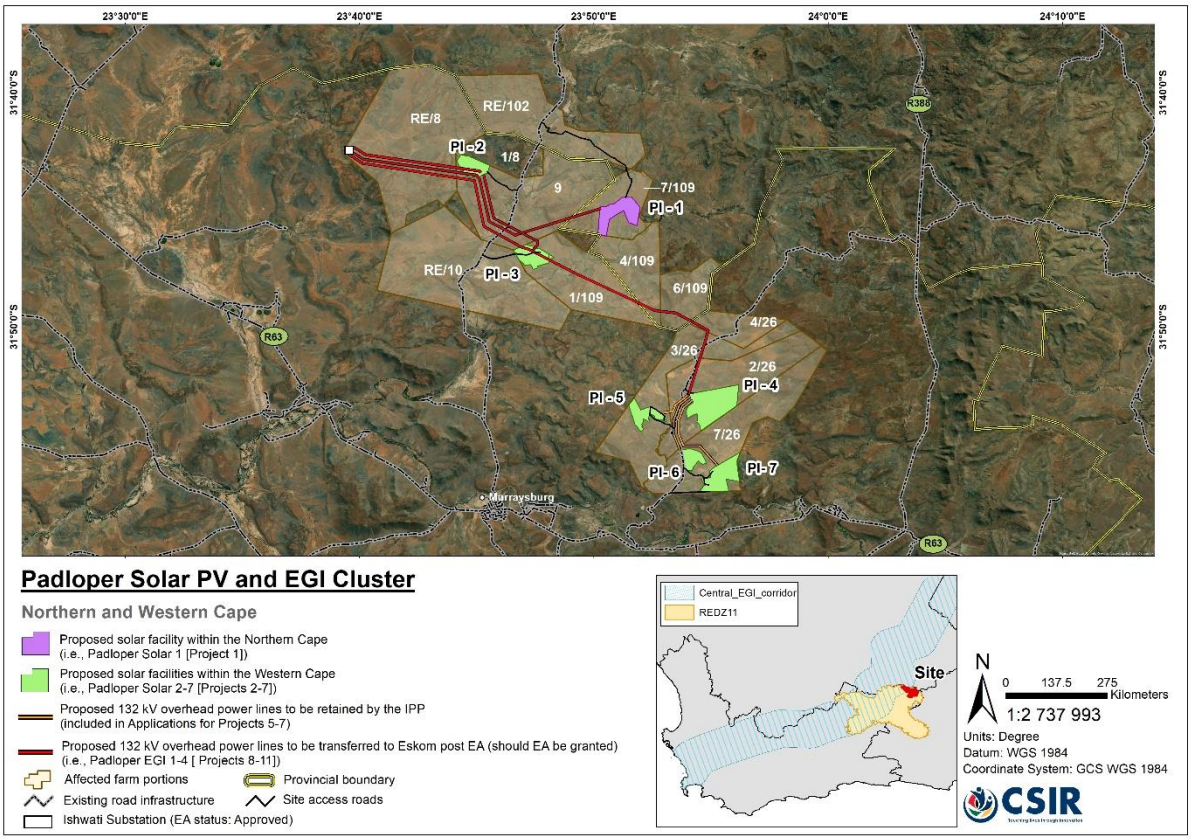


***Figure 1**: Location of the affected farm portions on which the proposed Padloper Solar Facilities 1-7 will be developed. These entire farm portions (outlined in brown) are the study area for the Padloper PV facilities, including access roads.*

The proposed Padloper EGIs 1-4 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.

Table 4: Electrical Grid Infrastructure (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 were assessed based on the worst-case scenario).

1.1 General site description

The landscape of the Padloper EGIs 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

The EIA Regulations determine 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'S 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 (C*um 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 PIA Report.

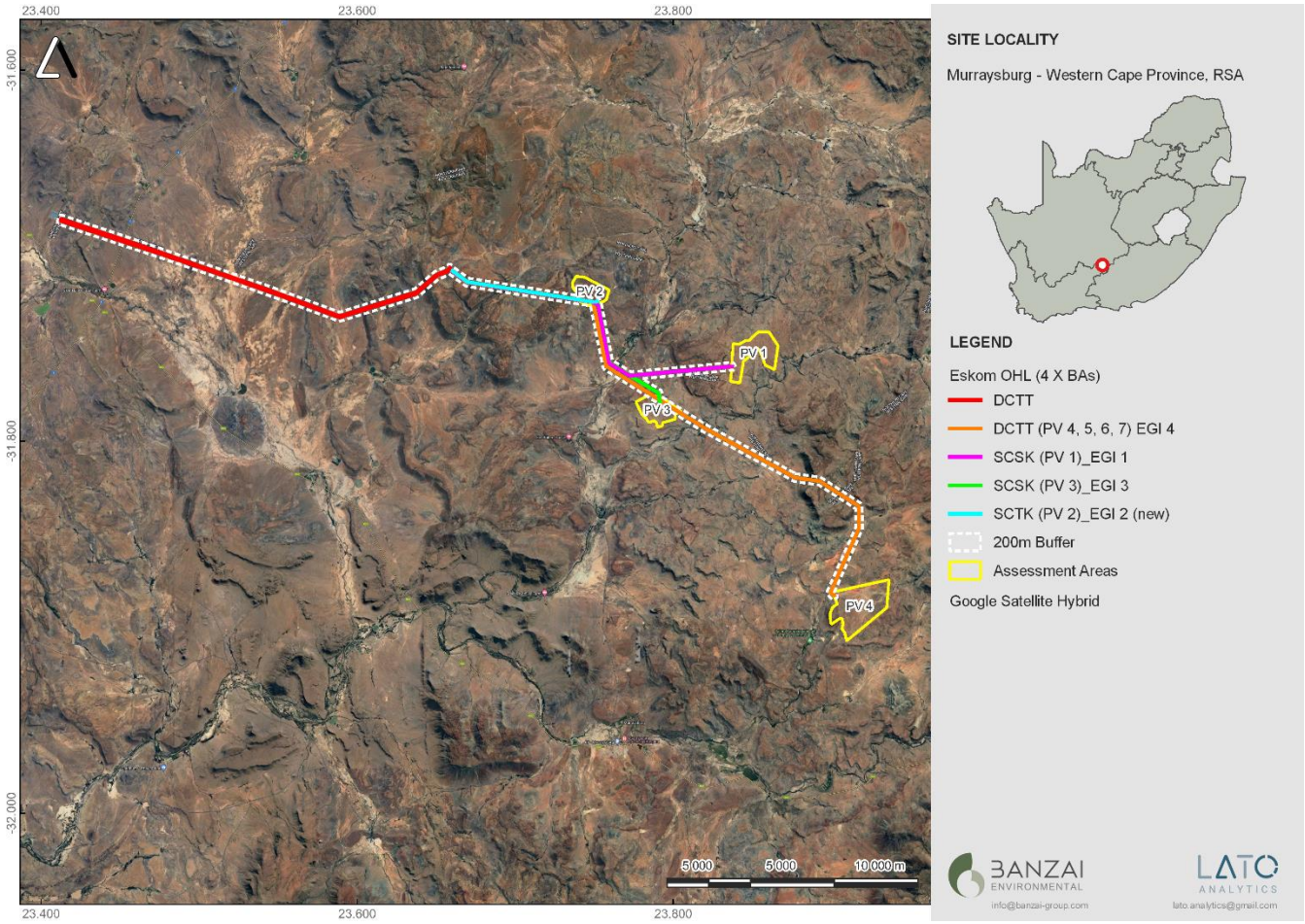


***Figure 2**: Regional locality of the Padloper EGIs 1-4 near Murraysburg in the Northern Cape and Western Cape.*

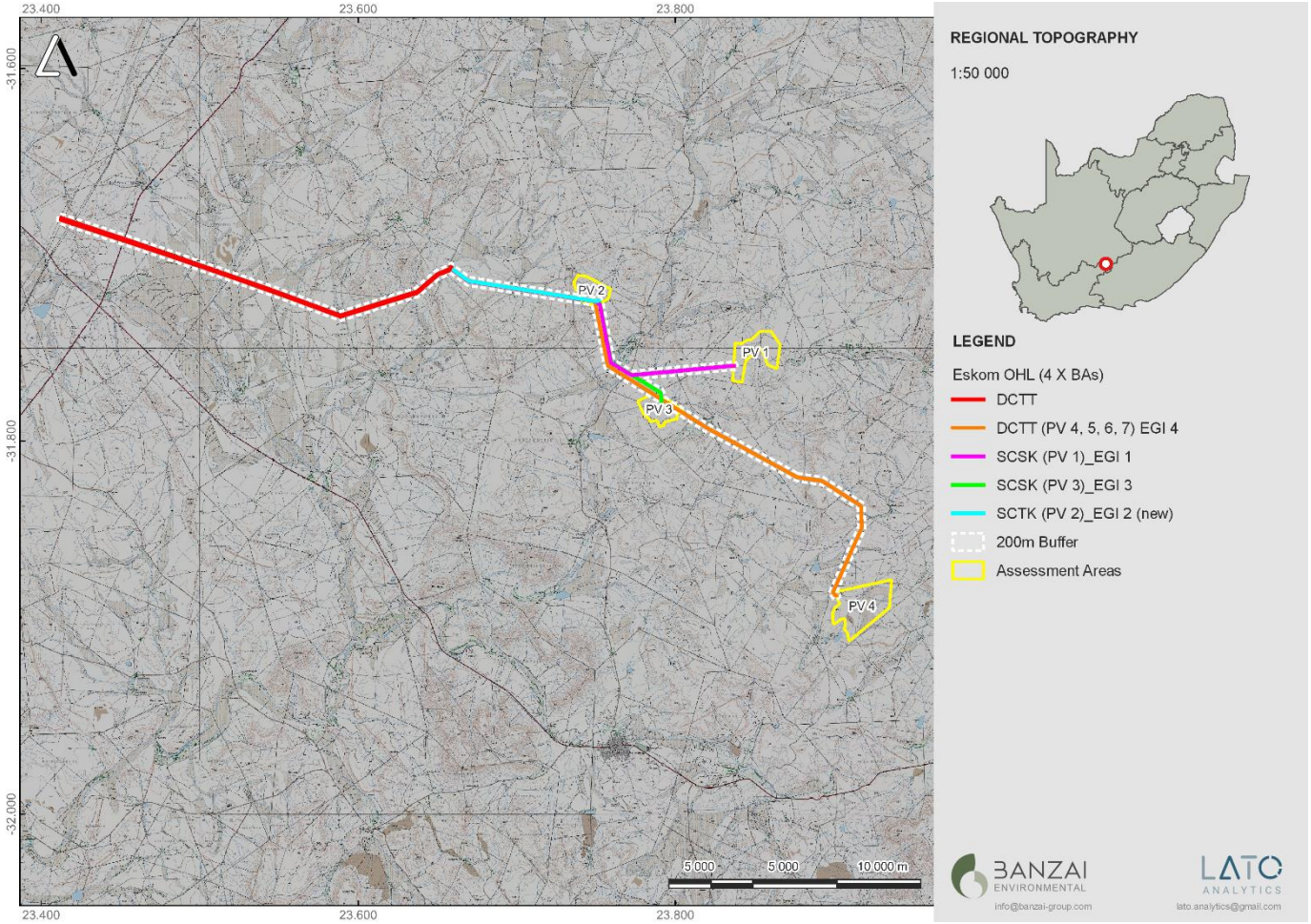


***Figure 3**: Regional topography of the Padloper EGIs 1-4 as near Murraysburg in the Northen Cape and Western Cape.*

3 LEGISLATION

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 No. 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 No. 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 a comprehensive and legally compatible PIA report has 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 or
    - 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

The present field-based PIA assesses the potential impacts on fossil heritage on the development. footprint. This study forms part of the HIA 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 scoping 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 EGIs 1-4 development area was determined by criss-crossing the development footprint and by physically investigating 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

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

The proposed Padloper EGIs 1-4 near Murraysburg in the Western Cape are depicted on the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) (Figure 4; Table 5). This map indicates that Padloper EGIs 1-4 is underlain by Quaternary alluvium, the Balfour (Pb) and Middelton Formations (Pth) of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as 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 6). 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 alluvium, colluvium, eluvium and gravel, the Balfour and Middelton Formations of the Adelaide Subgroup as well as Jurassic Dolerite.

Quaternary superficial deposits are the youngest geological deposits formed during the Quaternary (approximately 2.6 million years ago to present). In the proposed development, areas of alluvium, colluvium and eluvium is present. Research has indicated that Quaternary deposits reveal palaeoclimatic changes in the different geological formations (Hunter *et al*., 2006). The climatic fluctuations in the Cenozoic Era were responsible for the formation of most geomorphologic features in southern Africa (Maud, 2012). Various warming and cooling events occurred in the Cenozoic but climatic changes during the Quaternary, specifically the last 1.8 Ma, were the most drastic climate changes relative to all climate variations in the past Barnosky (2005). Climate in the Quaternary Period were both drier and wetter than the present and resulted in changes in river flow patterns, sedimentation processes and vegetation variation (Tooth *et al.*, 2004). Fossil assemblages of this Group are generally very low in diversity and occur over a wide range. These fossils represent terrestrial plants and animals with a close resemblance to living forms. Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods and trace fossils. The palaeontology of the Quaternary superficial deposits has been relatively neglected in the past. Late Cenozoic calcrete may comprise of bones, horn corns as well as mammalian teeth. Tortoise

remains have also been uncovered as well as trace fossils which includes termite and insect's burrows and mammalian trackways. Amphibian and crocodile remains have been uncovered where the depositional settings in the past were wetter. According to the SAHRIS Palaeomap these sediments has a Moderate Palaeontological Sensitivity.

