

PHASE 1 HIA SOLAR PHOTOVOLTAIC (PV) FACILITY DEVELOPMENT KOEDOESKOP

PHASE 1 HIA FOR THE PROPOSED DEVELOPMENT OF UP TO 480MW
SOLAR PHOTOVOLTAIC (PV) FACILITY BY ALLIED GREEN ENERGY (PTY) LTD ON
PORTION 1 OF THE FARM ZWARTWITPENSBOK FONTEIN 434-KQ, KOEDOESKOP,
THABAZIMBI LOCAL MUNICIPALITY, WATERBERG DISTRICT, LIMPOPO PROVINCE

PREPARED FOR:

CONSERVA ENVIRONMENTAL MANAGEMENT SERVICES

PREPARED BY:

HEIDI FIVAZ & SKY-LEE FAIRHURST
ELIZE BUTLER & JAN ENGELBRECHT
UBIQUE HERITAGE CONSULTANTS

08 SEPTEMBER 2023

Web: www.ubiquecrm.com

Mail: info@ubiquecrm.com

CSD Supplier Number MAAA0586123

CLIENT:	Conserva Environmental Management Services
CONTACT PERSON:	Marissa Botha Email: conserva-ems@outlook.com
HERITAGE CONSULTANT:	UBIQUE Heritage Consultants www.ubiquecrm.com info@ubiquecrm.com
CONTACT PERSON:	<p>Heidi Fivaz (archaeologist and CRM Field Director) Member of the Association of Southern African Professional Archaeologists: Member number: 433 Email: heidi@ubiquecrm.com</p> <p>Sky-Lee Fairhurst (archaeologist) Member of the Association of Southern African Professional Archaeologists: Member number: 541 Email: sky@ubiquecrm.com</p> <p>Jan Engelbrecht (archaeologist and CRM Field Supervisor) Member of the Association of Southern African Professional Archaeologists: Member number: 297 Email: jan@ubiquecrm.com</p>

Declaration of Independence:

UBIQUE Heritage Consultants hereby confirm our independence as heritage specialists and declare that:

- we are suitably qualified and accredited to act as independent specialists in this application;
- we do not have any vested interests (either business, financial, personal or other) in the proposed development project other than remuneration for the heritage assessment and heritage management services performed;
- the work was conducted objectively and ethically, per a professional code of conduct and within the framework of South African heritage legislation.

Signed:

J.A.C. Engelbrecht, H. Fivaz & S. Fairhurst
UBIQUE Heritage Consultants

Date: 2023-09-08

Copyright: This report is confidential and intended solely for the use of the individual or entity to whom it is addressed or to whom it was meant to be addressed. It is provided solely for the purposes set out in it and may not, in whole or in part, be used for any other purpose or by a third party without the author's prior written consent.

SUMMARY OF SPECIALIST EXPERTISE

HEIDI FIVAZ

CRM ARCHAEOLOGIST & OBJECT CONSERVATOR

Heidi Fivaz has been a part of UBIQUE Heritage Consultants since 2016 and took over ownership in 2018. She is responsible for project management, surveys, research and report compilation. She holds a B.Tech. Fine Arts degree (2000) from the Tshwane University of Technology, a BA in Culture and Arts Historical Studies degree (2012) from UNISA and received her BA (Hons) in Archaeology in 2015 (UNISA). She has received extensive training in object conservation from the South African Institute of Object Conservation and specialises in glass and ceramics conservation. She is also a skilled artefact and archaeological illustrator. Ms Fivaz was awarded her MA in Archaeology (with distinction) in 2021 by the University of South Africa (UNISA), focusing on historical and industrial archaeology. She is a professional member of the Association of South African Archaeologists and a CRM Field Director. She has worked on numerous archaeological excavation and surveying projects over the past thirteen years.

SKY-LEE FAIRHURST

ARCHAEOLOGIST

Sky-Lee Fairhurst has been part of UBIQUE Heritage Consultants since 2019. She is responsible for research, desktop studies, report compilation and surveys. Miss Fairhurst obtained her BA in Archaeology and Biblical archaeology in 2016 and her BA Hons in Archaeology (*cum laude*) at the University of South Africa (UNISA) in 2018, focussing on research themes of gender, households and Late Iron Age settlements. She is currently pursuing her interest in southern African agropastoral societies as an MA Archaeology student at the University of South Africa (UNISA). She is skilled at artefacts and archaeological illustrations. Over the past nine years, she has obtained considerable excavation and survey experience and worked on various sites, including Historical, Iron Age, and Palaeontological sites.

JAN ENGELBRECHT

CRM ARCHAEOLOGIST

Jan Engelbrecht is accredited by the Cultural Resources Management section of the Association of Southern African Professional Archaeologists (ASAPA) to undertake Phase 1 AIAs and HIAs in South Africa. He is also a member of the Association for Professional Archaeologists (ASAPA). Mr Engelbrecht holds an honours degree in archaeology (specialising in the history of early farmers in southern Africa (Iron Age) and the Colonial period) from the University of South Africa. He has 12 years of experience in heritage management. He has worked on projects as diverse as the Zulti South HIA of Richards Bay Minerals, research on the David Bruce heritage site at Ubombo in Kwa-Zulu Natal, and various archaeological excavations and historical, archaeological projects. He has worked with many rural communities to establish integrated heritage and land use plans and speaks Zulu fluently. Mr Engelbrecht established Ubiqum Heritage Consultants in 2012. The company moved from KZN to the Northern Cape and is currently based at Askham in the Northern Cape within the Mier local municipality in the Kgalagadi region. He had a significant military career as an officer; whereafter he qualified as an Animal Health Technician at Technikon RSA and UNISA. He is currently studying for his MA Degree in Archaeology.

EXECUTIVE SUMMARY

Project description

UBIQUE Heritage Consultants were appointed by Conserva Environmental Management Services as independent heritage specialists to conduct a cultural heritage impact assessment in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA) to determine the development impact on heritage and archaeological resources within the proposed development area, Portion 1 of the Farm Zwartwitpensbokfontein 434-KQ, Koedoeskop, Thabazimbi Local Municipality, Waterberg District, Limpopo Province.

Findings and Impact on Heritage Resources

The proposed Solar Photovoltaic (PV) facility footprint is densely overgrown, which impedes visibility. However, the area has been previously disturbed, and it is unlikely that in-situ heritage resources of high significance are present, aside from the three fenced graves and structural remains recorded in the easternmost section of the focus area. Therefore, based on the survey results, the development will not negatively impact heritage resources if the recommended buffer zone around the graves is implemented.

The proposed Mmehane Township Establishment is underlain by Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). The Palaeotechnical Report of the Limpopo Province (Groenewald et al., 2014) allocates a High Palaeontological Sensitivity and indicates that the Lyttelton Formation represents the Malmani Subgroup in this area. In addition, the PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High (Butler 2023 Appendix A). However, no fossiliferous outcrop was found in the proposed development during the field survey. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of Low significance in palaeontological terms.

Recommendations

Based on the assessment of the potential impact of the development on the identified heritage, the following recommendations are made, taking into consideration any existing or potential sustainable social and economic benefits:

1. Three fenced graves, one with a standing headstone, were recorded in the easternmost section of the focus area, approximately 280 m northwest of the proposed security facility (existing structure to be repurposed). **Graves are of High Significance, and a buffer radius of 100 m is recommended.**

2. Should it be impossible to avoid the graves during development, mitigation in the form of grave relocation could be undertaken. This is, however, a lengthy and costly process. Grave relocation specialists should be employed to manage the liaison process with the communities and individuals who, by tradition or familial association, might have an interest in these graves or burial grounds, as well as manage the permit acquisition from the SAHRA Burial Grounds and Graves (BGG) Unit and the arrangements for the exhumation and re-interment of the contents of the graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.
3. The remains of a stone foundation and the occurrence of metal material are of low significance and not conservation-worthy. Therefore, no further mitigation is required.
4. No other significant heritage sites or features were identified within the surveyed sections of the development footprint. The areas are densely overgrown, which impedes visibility. However, even though the sites are disturbed, and no heritage resources were located, we recommend a final site walk-down after clearing vegetation. Based on the survey results, the development will not impact heritage resources.
5. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of Low significance in palaeontological terms. Therefore, the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The development construction may thus be permitted to its whole extent, as the development footprint is not considered sensitive regarding palaeontological resources. However, the Chance Find Protocol must be implemented if fossil remains are discovered during any construction phase, either on the surface or uncovered by excavations (Butler 2023).
6. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490) must be alerted immediately as per section 36(6) of the NHRA. Depending on the nature of the finds, a professional archaeologist or palaeontologist must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources are of archaeological or palaeontological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred due to such oversights.