The Jurassic dolerite present in the development form part of the Karoo Igneous Province is one of the worlds 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*. 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 11-18*)*, 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 11) 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 17), *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 16) 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.

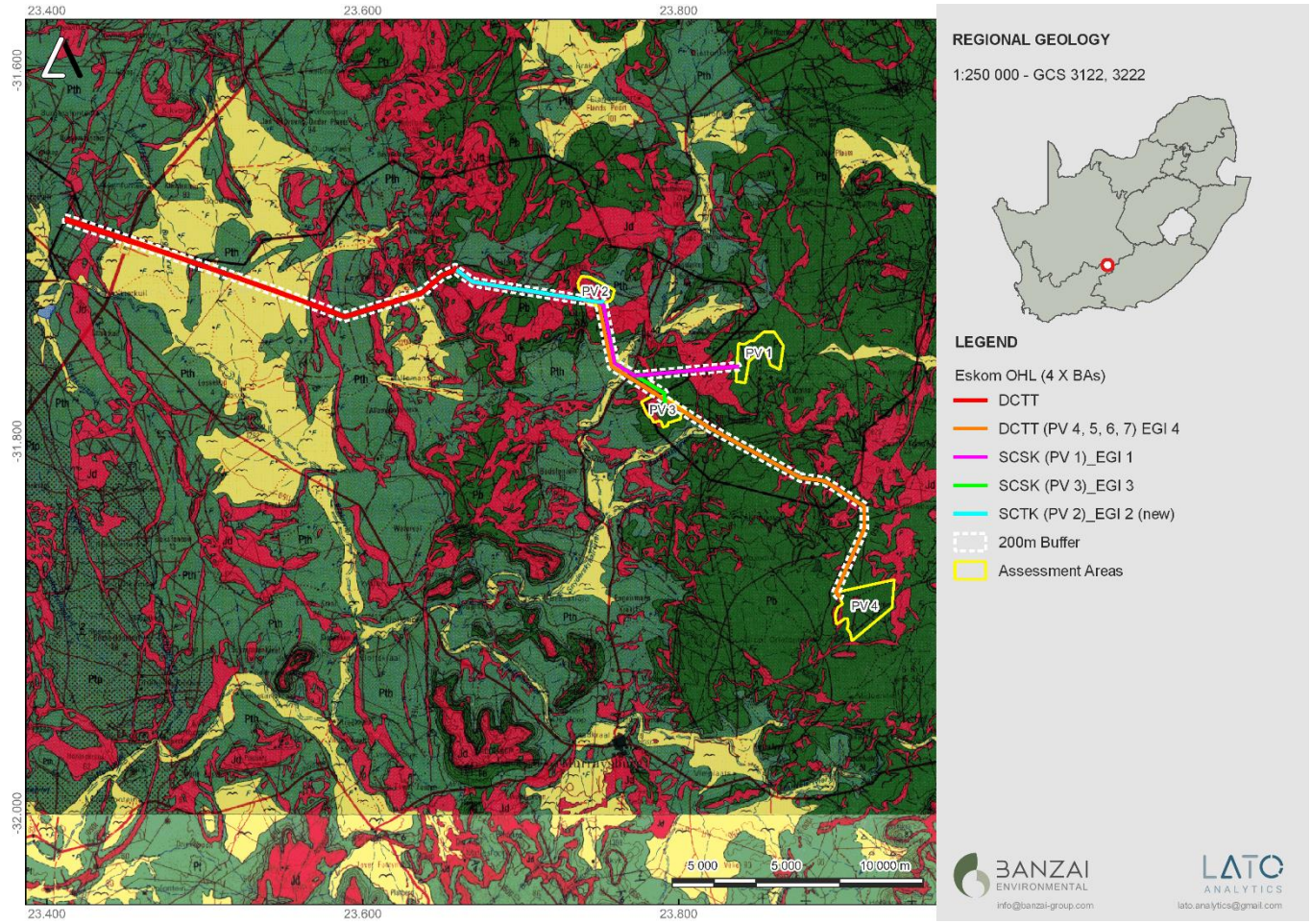
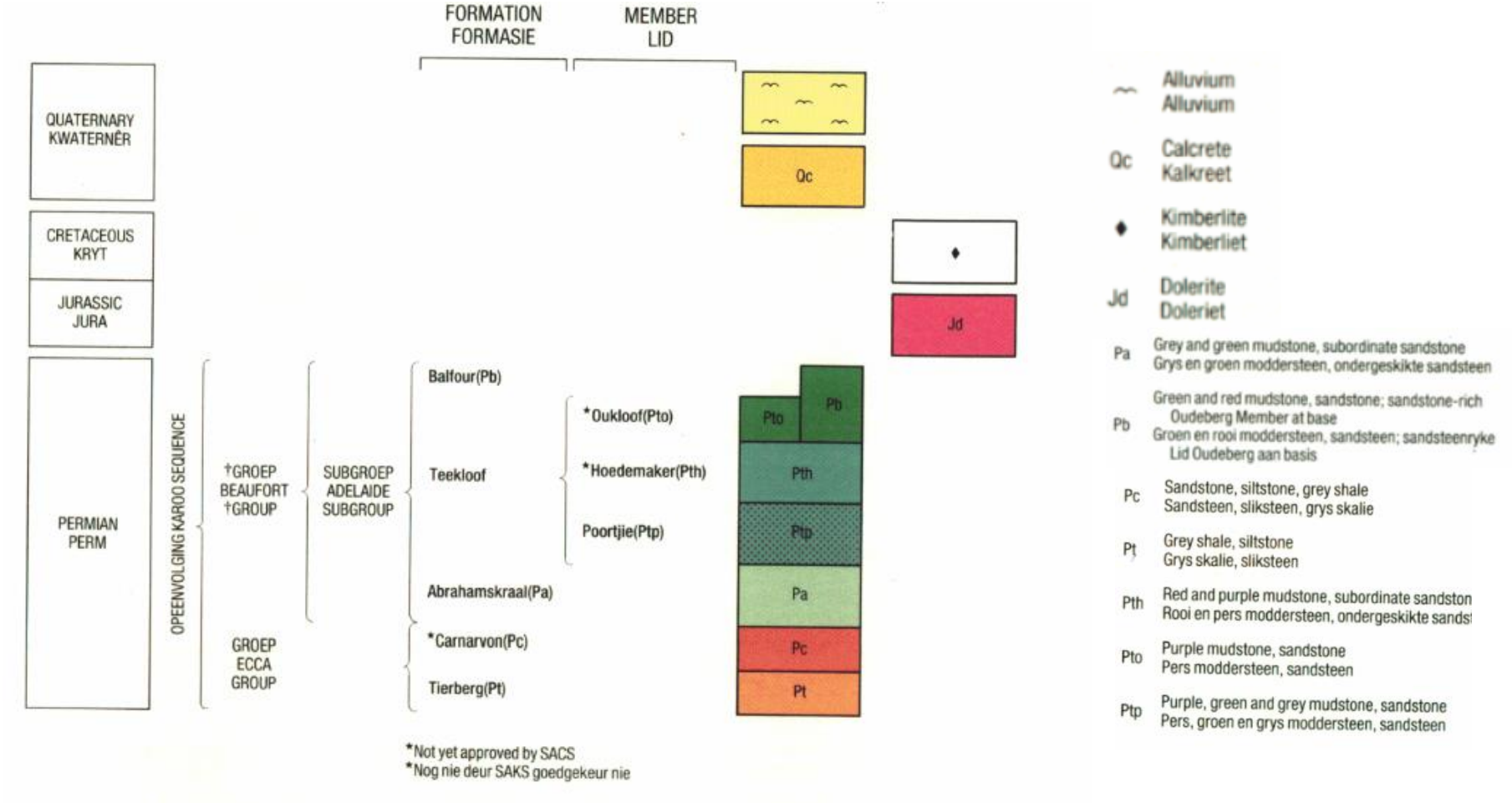


***Figure 4**. Extract of the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) indicating the geology of the Padloper EGIs 1-4 near Murraysburg in the Northern Cape and Western Cape. The development is underlain by the Quaternary superficial sediments(Qs, and single bird figure), the Balfour (Pb, bright green) and Middelton (Pth, light green) Formations of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as Jurassic dolerite (Jd, red).*

Table 5: Legend to the 1:250 000 1:250 000 Victoria West 3122 (1966) Geological map (Council of Geoscience, Pretoria).



The National Palaeontological Databases is a combined database of all fossils collected by the different research institutions in South Africa. Fossils recovered near the study area is indicated by white triangles with red outlines (Figure 5). However, only one fossil was collected in the development footprint. These fossils indicated on the map were all collected and is now housed in accredited museum or university collections.

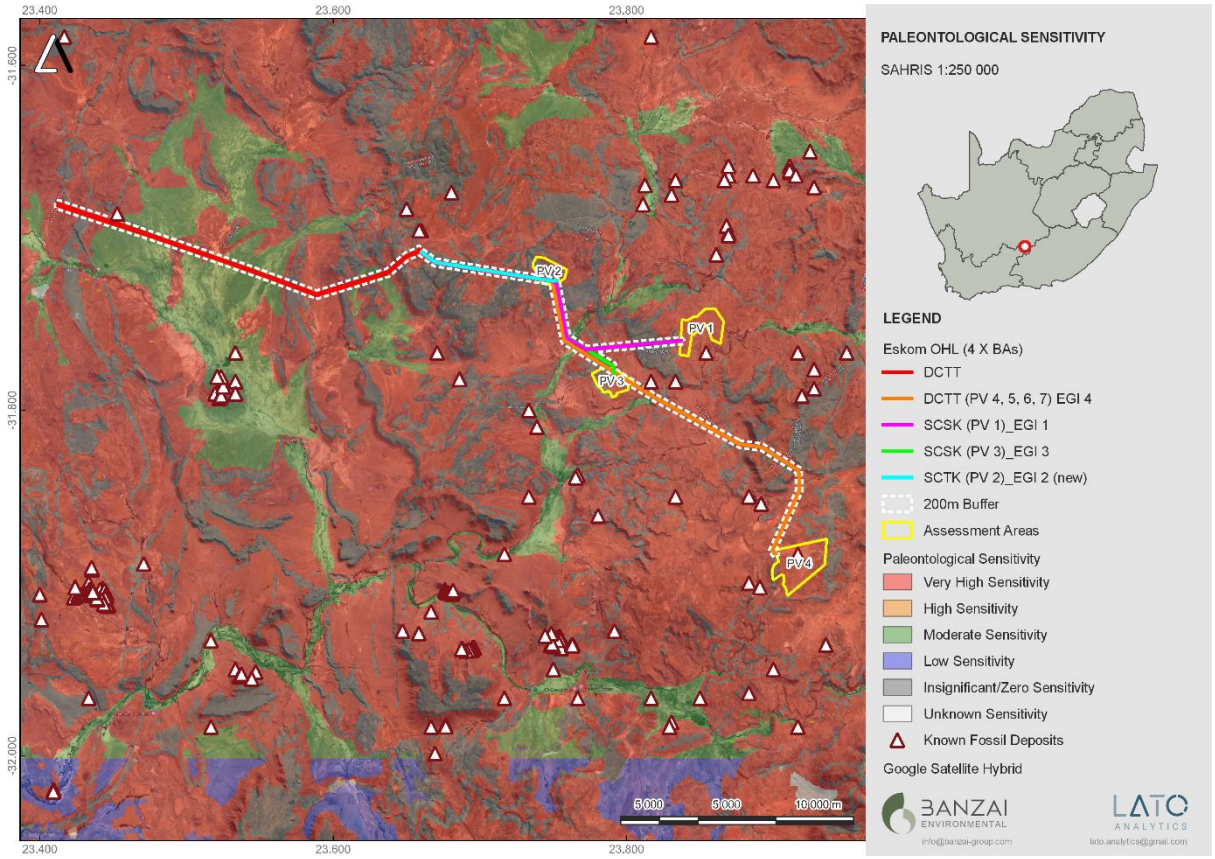
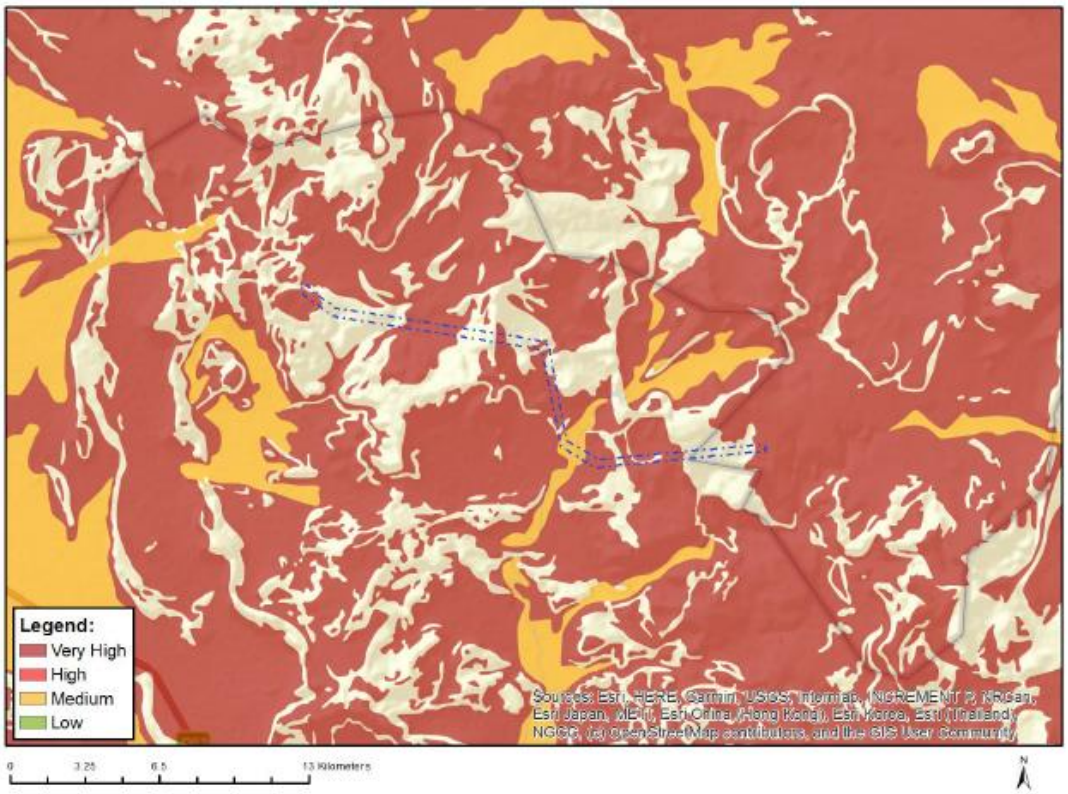


Figure 5: *Extract of the SAHRIS PalaeoMap (Council of Geosciences) indicates that* Padloper EGIs 1-4 are *underlain by sediments with a Very High (red), Moderate (green) and Zero (grey) Palaeontological Sensitivity. Fossils finds recorded on the National Palaeontological Database is indicated in white triangles with red outlines.*

Table 6: 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.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

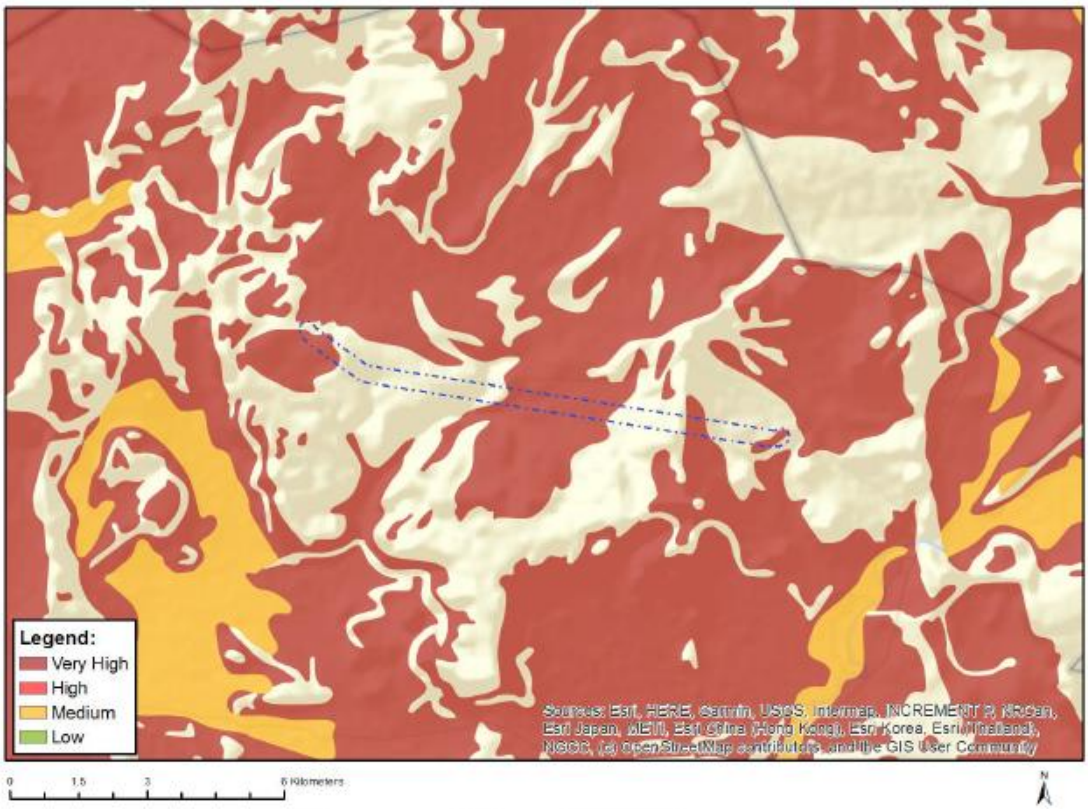
Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

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

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper EGI 1 is Very High (dark red), while areas with a moderate (yellow) and unknown (white) is also crossed.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

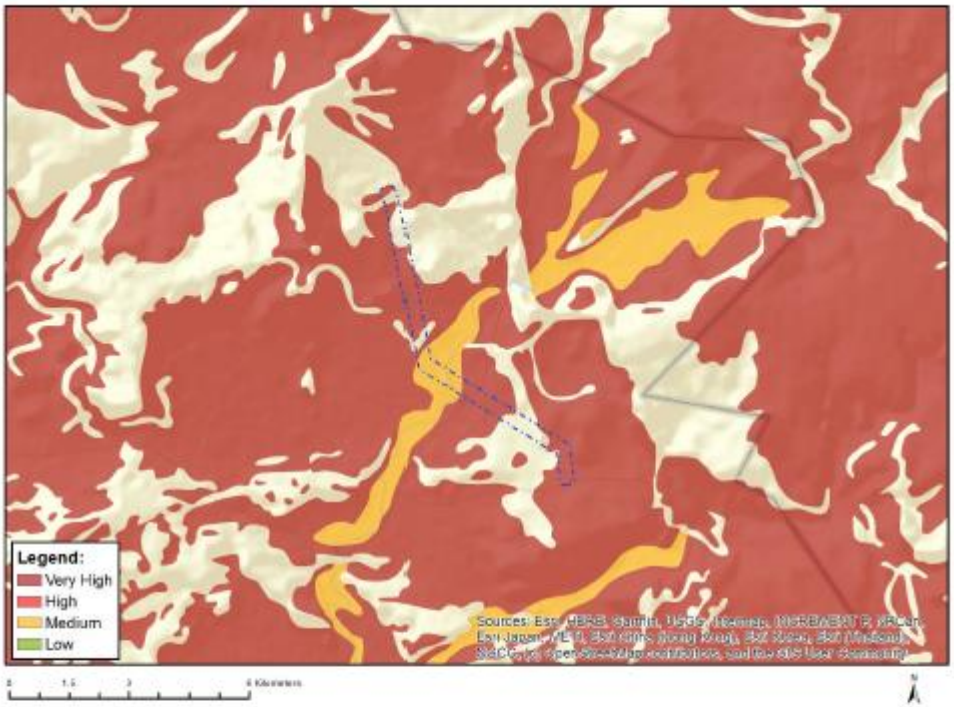
Sensitivity Features:

Sensitivity	Feature(s)
Very High	Features with a Very High paleontological sensitivity

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

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper EGI 2 is Very High (dark red), while areas with an unknown (white) is also crossed.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

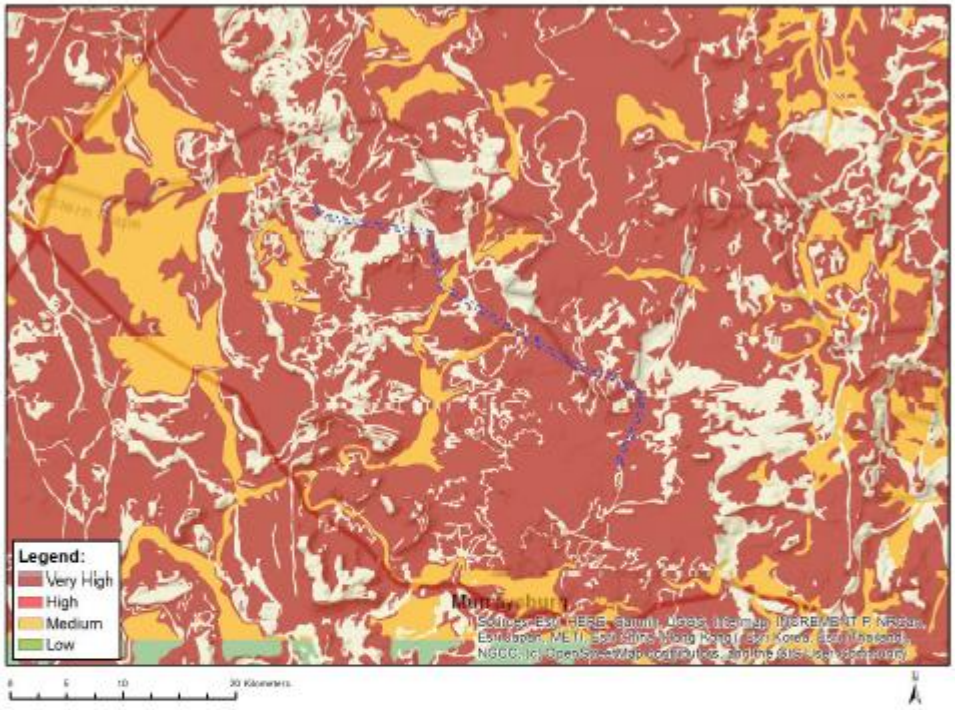
Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

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

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper EGI 3 is Very High (dark red), while areas with a moderate (yellow) and unknown (white) is also crossed.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

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

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper EGI 4 is Very High (dark red), while areas with a moderate (yellow) and unknown (white) is also crossed.

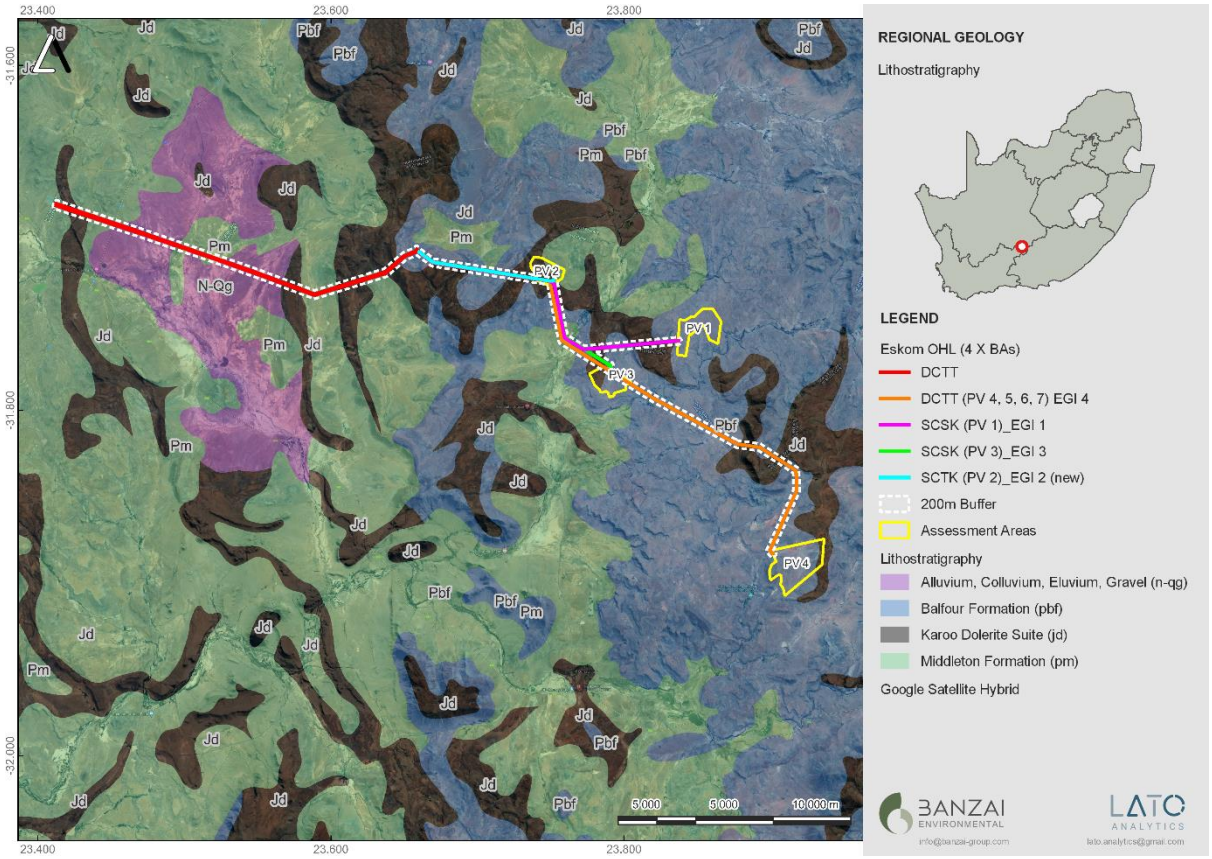


***Figure 10**: Updated Geology compiled by the Council of Geosciences (Council for Geoscience, Pretoria) indicates that the proposed Padloper EGIs 1-4 are underlain by the alluvium, colluvium, eluvium and gravel (n-qg), Karoo Dolerite Suite (Jd), Balfour (pdf) and Middleton (pm) Formations (Adelaide Subgroup, Karoo Supergroup).*