TABLE OF CONTENTS

SUMMARY OF SPECIALIST EXPERTISE	iii
EXECUTIVE SUMMARY	iv
Project description	iv
Findings and Impact on Heritage Resources.....	iv
Recommendations	iv
TABLE OF FIGURES	vii
ABBREVIATIONS	viii
GLOSSARY	viii
1. INTRODUCTION.....	1
1.1 Scope of study.....	1
1.2 Assumptions and limitations	2
2. TERMS OF REFERENCE	3
2.1 Statutory Requirements	3
2.1.1 General	3
2.1.2 National Heritage Resources Act 25 of 1999	3
2.1.3 Heritage Impact Assessments/Archaeological Impact Assessments.....	3
2.1.4 Management of Graves and Burial Grounds.....	4
3. STUDY APPROACH AND METHODOLOGY.....	6
3.1 Desktop study.....	6
3.1.1 Literature review.....	6
3.2 Field study	6
3.2.1 Systematic survey	6
3.2.2 Recording significant areas	7
3.2.3 Definitions of heritage resources.....	7
3.3 Determining significance.....	7
3.3.1 Assessment of development impacts.....	9
3.4 Report	11
4. PROJECT OVERVIEW.....	12
4.1 Technical information.....	12
5. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND.....	16
5.1 Region: Limpopo Province.....	16
5.1.1 Stone Age.....	16

5.1.2	Iron Age	17
5.1.3	Historical period	18
5.2	Local: Thabazimbi	18
6.	HERITAGE SENSITIVITY	20
6.1	Summary of Local Heritage Resources: Koedoeskop	20
7.	IDENTIFIED RESOURCES AND HERITAGE ASSESSMENT	23
7.1	Surveyed area	23
7.2	Description of the affected environment	23
7.3	Identified heritage resources	26
7.3.1	Archaeological Resources Identified	27
7.3.2	Palaeontological Resources	29
8.	ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT	30
9.	RECOMMENDATIONS	31
10.	CONCLUSION	33
11.	BIBLIOGRAPHY	34
	APPENDIX A	37

TABLE OF FIGURES

Figure 1	Conceptual Solar Farm Layout Plan. Image: Allied Green Energy (Pty) Ltd.....	13
Figure 2	Regional locality of the development footprint, indicated on Google Earth Satellite imagery.....	14
Figure 3	Regional locality of the development footprint, indicated on topo cadastral map 2427CD 1: 50 000.	14
Figure 4	Regional locality of the development footprint, indicated Chief-Surveyor General ArcGIS Web Map (https://csggis.drdir.gov.za/psv/).....	15
Figure 5	The Project area indicated on the Heritage Screening tool (https://screening.environment.gov.za/).....	20
Figure 6	Survey tracks across the development footprint.	23
Figure 7	Views of the affected development area.....	25
Figure 8	Location of recorded heritage resources.....	26
Figure 9	Resources recorded at points 001 and 002.....	28
Figure 10	Graves recorded at point 003.....	28
Figure 11	The SAHRIS PalaeoSensitivity Map, indicating Very High (red) and High (orange) palaeontological significance in the study area. (https://sahris.sahra.org.za/map/palaeo).....	29
Figure 12	Map indicating the recommended buffer zone around the graves.....	32

ABBREVIATIONS

AIA:	Archaeological Impact Assessment
ASAPA:	Association of South African Professional Archaeologists
CRM:	Cultural Resource Management
EIA:	Early Iron Age
EMP:	Environmental Management Plan
ESA:	Earlier Stone Age
GPS:	Global Positioning System
HIA:	Heritage Impact Assessment
HWC:	Heritage Western Cape
IA:	Iron Age
IMP:	Integrated Management Plan
LSA:	Later Stone Age
MIA:	Middle Iron Age
MSA:	Middle Stone Age
NBKB:	Ngwao-Boswa Jwa Kapa Bokone (Northern Cape PHRA)
NHRA:	National Heritage Resources Act
PHRA:	Provincial Heritage Resource Agency
SADC:	Southern African Development Community
SAHRA:	South African Heritage Resources Agency
SAHRIS:	South African Heritage Resources Information System

GLOSSARY

Archaeological:	Material remains resulting from human activity in a state of disuse, older than 100 years, including artefacts, human and hominid remains and artificial features and structures.
Historic building:	Structures 60 years and older.
Heritage:	That which is inherited and forms part of the National Estate (historic places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).
Heritage resources:	Valuable, finite, non-renewable and irreplaceable resources that provide evidence of the origins of South African society
Mitigation:	Anticipating and preventing adverse impacts and risks, then to minimise them, rehabilitate or repair impacts to the extent feasible.
'Public monuments:	All monuments and memorials, erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government; or – which were paid for by public subscription, government funds, or a public-spirited or military organisation and are on land belonging to any private individual.
'Structures':	Any building, works, device or other facility made by people, and which are fixed to land, and include any fixtures, fittings and equipment associated therewith.



1. INTRODUCTION

1.1 Scope of study

The project involves the proposed development of a Solar Photovoltaic (Pv) Facility by Allied Green Energy (Pty) Ltd on Portion 1 of the Farm Zwartwitpensbokfontein 434-KQ, Koedoeskop, Thabazimbi Local Municipality, Waterberg District, Limpopo Province. UBIQUE Heritage Consultants were appointed by Conserva Environmental Management Services as independent heritage specialists in accordance with the National Environmental Management Act 107 of 1998 (NEMA) and in compliance with Section 38 of the National Heritage Resources Act 25 of 1999 (NHRA) to conduct a cultural heritage assessment (AIA/HIA) of the development area.

The assessment aims to identify and report any heritage resources that may fall within the development footprint; to determine the impact of the proposed development on any sites, features, or objects of cultural heritage significance; to assess the significance of any identified resources; and to assist the developer in managing the documented heritage resources in an accountable manner, within the framework provided by the National Heritage Resources Act (Act 25 of 1999) (NHRA).

South Africa's heritage resources are rich and widely diverse, encompassing sites from all periods of human history. Resources may be tangible, such as buildings and archaeological artefacts, or intangible, such as landscapes and living heritage. Their significance is based on their aesthetic, architectural, historical, scientific, social, spiritual, linguistic, economic or technological values; their representation of a time or group; their rarity; and their sphere of influence.

Natural (e.g. erosion) and human (e.g. development) activities can jeopardise the integrity and significance of heritage resources. In the case of human activities, a range of legislation exists to ensure the timely and accurate identification and effective management of heritage resources for present and future generations.

The result of this investigation is presented within this heritage impact assessment report. It comprises the recording of heritage resources present/ absent and offers recommendations for managing these resources within the context of the proposed development.

Depending on SAHRA's acceptance of this report, the developer will receive permission to proceed with the proposed development, considering any proposed mitigation measures.

1.2 Assumptions and limitations

It is assumed that the description of the proposed project, as provided by the client, is accurate. Furthermore, it is assumed that the public consultation process undertaken as part of the Environmental Impact Assessment (EIA) is comprehensive and does not have to be repeated as part of the heritage impact assessment.

The significance of the sites, structures and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. The various aspects are not mutually exclusive, and any site is evaluated with reference to any number of these aspects. Cultural significance is site-specific and relates to the content and context of the site.

The comprehensive field survey and intensive desktop study have taken all possible care to identify sites of cultural importance within the development areas. However, it is essential to note that some heritage sites may have been missed due to their subterranean nature or dense vegetation cover. No subsurface investigation (i.e. excavations or sampling) was undertaken since a SAHRA permit is required for such activities. Therefore, should any heritage features and/or objects, such as architectural features, stone tool scatters, artefacts, human remains, or fossils, be uncovered or observed during construction, operations must be stopped, and a qualified archaeologist must be contacted to assess the find. Observed or located heritage features and/or objects may not be disturbed or removed in any way until the heritage specialist has been able to assess the significance of the site (or material) in question.



2. TERMS OF REFERENCE

2.1 Statutory Requirements

2.1.1 General

The principle is that the environment should be protected for present and future generations by preventing pollution, promoting conservation and practising ecologically sustainable development. With regard to spatial planning and related legislation at national and provincial levels, the following legislation may be relevant:

- Physical Planning Act 125 of 1991
- Municipal Structures Act 117 of 1998
- Municipal Systems Act 32 of 2000
- Development Facilitation Act 67 of 1995 (DFA)

The identification, evaluation and management of heritage resources in South Africa are required and governed by the following legislation:

- National Environmental Management Act 107 of 1998 (NEMA)
- KwaZulu-Natal Heritage Act 4 of 2008 (KZNHA)
- National Heritage Resources Act 25 of 1999 (NHRA)
- Minerals and Petroleum Resources Development Act 28 of 2002 (MPRDA)

2.1.2 National Heritage Resources Act 25 of 1999

The NHRA established the South African Heritage Resources Agency (SAHRA) together with its Council to fulfil the following functions:

- coordinate and promote the management of heritage resources at the national level;
- set norms and maintain essential national standards for the management of heritage resources in the Republic and to protect heritage resources of national significance;
- control the export of nationally significant heritage objects and the import into the Republic of cultural property illegally exported from foreign countries;
- enable the provinces to establish heritage authorities which must adopt powers to protect and manage certain categories of heritage resources; and
- provide for local authorities' protection and management of conservation-worthy places and areas.

2.1.3 Heritage Impact Assessments/Archaeological Impact Assessments

Section 38(1) of the NHRA of 1999 requires **the responsible heritage resources authority to notify the person who intends to undertake a development that fulfils the following criteria to submit an impact assessment report if there is reason to believe that heritage resources will be affected by such event:**

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- the construction of a bridge or similar structure exceeding 50m in length;
- any development or other activity that will change the character of a site—
 - exceeding 5000m² in extent; or
 - involving three or more existing erven or subdivisions thereof; or
 - involving three or more erven or divisions thereof which have been consolidated within the past five years; or
 - the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- the rezoning of a site exceeding 10 000m² in extent; or
- any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

2.1.4 Management of Graves and Burial Grounds

- **Graves younger than 60 years** are protected in terms of Section 2(1) of the Removal of Graves and Dead Bodies Ordinance 7 of 1925 as well as the Human Tissues Act 65 of 1983.
- **Graves older than 60 years, situated outside a formal cemetery administered by a local Authority** are protected in terms of Section 36 of the NHRA as well as the Human Tissues Act of 1983. Accordingly, such graves are the jurisdiction of SAHRA. The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of NHRA) is applicable to graves older than 60 years that are situated outside a formal cemetery administered by a local authority. Graves in the category located inside a formal cemetery administered by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

The **protocol for the management of graves older than 60 years situated outside a formal cemetery administered by a local authority** is detailed in Section 36 of the NHRA:

(3) (a) No person may, without a permit issued by SAHRA or a provincial heritage resources authority—

(a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

(b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

(c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.