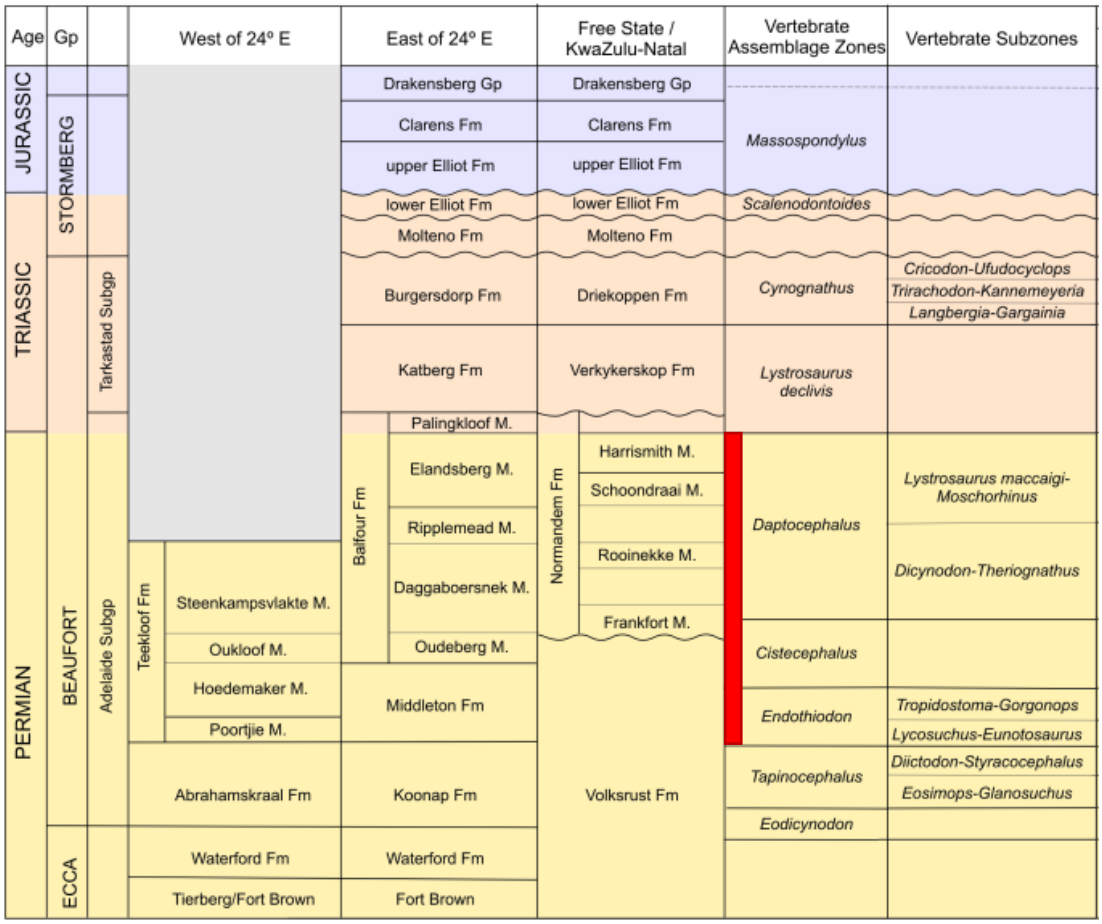


***Figure 11**: Vertebrate biozonation range chart for the Main Karoo Basin of South Africa.*

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.

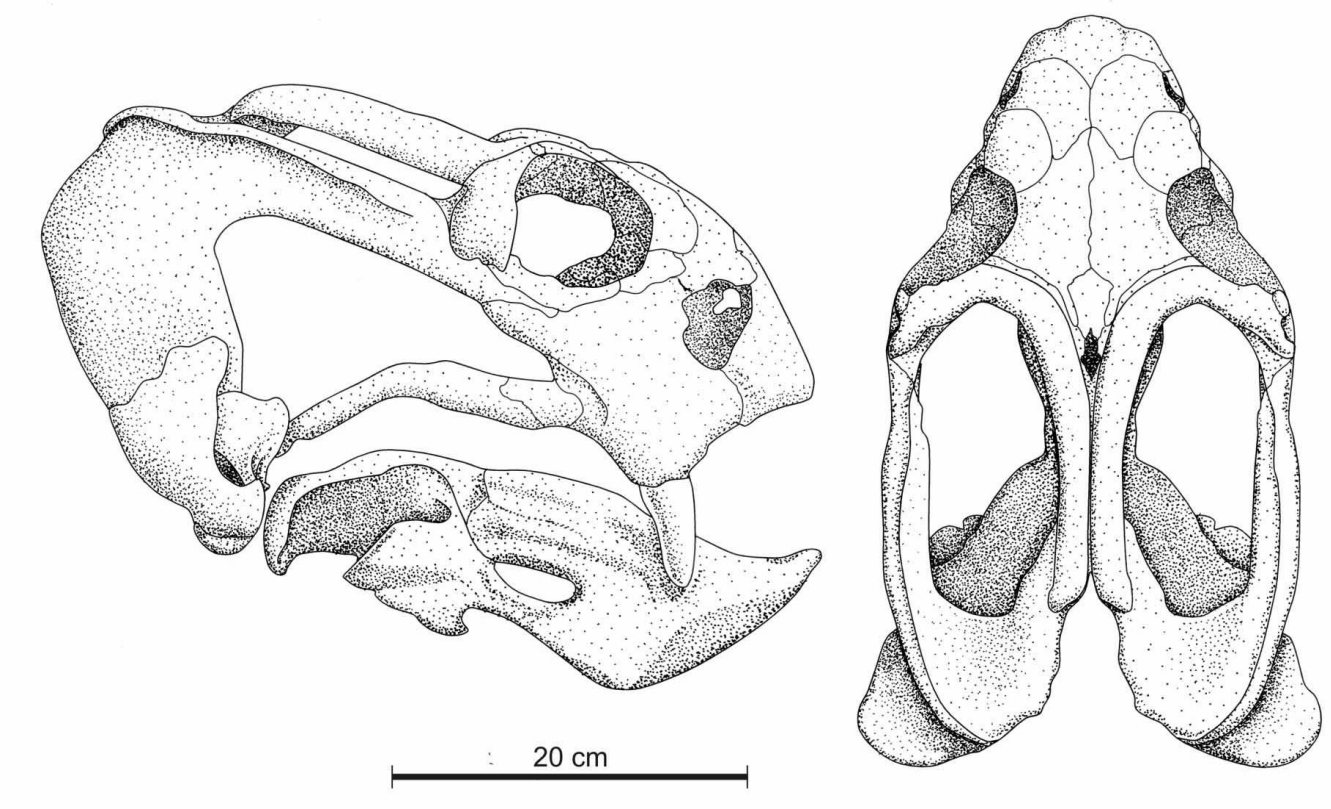


***Figure 12**: Lateral and dorsal views of skull of the dicynodont Daptocephalus leoniceps, the main biozone defining fossil and dorsal views (Image taken from Viglietti, 2020).*

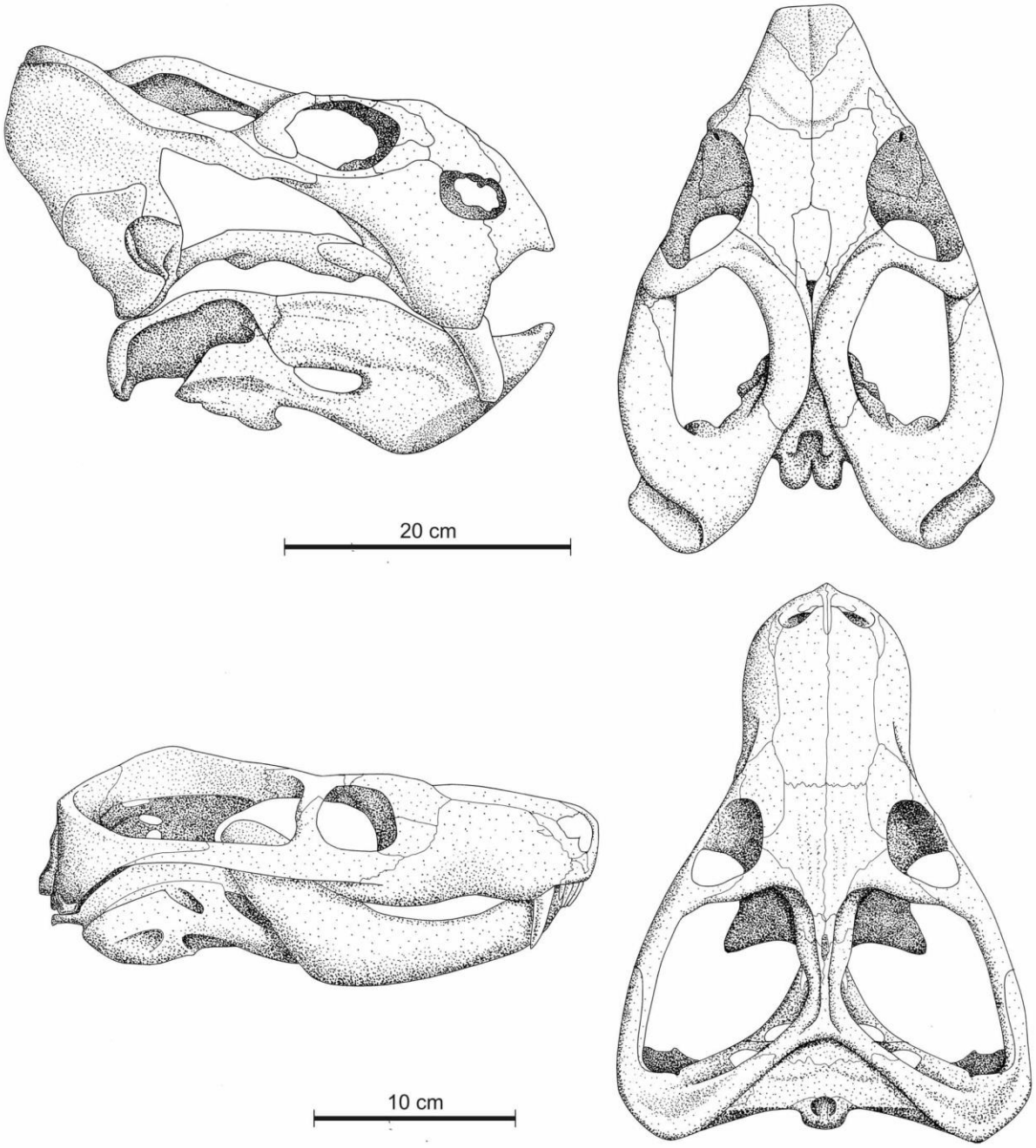


***Figure 13**: Skulls of the biozone defining fossils of the Dicynodon-Theriognathus Subzone in lateral and dorsal views. Dicynodon lacerticeps (top), Theriognathus microps (bottom) (Image taken from Viglietti, 2020).*

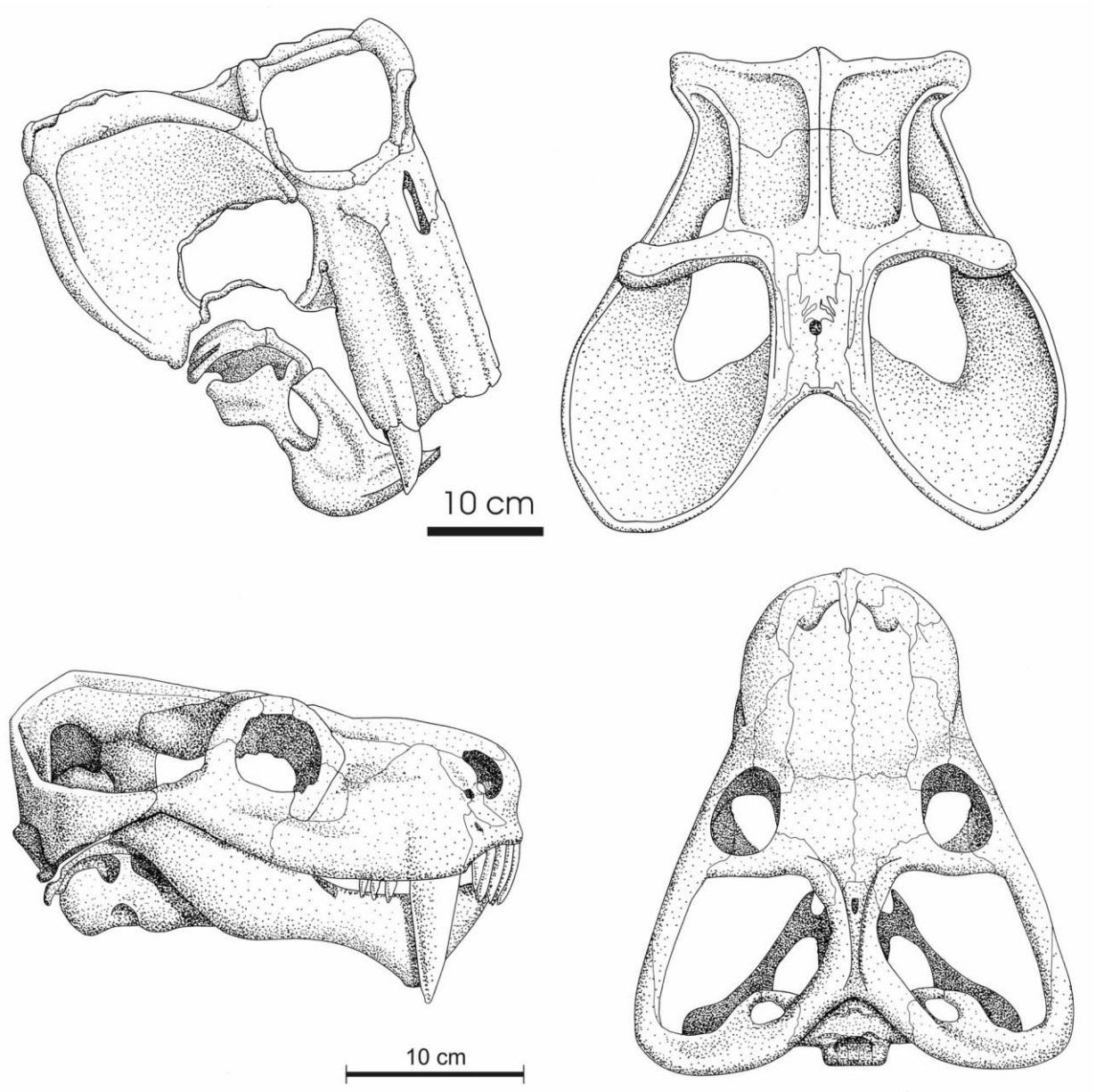


Figure 14: *Biozone defining fossils of the Lystrosaurus maccaigi- Moschorhinus Subzone. The skulls of the Lystrosaurus maccaigi (top) and Moschorhinus kitchingi (bottom) in lateral.*

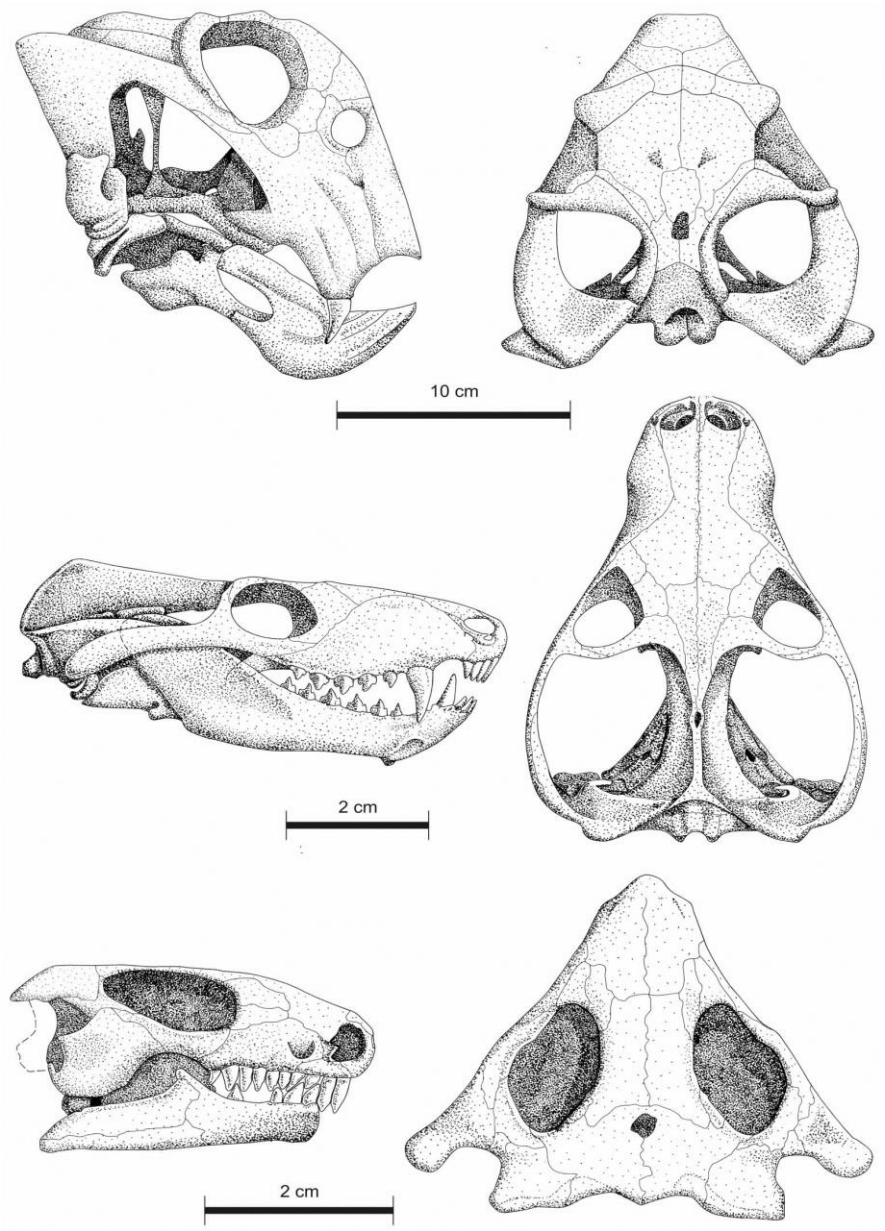


***Figure 15**: Lateral and dorsal views of the index taxa defining the Lystrosaurus declivis Assemblage Zone. (top) Lystrosaurus declivis, (centre) Thrinaxodon liorhinus, (bottom) Procolophon trigoniceps (Image taken from Botha and Smith, 2020).*

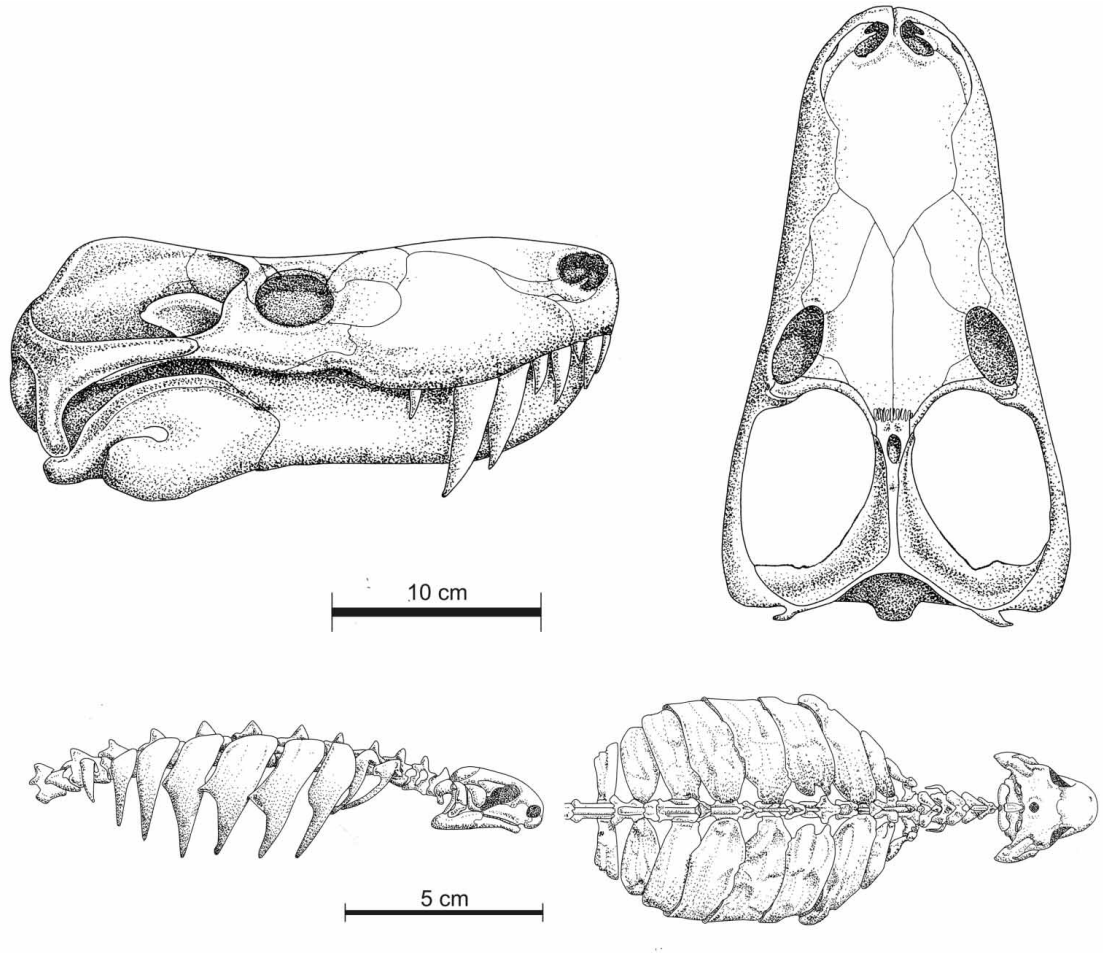


***Figure 16**: Lateral and dorsal views of Lycosuchus vanderrieti (top), and Eunotosaurus africanus (bottom), the biozone defining taxa of the Lycosuchus – Eunotosaurus Subzone (Taken from Day and Smith, 2020).*

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).

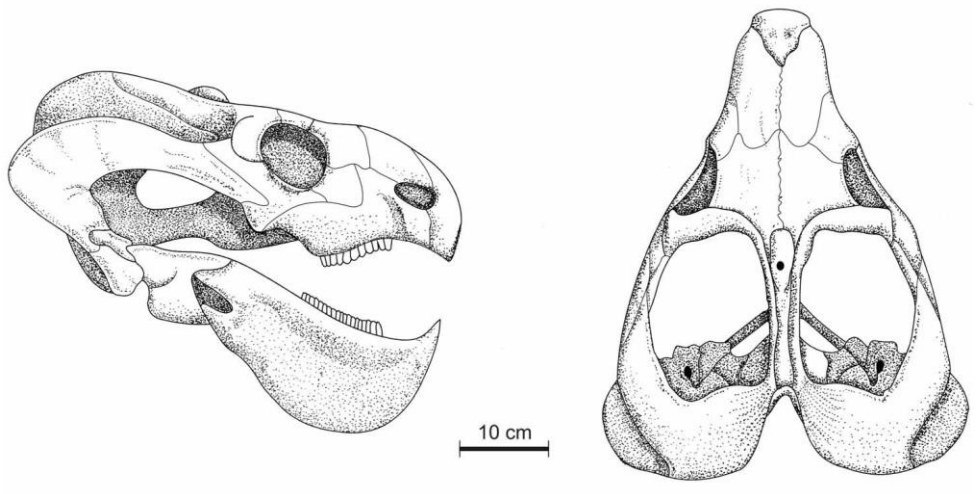


***Figure 17**: Endothiodon bathystoma, in lateral and dorsal views is the biozone defining fossil of the Endothiodon Assemblage Zone.*