(4) SAHRA or a provincial heritage resources authority may not issue a permit for the destruction or damage of any burial ground or grave referred to in subsection (3)(a) unless it is satisfied that the applicant has made satisfactory arrangements for the exhumation

and re-interment of the contents of such graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.

(5) SAHRA or a provincial heritage resources authority may not issue a permit for any activity under subsection (3)(b) unless it is satisfied that the applicant has, in accordance with regulations made by the responsible heritage resources authority—

- (a) made a concerted effort to contact and consult communities and individuals who by tradition have an interest in such grave or burial ground; and
- (b) reached agreements with such communities and individuals regarding the future of such grave or burial ground.

(6) Subject to the provision of any other law, any person who in the course of development or any other activity discovers the location of a grave, the existence of which was previously unknown, must immediately cease such activity and report the discovery to the responsible heritage resources authority which must, in cooperation with the South African Police Service and in accordance with regulations of the responsible heritage resources authority—

- (a) carry out an investigation for the purpose of obtaining information on whether or not such grave is protected in terms of this Act or is of significance to any community; and
- (b) if such grave is protected or is of significance, assist any person who or community which is a direct descendant to make arrangements for the exhumation and re-interment of the contents of such grave or, in the absence of such person or community, make any such arrangements as it deems fit.



3. STUDY APPROACH AND METHODOLOGY

3.1 Desktop study

The first step in the methodology was to conduct a desktop study of the heritage background of the area and the proposed development site. This entailed scoping and scanning historical texts/records, previous heritage studies, and research around the study area.

The study area is contextualised by incorporating data from previous CRM reports in the area and an archival search. The objective is to extract data and information on the area in question, looking at archaeological sites, historical sites and graves.

No archaeological site data was available for the project area. A concise account of the archaeology and history of the broader study area was compiled (sources listed in the bibliography).

3.1.1 Literature review

A literature survey was undertaken to obtain background information regarding the area. Through researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (<http://www.sahra.org.za/sahris>), it was determined that several other archaeological or historical studies had been performed within the broader vicinity of the study area. Sources consulted in this regard are indicated in the bibliography.

3.2 Field study

Phase 1 (AIA/HIA) requires the completion of a field study to establish and ensure the following:

3.2.1 Systematic survey

A systematic survey of the proposed project area was completed to locate, identify, record, photograph, and describe archaeological, historical or cultural interest sites.

UBIQUE Heritage Consultants inspected the proposed development and surrounding areas on the **1st and 2nd of August 2023** and completed a controlled-exclusive, pre-planned pedestrian and vehicular survey. We inspected the ground's surface, wherever the surface was visible. This was done with no substantial attempt to clear brush, sand, deadfall, leaves or other material that may cover the surface and with no effort to look beneath the surface beyond inspecting rodent burrows, cut banks and other exposures fortuitously observed.

The survey was tracked with a handheld Garmin global positioning unit (Garmin eTrex 10) and the Locus App on smartphones.

3.2.2 Recording significant areas

GPS points of identified significant areas were recorded with a handheld Garmin global positioning unit (Garmin eTrex 10). Photographs were taken with a Canon EOS and Panasonic Lumix camera. Detailed field notes were taken to describe observations. The layout of the area and plotted GPS points, tracks and coordinates were transferred to Google Earth, and QGIS and maps were created.

3.2.3 Definitions of heritage resources

The NHRA defines a heritage resource as any place or object of cultural significance, i.e., aesthetic, architectural, historical, scientific, social, spiritual, linguistic, or technological value or significance. These include, but are not limited to, the following wide range of places and objects:

- Living heritage as defined in the National Heritage Council Act No 11 of 1999 (cultural tradition; oral history; performance; ritual; popular memory; skills and techniques; indigenous knowledge systems; and the holistic approach to nature, society and social relationships);
- Ecofacts (non-artefactual organic or environmental remains that may reveal aspects of past human activity; definition used in KwaZulu-Natal Heritage Act 2008);
- places, buildings, structures and equipment;
- places to which oral traditions are attached or which are associated with living heritage;
- historical settlements and townscapes;
- landscapes and natural features;
- geological sites of scientific or cultural importance;
- archaeological and palaeontological sites;
- graves and burial grounds;
- public monuments and memorials;
- sites of significance relating to the history of slavery in South Africa;
- movable objects, but excluding any object made by a living person; and
- battlefields.

3.3 Determining significance

Heritage resources are considered of value if the following criteria apply:

- a. It is important in the community or pattern of South Africa's history;
- b. It has uncommon, rare or endangered aspects of South Africa's natural or cultural heritage;
- c. It has the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage;

d.	It is vital in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects;
e.	It exhibits particular aesthetic characteristics valued by a community or cultural group;
f.	It is essential in demonstrating a high degree of creative or technical achievement at a particular period;
g.	It has a strong or unique association with a particular community or cultural group for social, cultural or spiritual reasons;
h.	It has a strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa;
i.	It is of significance relating to the history of slavery in South Africa.

Levels of significance of the various types of heritage resources observed and recorded are determined by the following criteria:

CULTURAL & HERITAGE SIGNIFICANCE	
LOW	A cultural object found out of context, not part of a site or without any related feature/structure in its surroundings.
MEDIUM	Any site, structure or feature is regarded as less important due to several factors, such as date, frequency and uniqueness. Likewise, any important object found out of context.
HIGH	Any site, structure or feature is regarded as important because of its age or uniqueness. Graves are always categorised as of a high importance. Likewise, any important object found within a specific context.

Field Ratings or Gradings are assigned to indicate the level of protection required and who is responsible for national, provincial, or local protection.

FIELD RATINGS & GRADINGS	
National Grade I	Heritage resources with exceptional qualities to the extent that they are of national significance and should therefore be managed as part of the national estate.
Provincial Grade II	Heritage resources with qualities of provincial or regional importance, although they may form part of the national estate, should be managed as part of the provincial estate.
Local Grade IIIA	Heritage resources are of local importance and worthy of conservation. Therefore, it should be included in the heritage register and not be mitigated (high significance).

FIELD RATINGS & GRADINGS	
Local Grade IIIB	Heritage resources are of local importance and worthy of conservation. Therefore, it should be included in the heritage register and mitigated (high/ medium significance).
General Protection Grade IVA	The site/resource should be mitigated before destruction (high/ medium significance).
General protection Grade IVB	The site/resource should be recorded before destruction (medium significance).
General protection Grade IVC	Phase 1 is considered sufficient recording, and it may be demolished (low significance).

3.3.1 Assessment of development impacts

A heritage resource impact may be defined broadly as the net change, either beneficial or adverse, between the integrity of a heritage site with and without the proposed development. Beneficial impacts occur wherever a proposed development actively protects, preserves, or enhances a heritage resource by minimising natural site erosion or facilitating non-destructive public use. More commonly, development impacts are of an adverse nature and can include:

- destruction or alteration of all or part of a heritage site;
- isolation of a site from its natural setting; and / or
- introduction of physical, chemical or visual elements out of character with the heritage resource and its setting.

Beneficial and adverse impacts can be direct or indirect and cumulative, as implied by the examples. Although indirect impacts may be more difficult to foresee, assess and quantify, they must form part of the assessment process. Therefore, the following assessment criteria have been used to assess the impacts of the proposed development on possible identified heritage resources:

CRITERIA	RATING SCALES	NOTES
Nature	POSITIVE	An evaluation of the type of effect the construction, operation and management of the proposed development would have on the heritage resource.
	NEGATIVE	
	NEUTRAL	
Extent	LOW	Site-specific affects only the development footprint.

CRITERIA	RATING SCALES	NOTES
	MEDIUM	Local (limited to the site and its immediate surroundings, including the surrounding towns and settlements within a 10 km radius);
	HIGH	Regional (beyond a 10 km radius) to national.
Duration	LOW	0-4 years (i.e. duration of construction phase).
	MEDIUM	5-10 years.
	HIGH	More than 10 years to permanent.
Intensity	LOW	Where the impact affects the heritage resource in such a way that its significance and value are minimally affected.
	MEDIUM	Where the heritage resource is altered, and its significance and value are measurably reduced.
	HIGH	Where the heritage resource is altered or destroyed to the extent that its significance and value cease to exist.
Potential for impact on irreplaceable resources	LOW	No irreplaceable resources will be impacted.
	MEDIUM	Resources that will be impacted can be replaced, with effort.
	HIGH	There is no potential for replacing a particular vulnerable resource that will be impacted.
Consequence	LOW	A combination of any of the following: <ul style="list-style-type: none"> Intensity, duration, extent and impact on irreplaceable resources are all rated low. Intensity is low and up to two of the other criteria are rated medium. - Intensity is medium, and all three other criteria are rated low.
	MEDIUM	Intensity is medium, and at least two of the other criteria are rated medium.
	HIGH	Intensity and impact on irreplaceable resources are rated high, with any combination of extent and duration. Intensity is rated high, with all the other criteria being rated medium or higher.
Probability (the likelihood of the impact occurring)	LOW	It is highly unlikely or less than 50 % likely that an impact will occur.
	MEDIUM	It is between 50 and 70 % certain that the impact will occur.
	HIGH	It is more than 75 % certain that the impact will occur, or it is definite that the impact will occur.
Significance (all impacts including potential)	LOW	Low consequence and low probability. Low consequence and medium probability. Low consequence and high probability.

CRITERIA	RATING SCALES	NOTES
cumulative impacts)	MEDIUM	Medium consequence and low probability. Medium consequence and medium probability. Medium consequence and high probability. High consequence and low probability.
	HIGH	High consequence and medium probability. High consequence and high probability.

3.4 Report

The desktop research and field survey results are compiled in this report. The identified heritage resources and anticipated direct, indirect, and cumulative impacts of the proposed project's development on the identified heritage resources will be presented objectively. Alternatives are offered if any significant sites are impacted adversely by the proposed project. All efforts will be made to ensure that all studies, assessments, and results comply with the relevant legislation, code of ethics, and Association of South African Professional Archaeologists (ASAPA) guidelines. The report aims to assist the developer in managing the documented heritage resources in a responsible manner and protecting, preserving, and developing them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999).



4. PROJECT OVERVIEW

UBIQUE Heritage Consultants were appointed by Conserva Environmental Management Services as independent heritage specialists to conduct a cultural heritage desktop assessment in accordance with Section 38 of the NHRA and the National Environmental Management Act 107 of 1998 (NEMA) to determine the possibility of heritage and archaeological resources within the proposed development area, on Portion 1 of the Farm Zwartwitpensbokfontein 434-KQ, Koedoeskop, Thabazimbi Local Municipality, Waterberg District, Limpopo Province.

The project entails the development of a Solar Photovoltaic (Pv) Facility by Allied Green Energy (Pty) Ltd that will potentially generate up to 480MW. The solar facility will tie into the 132kV Spitskop-Mamba power line.

4.1 Technical information

PROJECT DESCRIPTION	
Project name	Phase 1 Solar Photovoltaic (Pv) Facility Koedoeskop
Description	Phase 1 HIA for the proposed development of a 480MW Solar Photovoltaic (Pv) Facility on Portion 1 of the Farm Zwartwitpensbokfontein 434-KQ, Koedoeskop, Thabazimbi Local Municipality, Waterberg District, Limpopo Province.
DEVELOPER	
Allied Green Energy (Pty) Ltd	
Development type	Renewable energy: Solar farm
CONSULTANTS	
Environmental	Conserva Environmental Management Services
Heritage and archaeological	UBIQUE Heritage Consultants
Palaeontological	Banzai Environmental
PROPERTY DETAILS	
Province	Limpopo
District municipality	Waterberg
Local municipality	Thabazimbi Local Municipality
Topo-cadastral map	2427CD 1:50 000
Farm name	Portion 1 of the Farm Zwartwitpensbokfontein 434-KQ
Closest town	Thabazimbi
GPS Coordinates	24 ° 56'41.98"S 27 ° 26'38.21"E
PROPERTY SIZE	
379 ha	

DEVELOPMENT FOOTPRINT SIZE	250-265 ha	
LAND USE		
Previous	Agriculture and game farm	
Current	Game farm	
Rezoning required	No	
Sub-division of land	No	
DEVELOPMENT CRITERIA IN TERMS OF SECTION 38(1) NHRA		YES/NO
Construction of a road, wall, power line, pipeline, canal or other linear forms of development or barrier exceeding 300m in length.		Yes
Construction of bridge or similar structure exceeding 50m in length.		No
Construction exceeding 5000m ² .		Yes
Development involving three or more existing erven or subdivisions.		No
Development involving three or more erven or divisions that have been consolidated within the past five years.		No
Rezoning of site exceeding 10 000m ² .		No
Any other development category, public open space, squares, parks, recreation grounds.		No

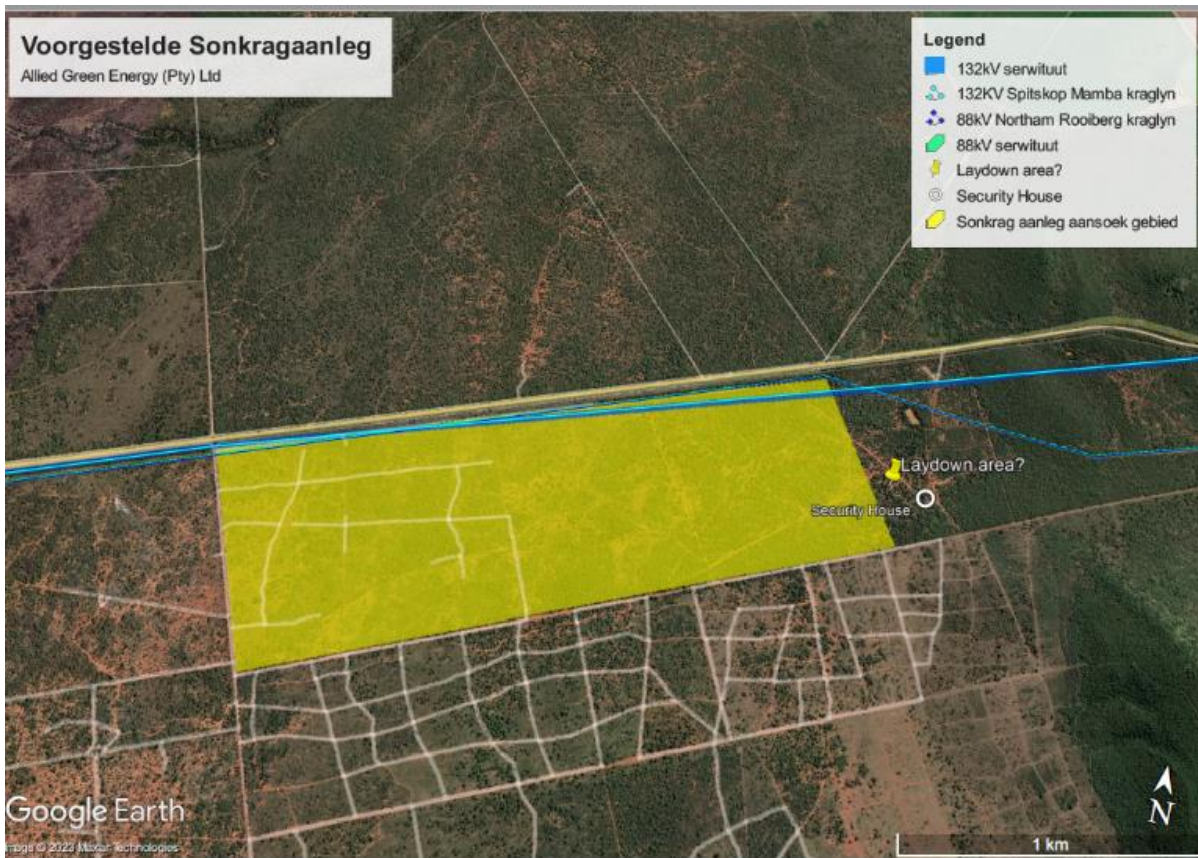


Figure 1 Conceptual Solar Farm Layout Plan. Image: Allied Green Energy (Pty) Ltd.



Figure 2 Regional locality of the development footprint, indicated on Google Earth Satellite imagery.

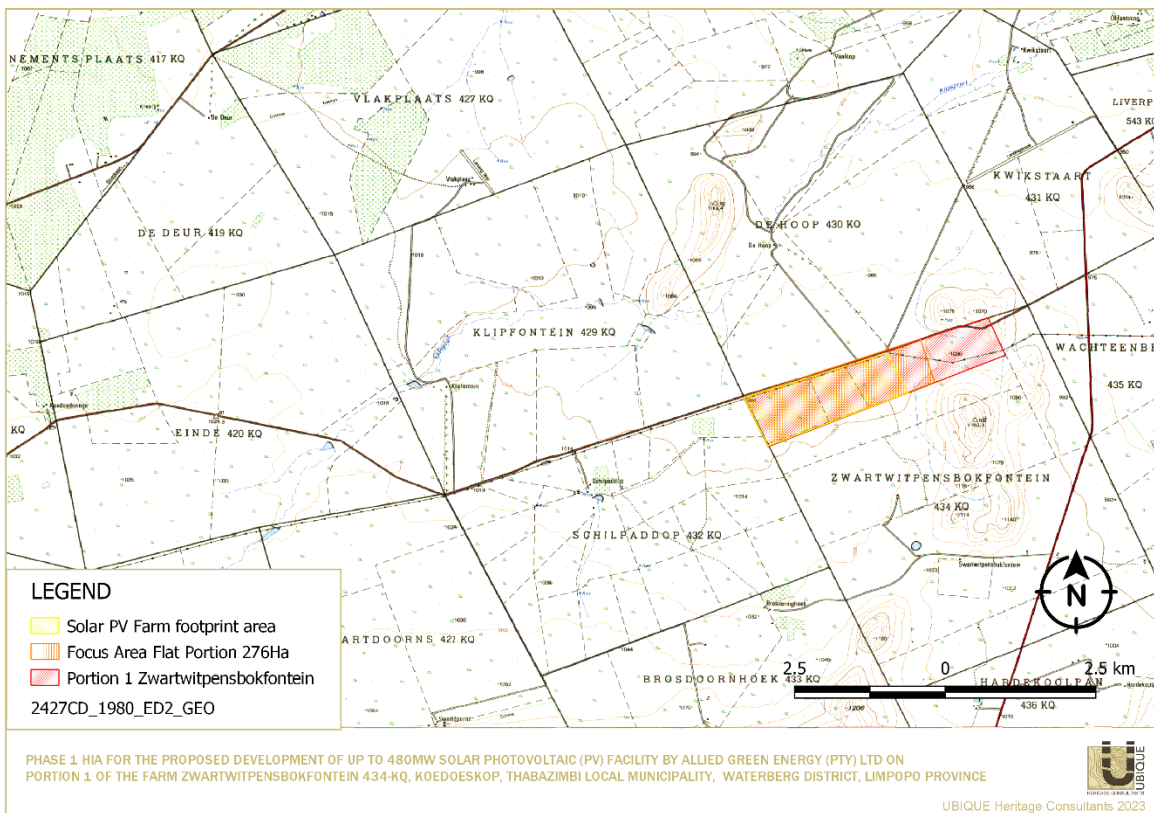


Figure 3 Regional locality of the development footprint, indicated on topo cadastral map 2427CD 1: 50 000.