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

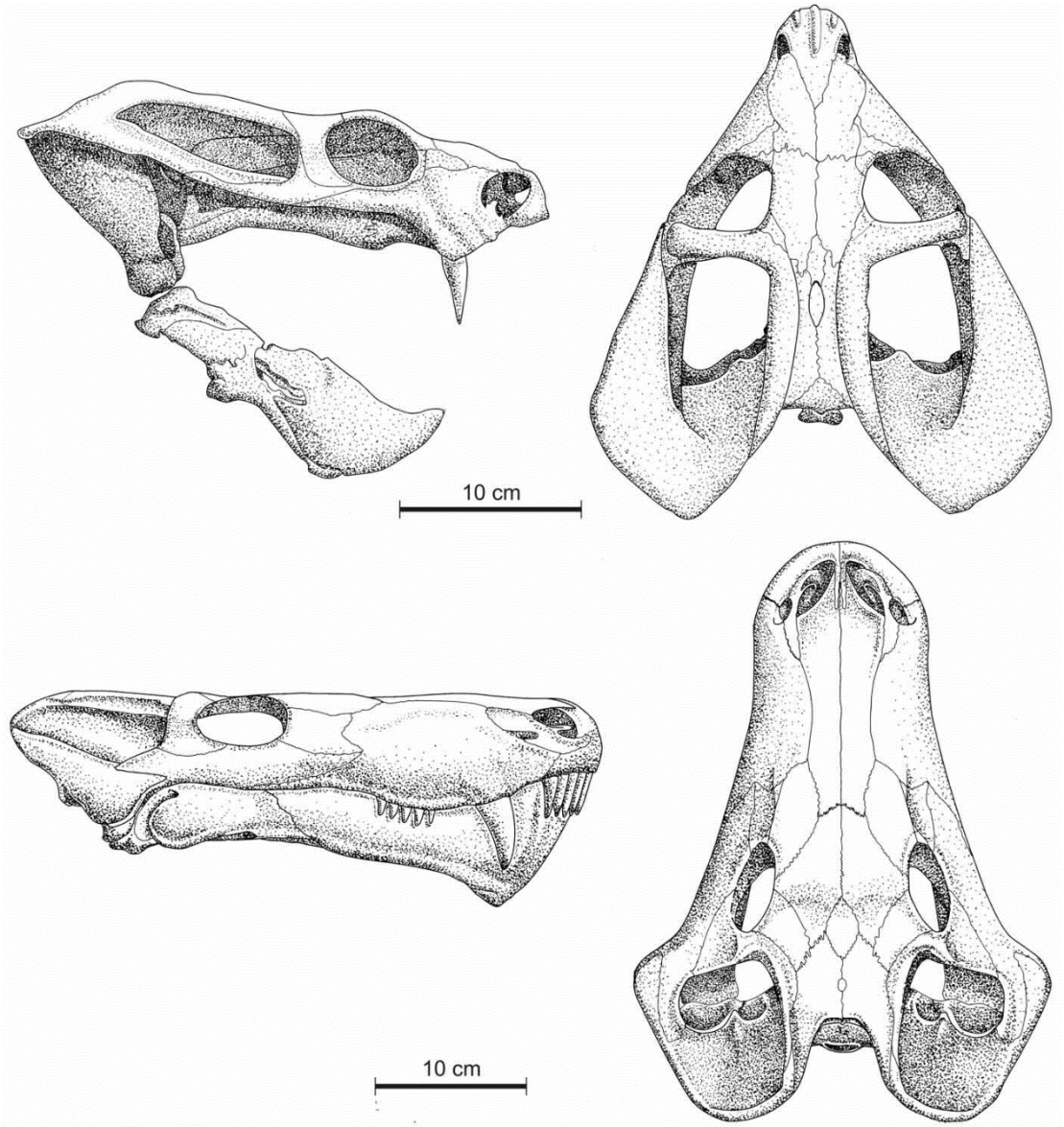


***Figure 18**: Lateral and dorsal views of the index taxa of the Tropidostoma – Gorgonops Subzone namely (top) Tropidostoma dubium, (bottom) Gorgonops torvus.*

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 m and 150 m along the Nuweveld escarpment and becomes thinner in the north (Day and Rubidge, 2019).

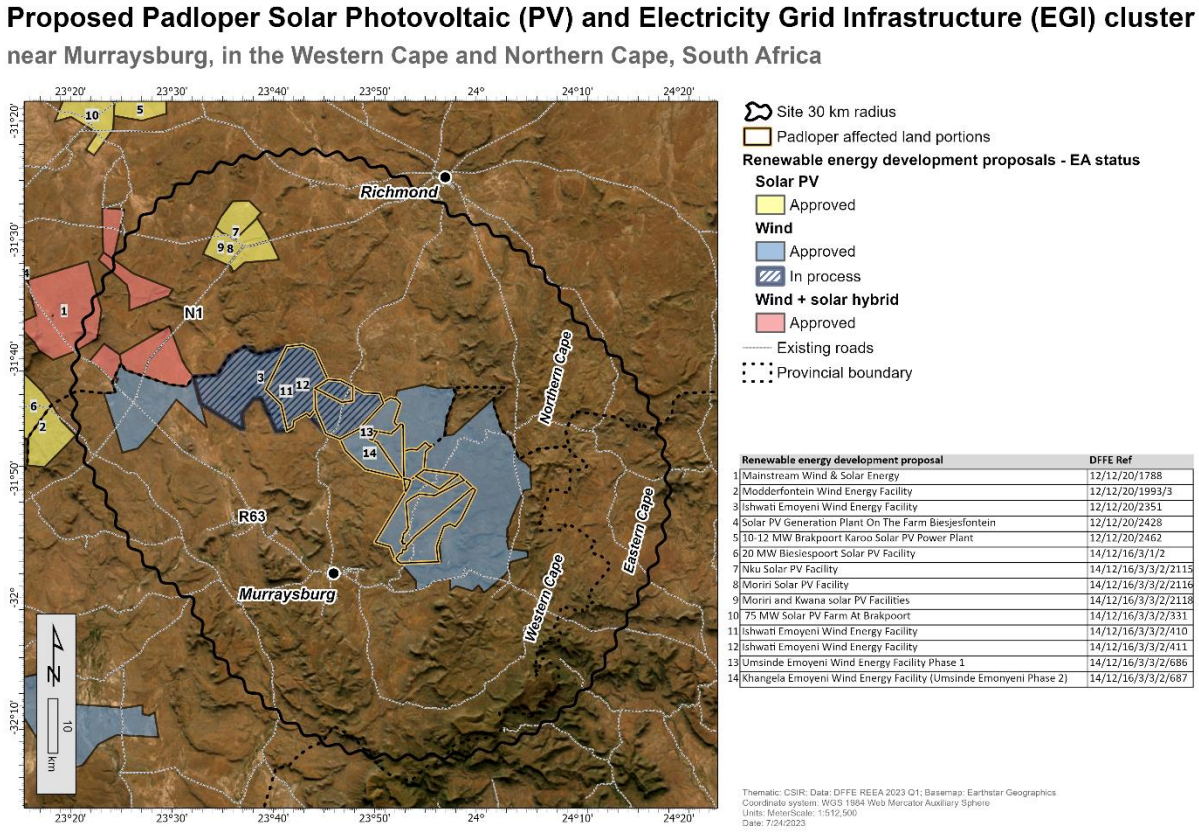


***Figure 19**: Renewable Energy Facilities in n 30 km radius of the Padloper Solar Energy Facility (SEF) Cluster.*

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 7: Renewable Energy Facilities in n 30 km radius of the Padloper Solar Energy Facilities (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 EGIs 1-4 are located close to the town of Murraysburg in the Northern Cape and Western Cape (Figures 1-3).

	Latitude	Longitude
Eastern margin	31°40'49.44"S	23°24'46.62"E
Western margin	31°56'2.80"S	23°55'10.23"E

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 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 and 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**: Quaternary alluvium mantled by low grassy vegetation near the Gamma Substation.*

***Figure 21**:Potentially fossiliferous mudrocks and sandstones of the Middelton Formation on the western portion of the EGI 4 development.*

***Figure 22**: Dolerite outcrop.*

***Figure 23**: Downwashed scree on the open plains.*

Figure 24: Drainage with potentially fossiliferous mudrocks in the Balfour Formation (*western portion of EGI 2).*

9 IMPACTS ASSESSMENT

9.1 Sensitivities identified by the DFFE National Web-Based Screening Tool.

As indicated in Section 5 the Screening Tool shows that the study area falls 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 EGIs 1-4.

9.1.1 Sensitivity Analysis Summary Statement

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 EGIs 1-4 in January 2023.

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 8: Rating of Impacts - Planning and Pre-construction Phase of Padloper EGI 1

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

Table 9: Rating of Impacts - Construction Phase Padloper EGI 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 EGIs 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 10: Rating of Impacts - Operational Phase Padloper EGI 1

Impact	*Impact Criteria*		*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
OPERATIONAL – Padloper EGIs 1						
	Status					*High*

NO IMPACT on Fossil Heritage	*Spatial Extent*					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

Table 11: Rating of Impacts -Decommissioning Phase Padloper EGI 1

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

Table 12: No-go Impacts - Padloper EGI 1

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

Table 13: Rating of Impacts - Planning and Pre-construction Phase of Padloper EGI 2

Impact	*Impact Criteria*	*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*
PLANNING AND PRE-CONSTRUCTION – Padloper EGIs 2					

NO IMPACT	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

Table 14: Rating of Impacts - Construction Phase Padloper EGI 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 EGIs 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 15: Rating of Impacts - Operational Phase Padloper EGI 2

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

Table 16: Rating of Impacts -Decommissioning Phase Padloper EGI 2

Impact	*Impact Criteria*	*Significance and Ranking (Pre-Mitigation)*	*Potential Mitigation Measures*	*Significance and Ranking (Post-Mitigation)*	*Confidence Level*

DECOMMISSIONING – Padloper EGIs 2						
NO IMPACT on Fossil Heritage	*Status*					*High*
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

Table 17: No-go Impacts - Padloper EGI 2

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

Table 18: Rating of Impacts - Planning and Pre-construction Phase of Padloper EGI 3

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

Table 19: Rating of Impacts - Construction Phase Padloper EGI 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 EGIs 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 EGI 3

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

Table 21: Rating of Impacts -Decommissioning Phase Padloper EGI 3

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

Table 22: No-go Impacts - Padloper EGI 3

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

Table 23: Rating of Impacts - Planning and Pre-construction Phase of Padloper EGI 4

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

Table 24: Rating of Impacts - Construction Phase Padloper EGI 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 EGIs 4						
Loss of fossil Heritage	*Status*	*Negative*	*Medium*	*Chance Find Protocol*	*Very Low*	*High*
	Spatial Extent	*Site specific*				
	Duration	*Permanent*				

Disturbance/damage and destruction of fossils at /below surface	*Consequence*	*Moderate Risk*				
	Probability	*Unlikely*				
	Reversibility	*Non-reversable*				
	Irreplaceability	*Irreplaceable*				

Table 25: Rating of Impacts - Operational Phase Padloper EGI 4

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

Table 26: Rating of Impacts -Decommissioning Phase Padloper EGI 4

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

Table 27: No-go Impacts - Padloper EGI 4

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

	Reversibility					
	Irreplaceability					
	Spatial Extent					
	Duration					
	Consequence					
	Probability					
	Reversibility					
	Irreplaceability					

Cumulative Impacts

Energy facilities in the Padloper PV 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 28: Cumulative Impact during Construction - Padloper EGIs 1

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*				

Table 29: Cumulative Impact during Construction - Padloper EGIs 2

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*				

Table 30: Cumulative Impact during Construction - Padloper EGIs 3

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*				

Table 31: Cumulative Impact during Construction - Padloper EGIs 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 EGIs 1-4

Post mitigation the overall significance will be Low.

9.1.2 Impact Summary

Table 32: Overall Impact Significance (Post Mitigation)	
Phase	**Overall Impact Significance**
Construction	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

The significance of the impact occurring will be negative very high before mitigation. The post mitigation the Significance of the Impact will be low.

9.3 Legislative and Permit Requirements

It is required to submit a Palaeontological Impact assessment as part of a Heritage Impact assessment 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 R2000 as of 1 January 2023.

10 FINDINGS AND RECOMMENDATIONS

The Padloper EGI 1-4 developments and associated 400m corridor is underlain by Quaternary alluvium, the Balfour and Middelton Formations of the Adelaide Subgroup as well as 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, that of the Ouaternary alluvium is moderate and the Adelaide Subgroup has a Very High Palaeontological Sensitivity (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 alluvium, colluvium, eluvium and gravel, 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 basin. Th National Palaeontological databases indicate that only one fossil has been uncovered very close to the Padloper EGIs 1-4. 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 EGIs 1-4 and 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 (Padloper EGIs 1-4 and 400m corridors) is relatively 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 are 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

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 this project, 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: +27 (0)21 483 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 EGIs 1-4.

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11 CHANCE FINDS PROTOCOL

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

- 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: +27 (0)21 462 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.

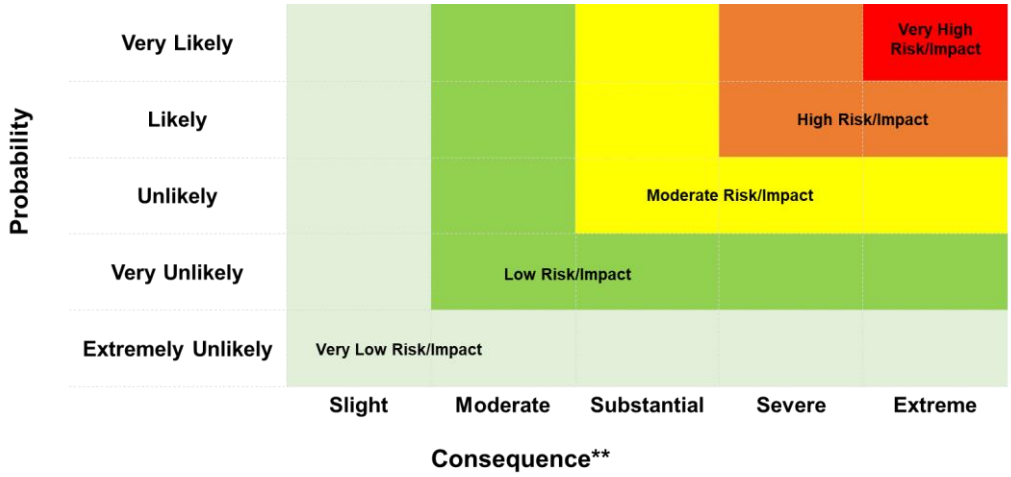
The consequence terms ranging from slight to extreme must be calibrated per Specialist Study so that there is transparency and consistency in the way a risk/impact is measured. For example, from a biodiversity and ecology perspective, the consequence ratings could be defined according to a reduction 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

The Project Applicant, Padloper Solar PV (Pty) Ltd (hereinafter referred to as "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 Cape 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 EGIs 1-4 and associated 400 m corridor.

[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.