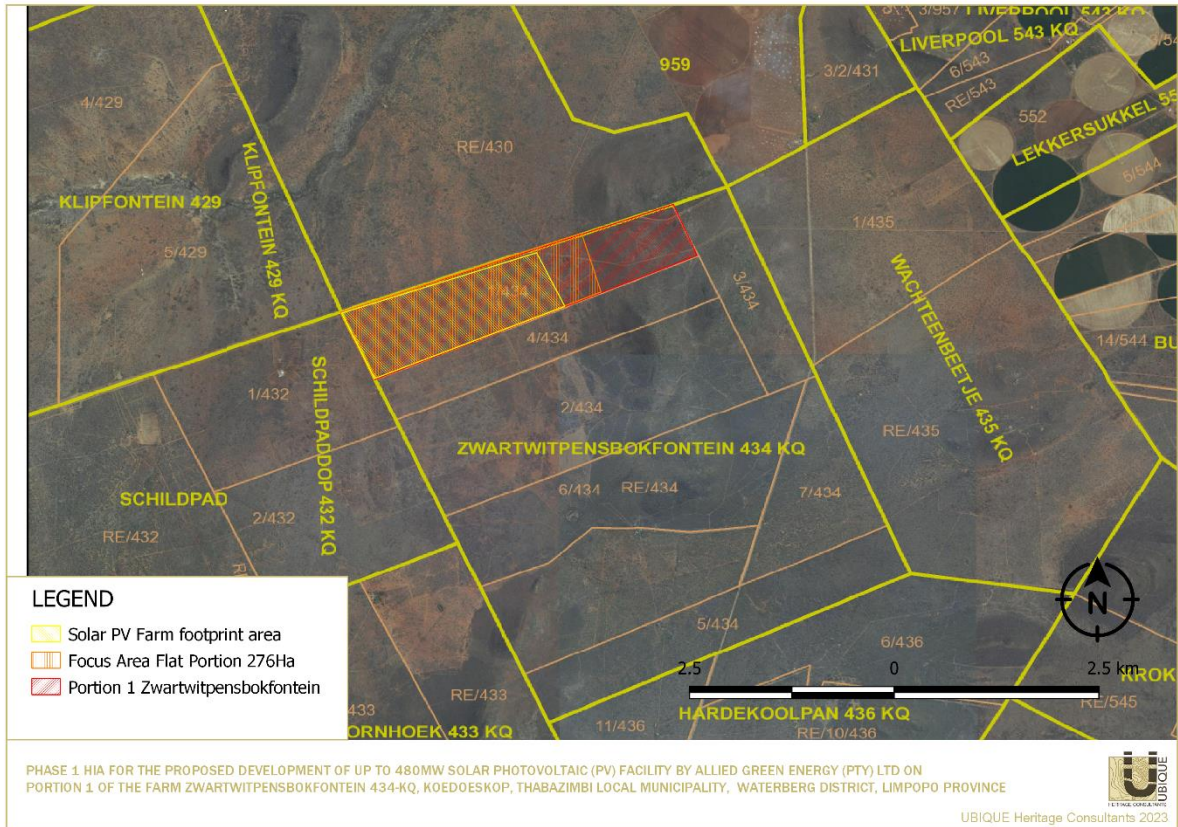


Figure 4 Regional locality of the development footprint, indicated Chief-Surveyor General ArcGIS Web Map (<https://csggis.drdlr.gov.za/psv/>)

5. HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

5.1 Region: Limpopo Province

South Africa has a long and varied history of human occupation (Deacon & Deacon 1999). This occupation dates to approximately 2 mya (million years ago) (Mitchell 2002). Briefly, the archaeology of South Africa can be divided into three "major" periods: the Stone Age, the Iron Age and the Historical Period. In addition, various archaeological and historical sites have been identified and documented throughout South Africa, including the Limpopo province.

5.1.1 Stone Age

In southern Africa, the Stone Age can be divided into three periods. It is, however, critical to note that dates are relative and only provide a broad framework for interpretation. The division of the Stone Age, according to Lombard et al. (2012), is as follows:

- Earlier Stone Age (ESA): >2 000 000 - >200 000 years ago
- Middle Stone Age (MSA): <300 000 - >20 000 years ago
- Later Stone Age (LSA): <40 000 - until the historical period

In short, the Stone Age refers to humans that mainly utilised stone as their technological marker. Each sub-division is formed by industries where the assemblages share attributes or common traditions (Lombard et al. 2012). The ESA is characterised by flakes produced from pebbles, cobbles, percussive tools, and objects created later during this period, such as large hand axes, cleavers, and other bifacial tools (Klein 2000). The MSA is associated with small flakes, blades and points. The aforementioned is generally suggested to have been made and utilised for hunting activities and had numerous functions (Wurz 2013). Hunter-gatherer lifeways are attested to in the Middle Stone Age record for at least the last 100 000 years (Wadley 2015). Such foraging groups continued to occupy the landscape throughout the Later Stone Age between 40 000 and 20 000 years ago, lasting until a couple of centuries.

About 2000 years ago, during the final ceramic Later Stone Age, the first evidence for goats/sheep was found in southern Africa, possibly associated with Khoekhoe herding groups (e.g., Sadr 2008). These groups came into being as a combination of the migration of East African pastoralists who mixed with local hunter-gatherers (e.g., Choudhury et al. 2021). However, it is almost impossible to differentiate between San and Khoekhoe groups based on archaeological or genetic records. Presently, these populations are referred to as Khoisan (Barnard 1992). Furthermore, the LSA is characterised by microlithic stone tools, scrapers and flakes (Binneman 1995; Lombard et al. 2012). The LSA is also associated with rock art. These sites are commonly found on slopes, hilltops, rocky outcrops and occasionally in river beds (Kruger 2018).

5.1.2 Iron Age

Archaeologically, the arrival of African farming communities from West Africa about 1700 years ago and their subsequent settlement, first in the northeastern parts and later in much of southern Africa, is known as the Iron Age (Huffman 2007). These farmers encountered Khoisan communities (Mitchell 2002). The archaeology of farming communities of southern Africa encompasses three phases. The Early Iron Age, dated 200 – 900 CE, represents the arrival of farmers in southern Africa. The Middle Iron Age (900 – 1300 CE) is best associated with the onset of state formation in the Limpopo Valley of South Africa. Finally, the Late Iron Age (1300 – 1840 CE) marked the arrival and spread of ancestral Nguni- and Sotho-Tswana communities into southern Africa and the development of state-level societies, such as Great Zimbabwe and Mutapa (Huffman 2007; Badenhorst 2010).

The Iron Age (IA) is characterised by the use of metal (Coertze & Coertze 1996: 346). There is some controversy about the periods within the IA. Van der Ryst & Meyer (1999) have suggested that there are two phases within the IA, namely:

- Early Iron Age (EIA) 200 – 1000 A.D
- Late Iron Age (LIA) 1000 – 1850 A.D

However, Huffman (2007) suggests instead that there are three periods within the Iron Age, these periods are:

- Early Iron Age (EIA) 250 – 900 A.D
- Middle Iron Age (MIA) 900 – 1300 A.D
- Late Iron Age (LIA) 1300 – 1840 A.D

Thomas Huffman believes that the Middle Iron Age should be included within this period; his dates have been widely accepted in the IA field of archaeology.

The South African Iron Age is generally characterised by farming communities with domesticated animals, cultivated plants, manufactured and used ceramics and beads, and smelted iron for weapons and manufactured tools (Hall 1987). Iron Age people were often mixed farmers/agropastoralists. These agropastoralists generally lived in areas with sufficient water for domestic use and arable soil that could be cultivated with an iron hoe. Most Iron Age (IA) settlements built by agropastoralists were permanent settlements (with a few exceptions). They comprised houses, raised grain bins, storage pits and animal kraals/byres, contrasting with pastoralists' and hunter-gatherers' temporary camps (Huffman 2007). It is evident in the archaeological record that IA groups had migrated with their material culture (Huffman 2002).

5.1.3 Historical period

The Historical/Colonial period generally refers to the last 500 years when European settlers and colonialism entered southern Africa (Binneman et al. 2011). During the colonial frontier period, place names started becoming fixed on maps and farm names, specifically in a cadastral sense.