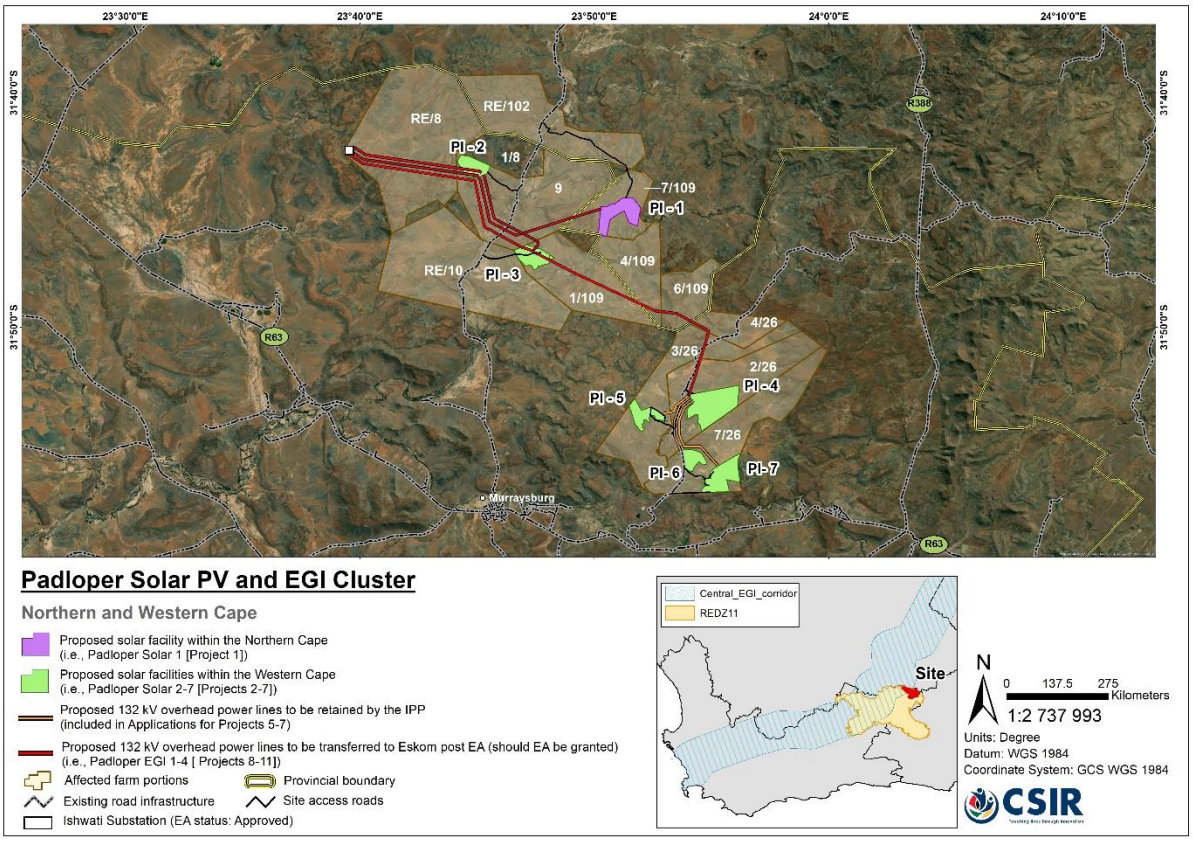


***Figure 21**: Location of the affected farm portions on which the proposed seven Padloper Solar PV Facilities will be constructed. These entire farm portions (outlined in brown) are the study area for the PV Facilities, including access roads.*

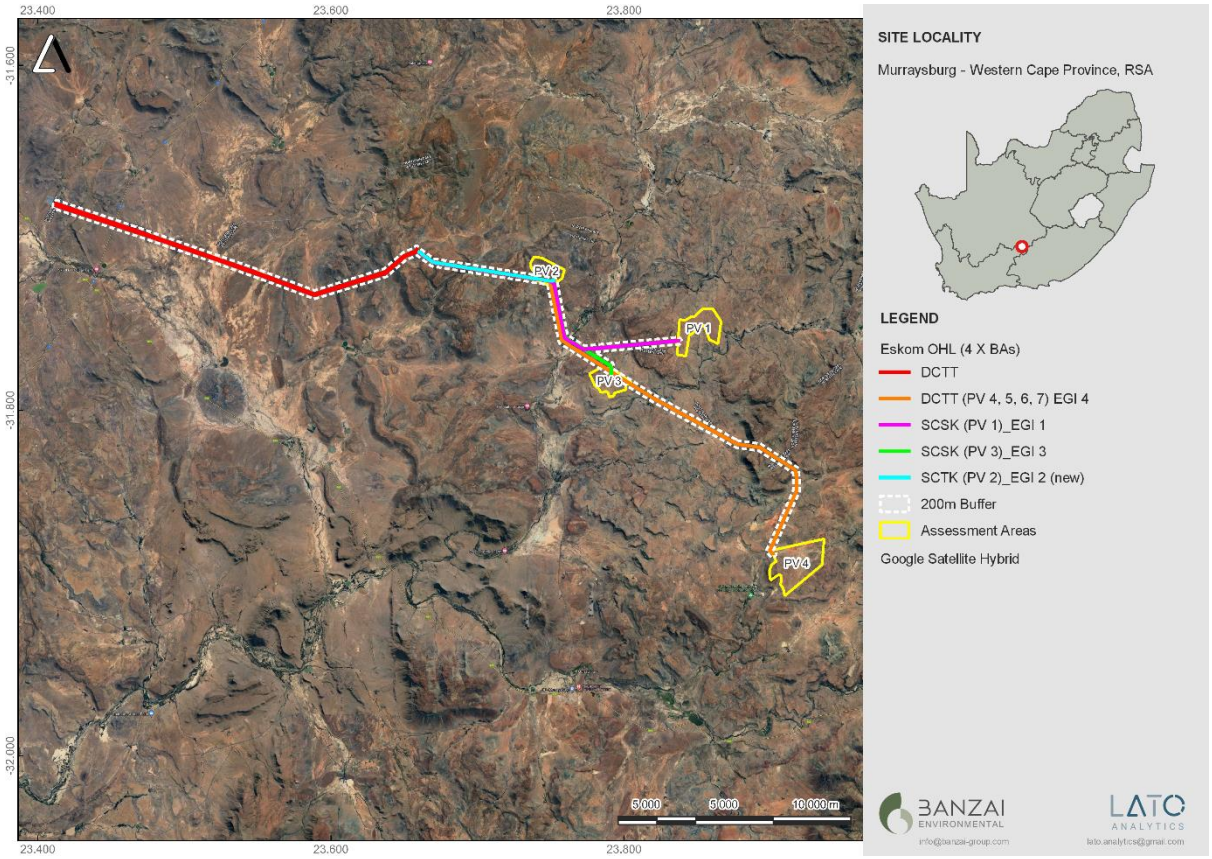


Figure 22: *Regional locality of the Padloper EGIs 1-4 near Murraysburg in the Northern and Western Cape*.

In terms of the National Environmental Management Act (Act No. 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

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

The proposed Padloper EGIs 1-4 near Murraysburg in the Western Cape is depicted on the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) (Figure 23).

This map indicates that Padloper EGI1 1-4 is underlain by Quaternary alluvium, the Balfour (Pb) and Middelton Formations (Pth) of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as 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 24, Table 14). The DFFE screening tool for the study areas is depicted in Figures 6 and indicates that the proposed development has a Very High (dark red) Palaeontological Sensitivity.

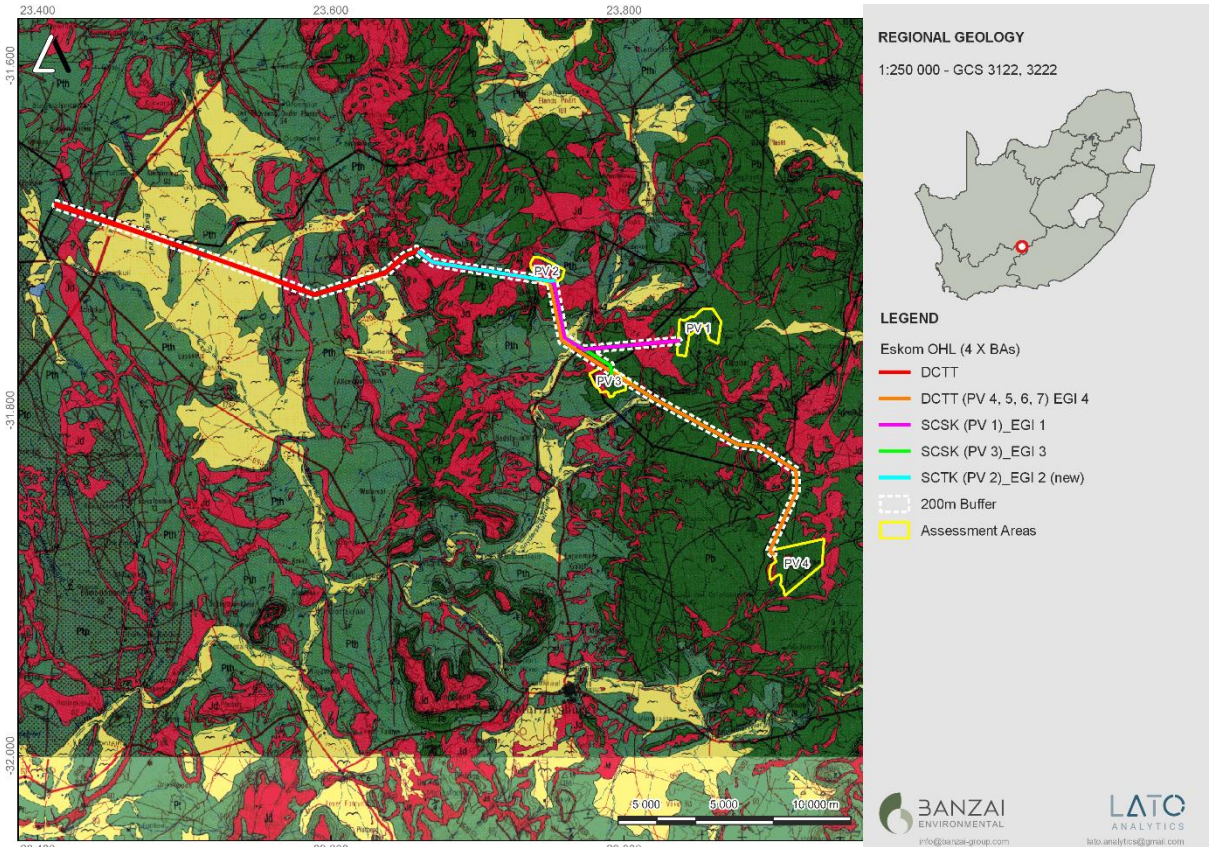


Figure 23: *Extract of the 1:250 000 Victoria West 3122 (1989) Geological map (Council of Geoscience, Pretoria) indicating the geology of the Padloper EGIs 1-4 near Murraysburg in the Western and Northern Cape Province. The development is underlain by the Quaternary alluvium(Qs, yellow single bird figure), the Balfour (Pb) and Middelton (Pth) Formations of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) as well as Jurassic dolerite.*

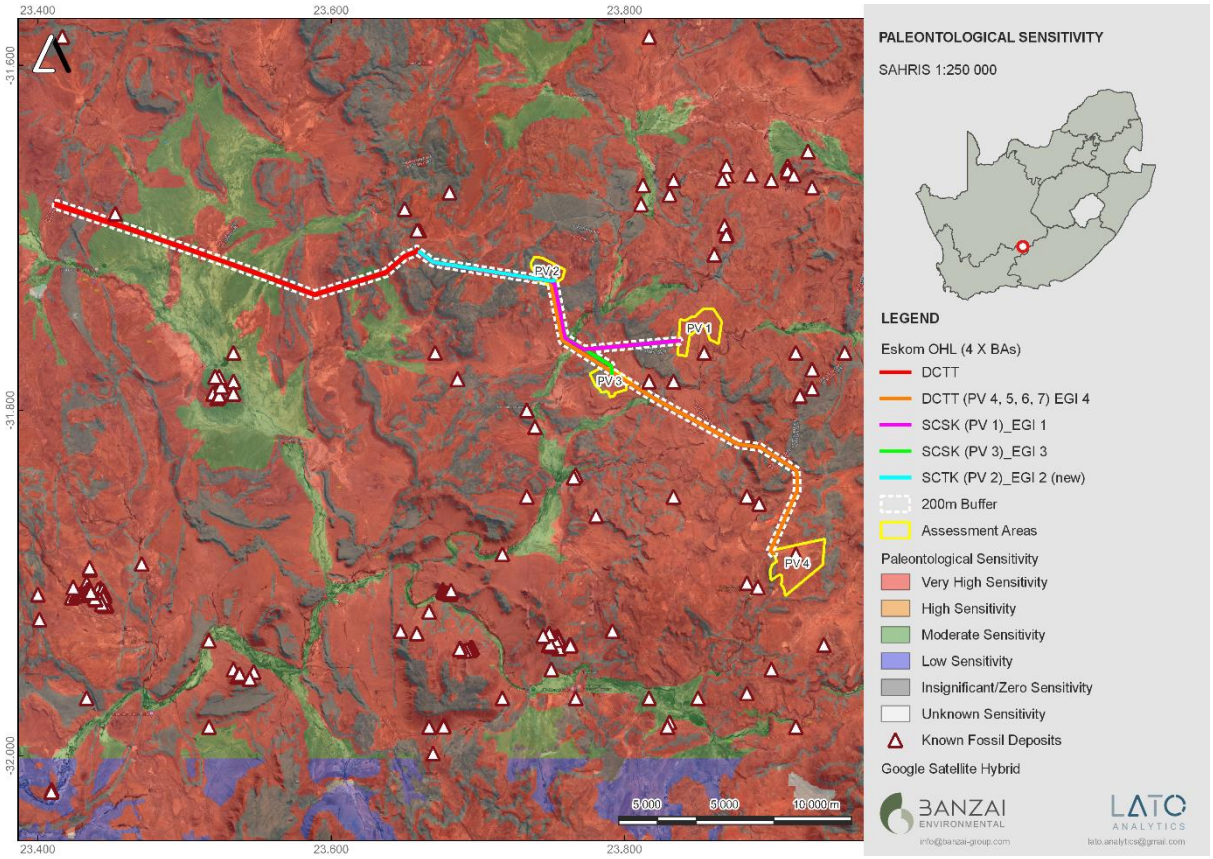
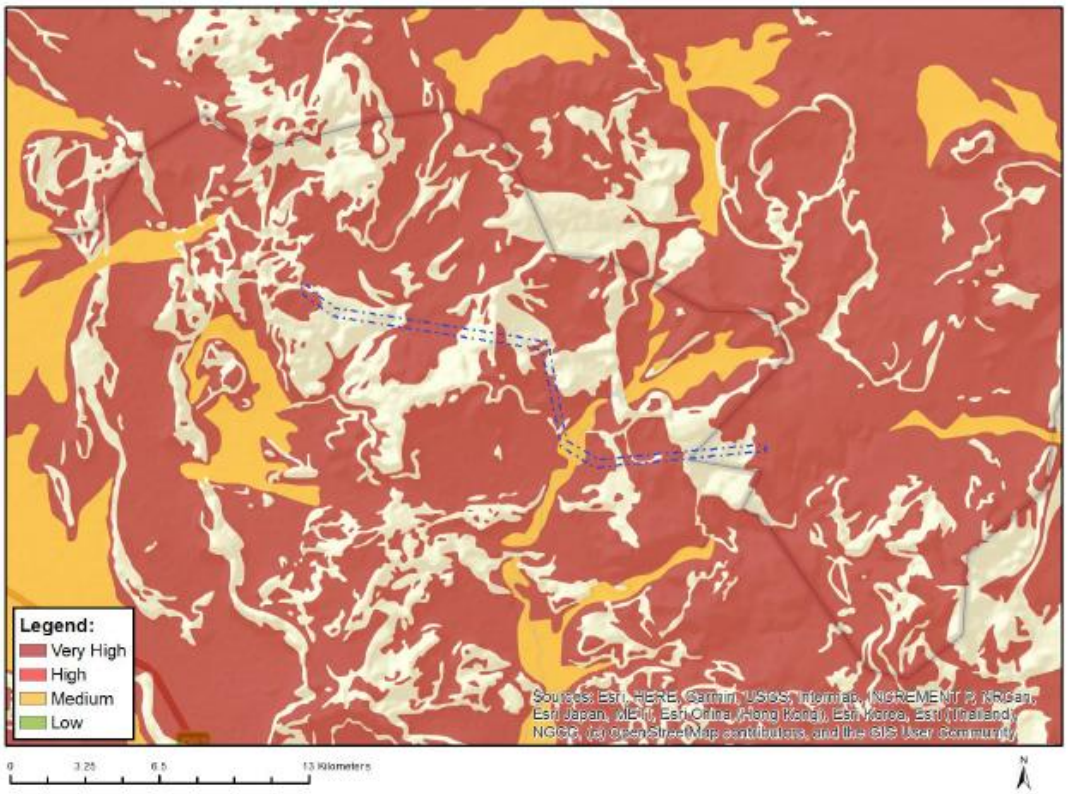


***Figure 24**: Extract of the SAHRIS PalaeoMap (Council of Geosciences) indicates that* Padloper EGIs 1-4 is *underlain by sediments with a Very High (red), Moderate (green) and Zero (grey) Palaeontological Sensitivity. Fossils finds recorded on the National Palaeontological Database is indicated in white triangles with red outlines.*

Table 15: 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 24, Table 15) indicates that the Palaeontological Sensitivity of the Quaternarily alluvium is Moderate (green), 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.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

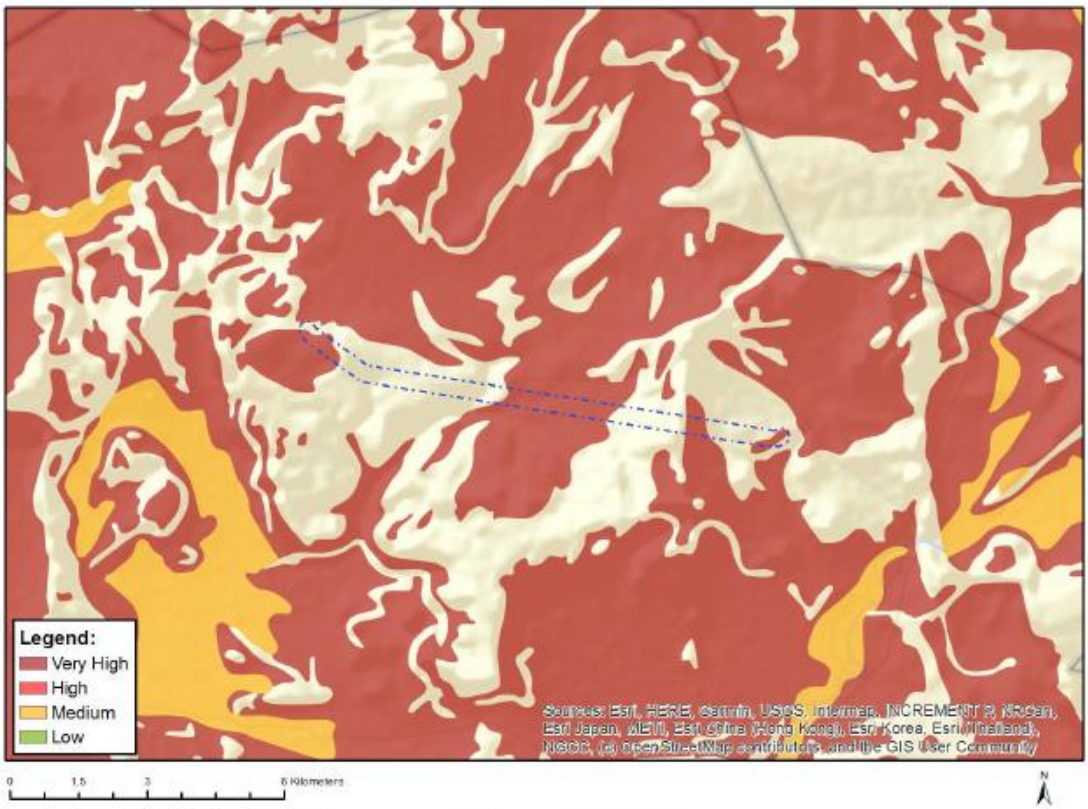
Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

***Figure 25**: Palaeontological Sensitivity of the Padloper EGI 1 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper EGI 1 is Very High (dark red), while areas with a moderate (yellow) and unknown (white) is also crossed.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

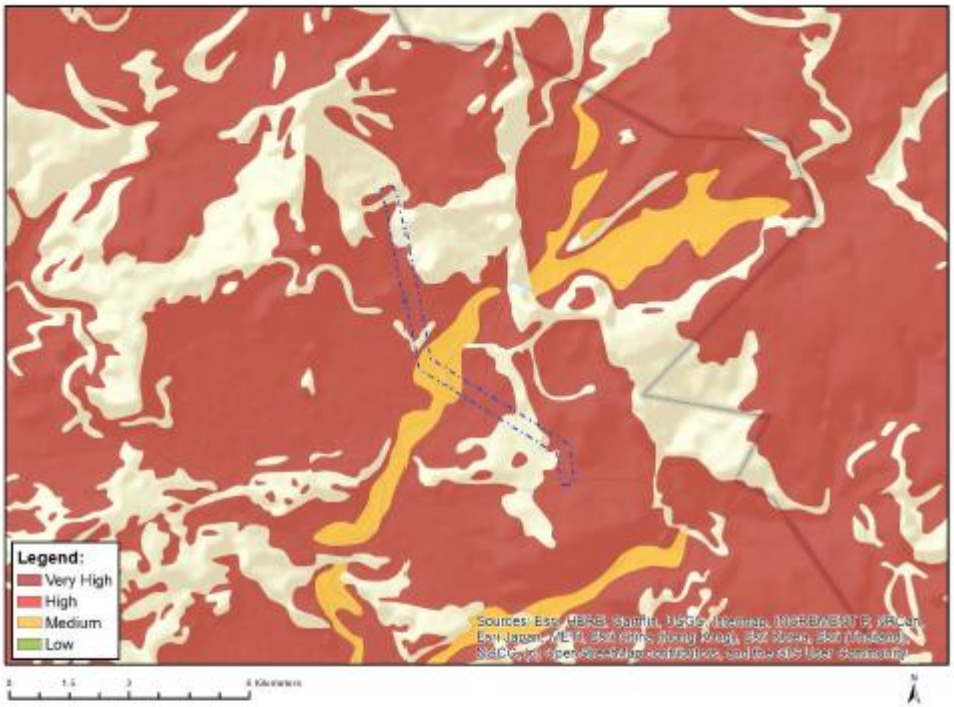
Sensitivity Features:

Sensitivity	Feature(s)
Very High	Features with a Very High paleontological sensitivity

***Figure 26**: Palaeontological Sensitivity of the Padloper EGI 2 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper EGI 2 is Very High (dark red), while areas with a moderate (yellow) is also crossed.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

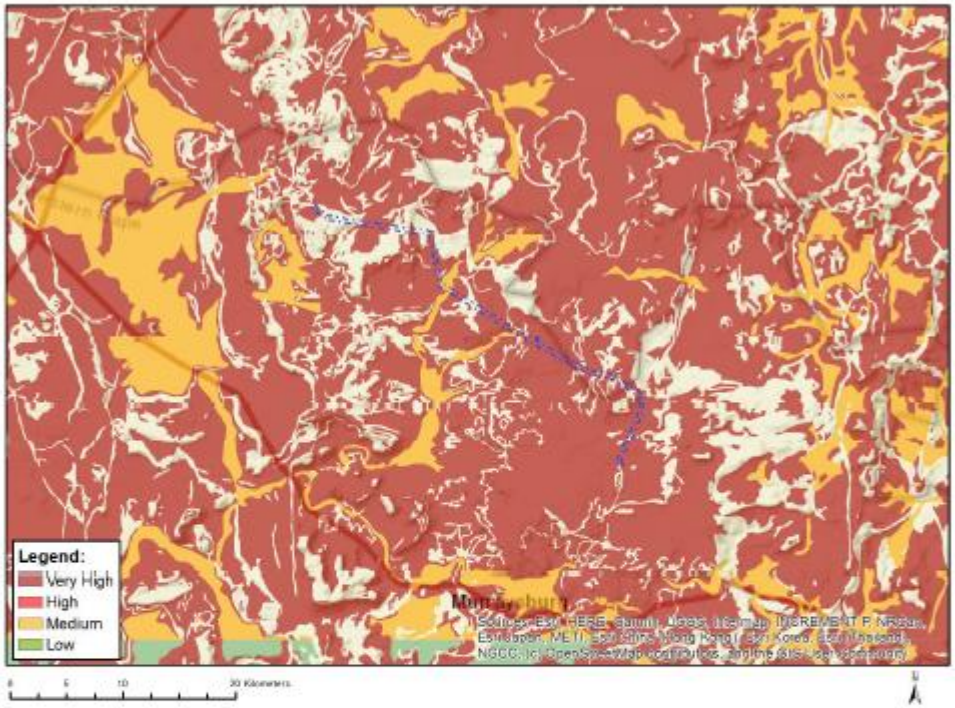
Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

***Figure 27**: Palaeontological Sensitivity of the Padloper EGI 3 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper EGI 3 is Very High (dark red), while areas with a moderate (yellow) and unknown (white) is also crossed.

MAP OF RELATIVE PALEONTOLOGY THEME SENSITIVITY



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
X			

Sensitivity Features:

Sensitivity	Feature(s)
Medium	Features with a Medium paleontological sensitivity
Very High	Features with a Very High paleontological sensitivity

***Figure 28**: Palaeontological Sensitivity of the Padloper EGI 4 by the National Environmental Web-bases Screening Tool.*

The National Environmental Web-based Screening Tool indicates that the Palaeontological Sensitivity of the Padloper EGI 4 is Very High (dark red), while areas with a moderate (yellow) and unknown (white) is also crossed.

4 CONCLUSION

The Site Sensitivities of the proposed Padloper EGIs 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 the proposed PV development is highly Sensitive from a Palaeontological point of view. A site investigation in January of 2023 did not report any fossiliferous outcrops. This classification is thus contested (National Environmental Web-based Screening Tool and SAHRIS) as far as the impact of the Padloper EGIs 1-4 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	National Museum, Bloemfontein
and Collection Manager	1998–2022

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