As an archaeological period, the Late Iron Age ended by the 1840s. By then, the ongoing *Mfecane* caused major socio-political disruptions in southern Africa. During the late 1600s and 1700s, Dutch settlers subjugated the Khoisan and established the Cape Colony. By the 1800s, a culmination of preceding tensions rooted in competition amongst local chiefdoms for trade at Delagoa Bay, increased demand for ivory by European traders, and droughts severely impacted maize-dependent communities. The steady rise of chiefdoms, such as the Mabhudu, Ndwande, Qwabe and Mtethwa, meant rulers expanded their patronage networks by conquering a competitor's land and people. Smaller chiefdoms caught up in the conflict fled and either attacked or merged with neighbouring populations. This political unrest would be followed by a similar uprising, the Mfecane (ca. 1818-1840 CE) (Ross 1999; Bonner 2002; Chewins 2016). European traders, travellers, and missionaries encountered Khoisan and African farmers during this time. Subsequent relations, with negative and positive impacts, continued into the 20th century (e.g., Hall 1987).

5.2 Local: Thabazimbi

Within the Sashe-Limpopo area, Stone- and Iron Age archaeological sites (e.g., Huffman et al. 2020; Wadley et al. 2016; Val et al. 2021) are common. The region was also home to varied cultural identities that interacted with one another throughout time (e.g. van Doornum 2008). Early Stone Age sites are not numerous within the study area (e.g., van Schalkwyk 1994; Wadley et al. 2016; Birkholtz & Birkholtz 2017). Middle and Later Stone Age occupations occur more towards the north of the Limpopo Province within the Waterberg plateau (Wadley et al., 2016; Val et al., 2021).

Thabazimbi is known for its iron ore, and Iron Age sites are relatively common in the area as the region provides ore for mining and fertile soil for crop cultivation. The Rhino Early Iron Age site is dated to 476–636 CE and 774–880 CE. Although the site included middens, granaries and pottery, the distribution of artefacts and features indicate that it was once a large settlement - some 150 m across. In this regard, Rhino Village was more extensive than a typical Early Iron Age homestead. At the same time, the distribution of granaries, middens and stone-filled pits conforms to the back arc of a single settlement. Thus, the site was probably home to a succession of hereditary leaders (Huffman et al., 2020). Middle Iron Age sites are absent from the area. Late Iron Age sites near Thabazimbi include Madikwe Village, Rhenosterkloof 1, and more than 40 other sites within the Rooiberg Valley (Bandama 2013). These sites are associated with Sotho-Tswana and Nguni-speaking communities who have resided in the region since the 16th century. Before the arrival of Europeans, Bantu-speaking communities were organised in centralised states of varying

sizes and survived through hunting, herding and agriculture while engaging in trade relations with one another (Huffman 2007; Stapleton 2010; Bandama 2013).

Existing socio-economic and political tension between chiefdoms and encroaching Europeans probably impacted chiefdoms residing in present-day Thabazimbi. During the mid-1820s, Mzilikazi became caught up in the Ndwandwe-Zulu conflict and began to absorb local Sotho- and Tswana-speaking communities residing in the former Transvaal province. By the mid-1830s, the Ndebele Kingdom of Mzilikazi constituted the main power on the western Highveld. Simultaneously, the 1830s also saw the expansion of Dutch-speaking migrants. After defeating Mzilikazi, they seized power on the western Highveld and developed similar tributary relations with local Tswana and Sotho groups (Hall 1987; Stapleton 2010).

The first white farmers settled in this area in the late 1830s. By the 1850s, Boers controlled much of the former Transvaal (Bergh 1992). The Waterberg District was created in March 1866, and in 1877 the British annexed the region (Vig 2018). Between the 1840s and 1870s, several violent frontier conflicts took place in the Waterberg district. Boer commandos demanded cattle and labour from the local communities. Some local headmen, Makopane (Kekana) and Mankopane (Langa), who resisted, saw their people being slaughtered. In the Pedi wars between 1876 and 1879, Sekhukhune surrendered to Boer forces and the British (Mohlamme 1999; Stapleton 2010).

The discovery of gold in the Zuid Afrikaansche Republiek in 1886 caused regional economic power for the Boer republics of the Transvaal and the Orange Free State. By 1899, as the chances of a diplomatic settlement over matters diminished, the South African War (1899-1902) broke out (Stapleton 2010). The Waterberg commando was involved at Rhodes' Drift, near Tuli, to reinforce the Soutpansberg commando. Eventually, these commandos left for the southern borders of the Transvaal after losing against the British and Bangwata (Parsons 1999). Eight years after the South African War, the Union of South Africa was established after World War I (1914-1918) broke out (Stapleton 2010). Before the Second World War (1939 – 1945), the Thabazimbi Iron Ore mine was established in 1934 by Iscor on the farm Kwaggashoek (Deats & Seligmann 1964). The modern-day town of Thabazimbi, meaning 'mountain of iron', was proclaimed in May 1953 (Raper 1987).



6. HERITAGE SENSITIVITY

The Heritage Screening tool (<https://screening.environment.gov.za/>) shows low significance with locations of very high and high sensitivity towards the northeast, south, southwest, and southeast of the proposed project areas.

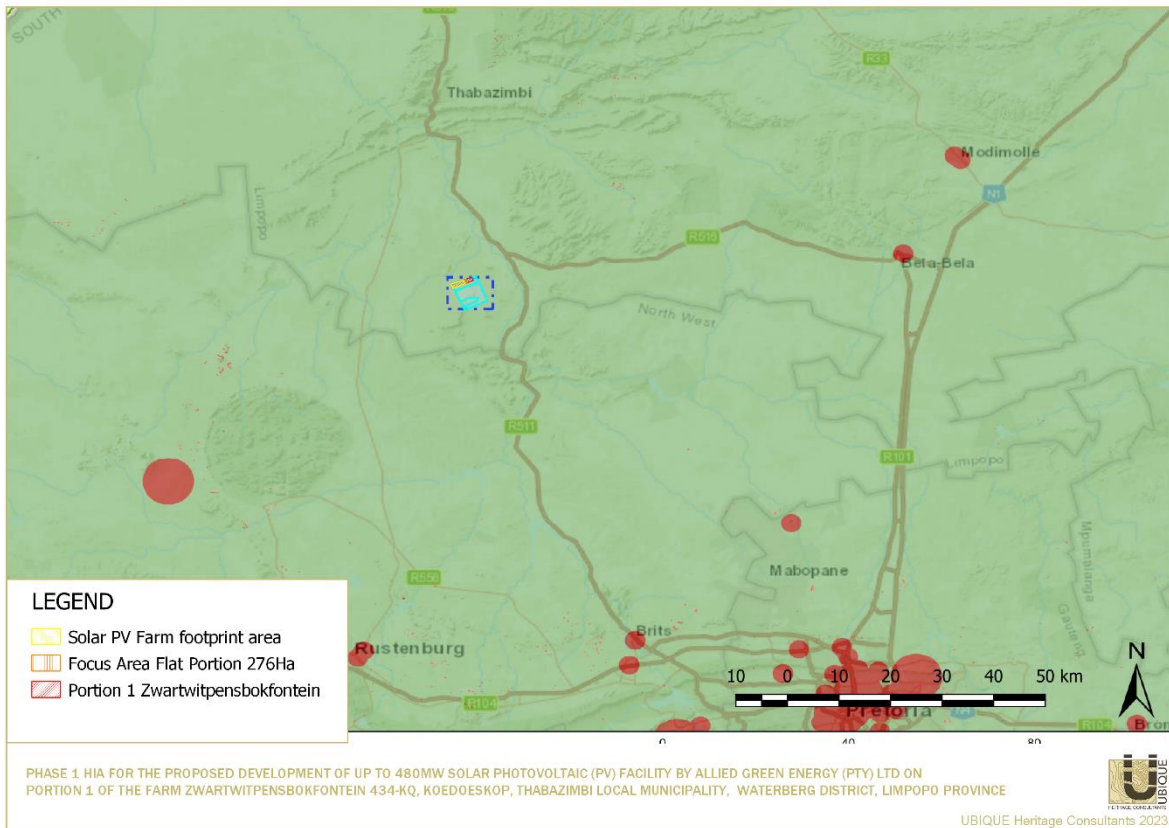


Figure 5 The Project area indicated on the Heritage Screening tool (<https://screening.environment.gov.za/>).

6.1 Summary of Local Heritage Resources: Koedoeskop

Very few heritage and archaeological studies were undertaken in the immediate surroundings of the present study area. No assessments had been conducted on or directly adjacent to the proposed areas for development. The closest assessments to the study area were conducted 3.5 km northwest, Portion 2 of the Farm Kwikstaart 431 KQ (Hutten 2014), 12.5 km east on the Farm Hardekoolbult 548 KQ (Küsel 2006), and 8.2 km south on the Farm Nooitgedacht 22 JQ (Roodt 2006). None of these reported any significant heritage resources. Within the larger area, most assessments encountered minimal or no archaeological features (e.g., Hutten 2010; Kruger 2021). Others did observe archaeological sites (e.g., Gaigher 2007; Miller 2011; van der Walt 2016). The Amandelbult and Rhino Andalusite Mine areas, located 17.5 km from the study area, have been extensively surveyed (e.g. Van Schalkwyk 1994; Huffman 2006). The 1994 survey identified several (more than 50) archaeological and heritage sites, including Stone Age sites and

occurrences, Early Iron Age sites, Late Iron Age stonewalled settlements, historic homesteads, and cemeteries. Similarly, at the Rhino Andalusite Mine, several Early and Late Iron Age sites were recorded and excavated (Huffman 2006). The closest archaeological finds to the study area on Farm Doornhoek 318 KQ are of the Late Iron Age and Historical periods.

ARCHAEOLOGICAL RESOURCES RECORDED			
HIA/AIA	SITE	COORDINATES	HERITAGE RESOURCES
Doornhoek 318 KQ, Thabazimbi	2427CB-MHC001	-24.55180951; 27.40326583	Possible historic era grave
Doornhoek 318 KQ, Thabazimbi	2427CB-MHC002	-24.55169686; 27.42762566 -24.55309697; 27.42622554	Late Iron Age site consisting of cattle enclosure, grain bin platforms and lower grindstones and ceramics scattered over a large area
Doornhoek 318 KQ, Thabazimbi	2427CB-MHC003	-24.55153593; 27.42838740	Late Iron Age smelting site and small scatters of iron slag occur
Doornhoek 318 KQ, Thabazimbi	2427CB-MHC004	-24.55513545; 27.42933154	Late Iron Age smelting site and small scatters of iron slag occur
Doornhoek 318 KQ, Thabazimbi	2427CB-MHC005	-24.53476676; 27.43432045	Possible historic era grave
Doornhoek 318 KQ, Thabazimbi	2427CB-MHC006	-24.54434761; 27.42542624	Late Iron Age Small scatters of ceramics exposed through erosion
Doornhoek 318 KQ, Thabazimbi	2427CB-MHC007	-24.54610177; 27.42872536 -24.54845139, 27.43459404	Late Iron Age Site consists of grain bin platforms, lower grindstones, ceramic- and slag scatters
Randstephne 455, Donkerpoort 448KQ, Waterval 443	PERREIRA GRAVE.	-24 37 03, 1; 27 36 22, 4	Gravestone of one J.H. TO Perriera, Kruitmaker from 1881 ZAR, was murdered in 1901.
Randstephne 455, Donkerpoort 448KQ, Waterval 443	GATKOP CAVE	-24 37 04, 6; 27 39 08, 4	In front of the cave is evidence of the site's continuous use for ancestral worship. An old notice erected by the Magistrate of 'Warmbad' (now Bela-Bela) warns of the presence of 'grotkooers', an illness resulting from inhalation of miasma from bat guano.

ARCHAEOLOGICAL RESOURCES RECORDED

HIA/AIA	SITE	COORDINATES	HERITAGE RESOURCES
Randstephne 455, Donkerpoort 448KQ, Waterval 443	RANDSTEPHNE HOMESTEAD	-24 35 51, 9; 27 40 17, 8	1920's era farmhouse
Randstephne 455, Donkerpoort 448KQ, Waterval 443	LABOURERS CEMETARY	-24 35 53, 8; 27 40 36, 3	Farm labourers Cemetary
Randstephne 455, Donkerpoort 448KQ, Waterval 443	CATTLE ENCLOSURES	-24 37 10, 1; 27 36, 29, 8	Late Iron Age 1800s, five stonewalled cattle enclosures
Randstephne 455, Donkerpoort 448KQ, Waterval 443	PRECOLONIAL MINE	-24 35 28, 4; 27 39, 46, 8	Late Iron Age ore mining activities
Randstephne 455, Donkerpoort 448KQ, Waterval 443	LIVING ENCLOSURE.	-24 35 02,84; 27 40 04,62	Small Iron Age village
Randstephne 455, Donkerpoort 448KQ, Waterval 443	SMELTING SITE.	-24 35 06, 1; 27 40 04, 97	Metal slag and pieces of tuyere from the smelting site.
Randstephne 455, Donkerpoort 448KQ, Waterval 443	IRON AGE SETTLEMENT.	-24 37 08, 01; 27 36 54, 19	Late Iron Age 1800s. Several stone-built enclosures present
Randstephne 455, Donkerpoort 448KQ, Waterval 443	BRIDGES	-24 37 10, 03; 27 36 24, 85	Historic era bridges
Portion 6 of the Farm Aapiesdoorn 316 KQ.	LATE IRON AGE STONE WALLING	24° 35' 44.7044 S; 27° 23' 07.5013" E	Ephemeral stone walling



7. IDENTIFIED RESOURCES AND HERITAGE ASSESSMENT

7.1 Surveyed area

The area surveyed for the impact assessment was dictated by the Google Earth map of the development footprints provided by the client. The proposed development area was surveyed on foot. The survey was conducted in transects determined by the landscape.

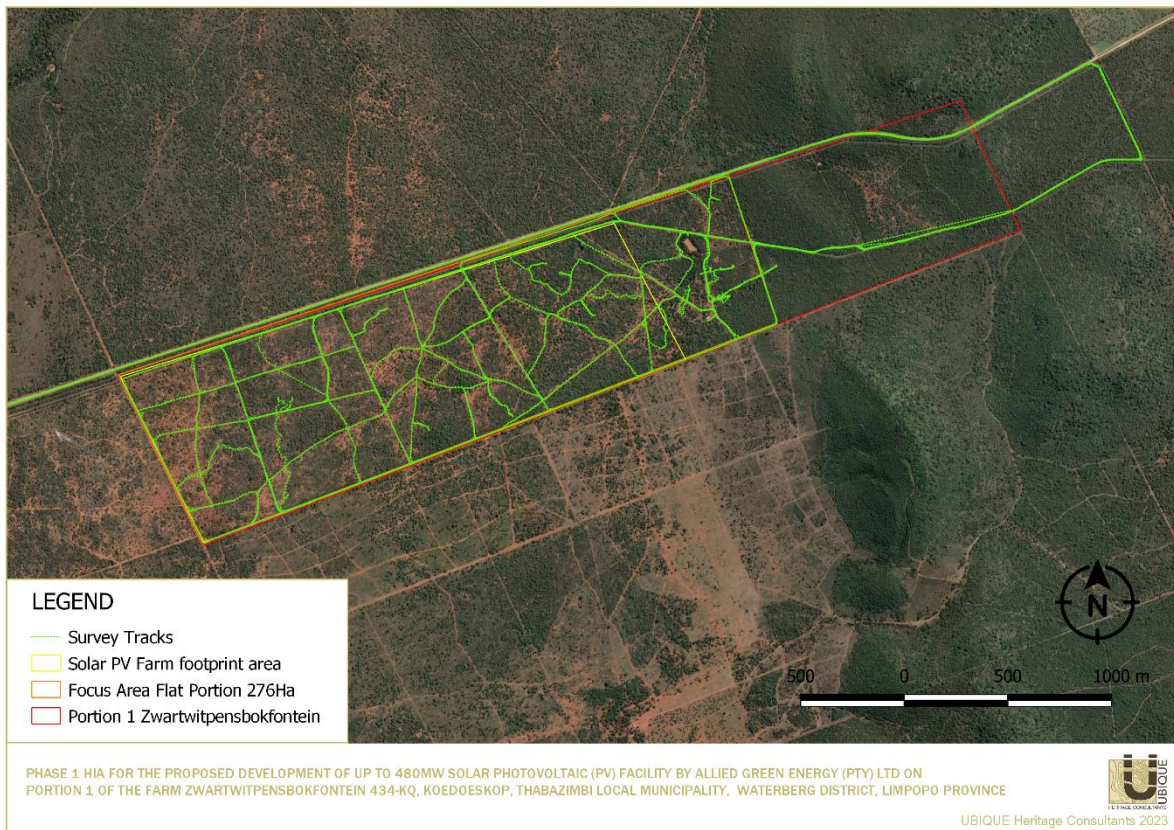


Figure 6 Survey tracks across the development footprint.

7.2 Description of the affected environment

The development area falls within the Dwaalboom Thornveld, which is characterised by plains with a layer of scattered, low to medium-high, deciduous microphyllous trees and shrubs with a few broad-leaved tree species and an almost continuous herbaceous layer dominated by grass species (Mucina & Rutherford 2006; SANBI 2023). Within the development footprint, the vegetation is very dense, with untraversable areas due to thorn bush thickets.

There are Dolemite koppies to the east, southeast of the focus area. No rocky outcrops are visible throughout the development footprint. The northern boundary of the footprint is the D1234 road,

and private farms are towards the west and south. There are no prominent water courses throughout the development site. There is a watering hole for animals within the area, with dams and crips.

The development footprint has been utilised for agriculture and, most recently, as a game farm. The area has, therefore, been previously disturbed, and there are multiple scraped roads, open and overgrown, traversing the footprint.

The socio-economic environment of the immediate area is predominantly agricultural.





Figure 7 Views of the affected development area.

7.3 Identified heritage resources

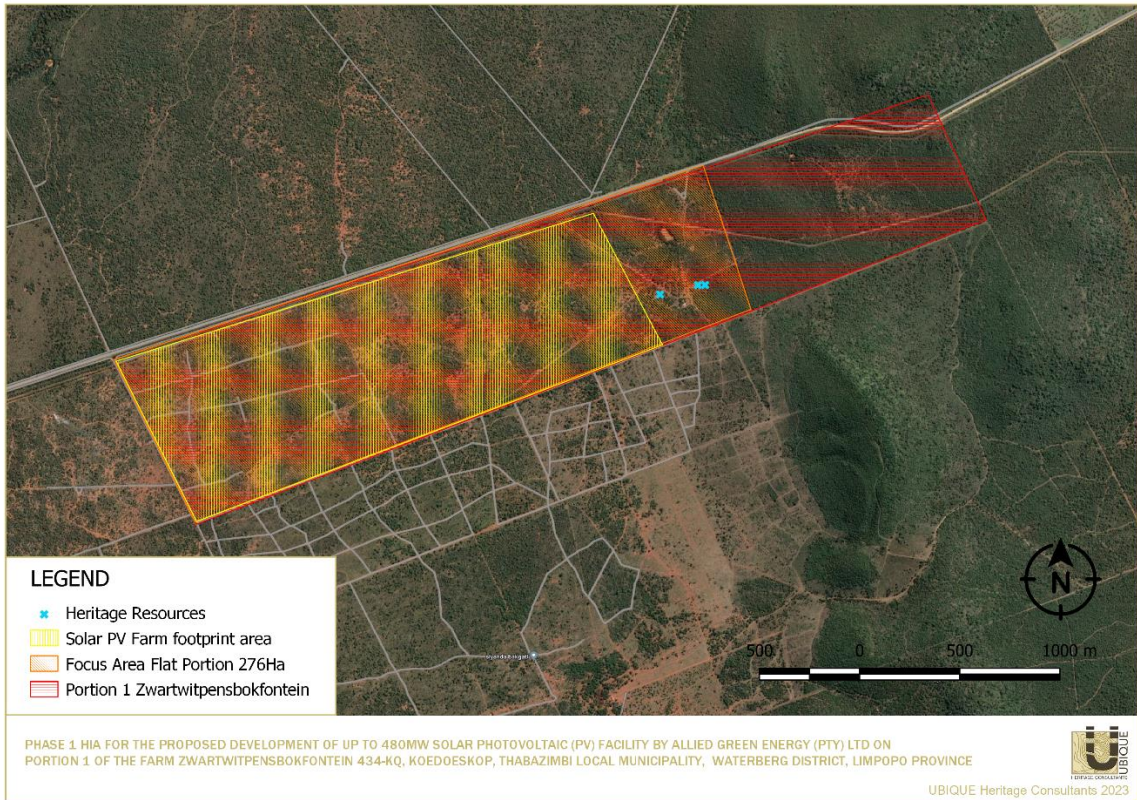


Figure 8 Location of recorded heritage resources

7.3.1 Archaeological Resources Identified

7.3.1.1. Prehistorical

No Stone Age Resources like isolated or scattered lithic material or knapping sites were recorded within the development footprint. No graves were found.

7.3.1.2. Iron Age

No cultural material, features or structures attributed to the Iron Age period were recorded within the development footprint. No graves were found.

7.3.1.3. Historical

A modern house is located outside the development footprint but within the eastern bounds of the focus area. The house is currently uninhabited, but the plans are that it will be utilised as a security hub. Surrounding the house are dams and pools. The structure does not appear historically significant (less than 60 years old); therefore, additional renovation will not be detrimental to heritage resources.

The remnants of a small stone foundation are northeast of the modern house (001). This was most likely part of the first farmhouse or outbuildings dating to farm establishment. Little is left of the foundation as the access road cuts through it. Stones from this structure have probably been repurposed into the pools, the garden and walling around the modern house. The foundation is too fragmented to be conservation-worthy and is considered to be of low significance.

Furthermore, no midden was recorded in association with the structural remains. The isolated occurrence of metal objects in the structure's southeast is without archaeological context and dates to the early 20th century (002). It is, therefore, also considered to be not conservation-worthy. **This means that the structure and surrounding metal finds have been sufficiently recorded (in Phase 1). It requires no further action.**

7.3.1.4. Graves

Three fenced graves are located northwest of the modern house structure (003). Two of the graves consist of field stone cairns that are barely visible, and the other grave has a hand-etched stone with the name Jan Hyustek, born in 1885 and died in 1929. The graves are situated within the focus area but outside of the proposed footprint; however, **graves are of High Significance, and a buffer radius of 100 m is recommended.**



Figure 9 Resources recorded at points 001 and 002



Figure 10 Graves recorded at point 003.

7.3.2 Palaeontological Resources

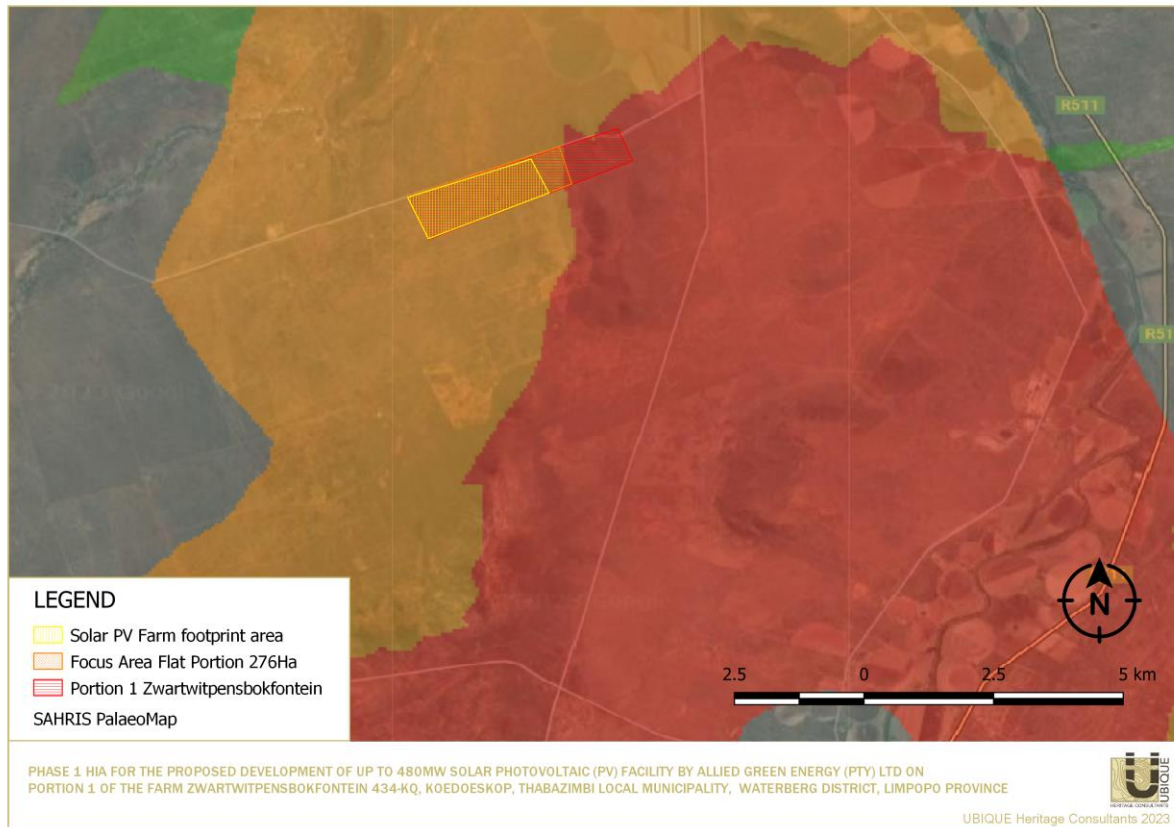


Figure 11 The SAHRIS PalaeoSensitivity Map, indicating Very High (red) and High (orange) palaeontological significance in the study area. (<https://sahris.sahra.org.za/map/palaeo>).

The Thabazimbi geological map indicates that the proposed Koedoeskop SPP is underlain by a small portion of Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). In contrast, the Daspoort Formation of the Pretoria Group underlies the largest portion. However, updated geology (compiled by the Council for Geosciences) refined the geology and indicated that the development is underlain by Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) and the Timeball Hill and Rooihogte Formations of the Pretoria Group (Transvaal Supergroup).

The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High, while that of the Daspoort Formation is High (Almond *et al.*, 2013; SAHRIS website). The suggested location is classified as having a Very High Palaeontology Theme Sensitivity in the DEA Screening Report.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 27 August 2023. No fossiliferous outcrop was detected in the proposed development. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of Low significance in palaeontological terms. Therefore, the proposed development will not damage the area's palaeontological resources (Butler 2023 Appendix A).

8. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

Description	Development Impact		Mitigation	Field rating/ Significance
Archaeological				
1. The heritage resources recorded at points 001 and 002, a stone structure foundation and isolated metal, are of low significance.	Nature	Neutral	No mitigation required.	NCW
	Extent	High		
	Duration	High		
	Intensity	Low		
	Potential of impact on irreplaceable resource	High		
	Consequence	Low		
	Probability of impact	High		
	Significance	Low		
Graves				
2. The heritage resources recorded at point 003, three fenced graves, are highly significant.	Nature	Negative	100 m Buffer Zone	Local IIIB High Significance
	Extent	Medium		
	Duration	High		
	Intensity	Medium		
	Potential of impact on irreplaceable resource	Medium		
	Consequence	High		
	Probability of impact	Medium		
	Significance	High		
Palaeontological				
3. The proposed Mmehane Township Establishment is underlain by Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup). However, no fossiliferous outcrop was found in the proposed development during the field survey. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of Low significance in palaeontological terms.	Nature	Neutral	No mitigation required.	N/A
	Extent	Low		
	Duration	Low		
	Intensity	Low		
	Potential of impact on irreplaceable resource	Low		
	Consequence	Low		
	Probability of impact	Low		
	Significance	Low		

The areas are densely overgrown, which impedes visibility. However, the sites have been disturbed in the past, and no heritage resources have been located in the proposed development footprint. Heritage resources of low significance were recorded in the larger focus area. The impact on the house foundation remains, and the metal material will be negative but of low consequence. However, the graves located in the focus area outside the eastern boundary of the development area are of high significance, and the impact on these resources will be negative and of high consequence. Therefore, the graves need a buffer zone to ensure protection from long and short-term development.

The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of Low significance in palaeontological terms. Therefore, the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The development construction may thus be permitted to its whole extent, as the development footprint is not considered sensitive regarding palaeontological resources (Butler 2023).

9. RECOMMENDATIONS

Based on the assessment of the potential impact of the development on the identified heritage, the following recommendations are made, taking into consideration any existing or potential sustainable social and economic benefits:

1. Three fenced graves, one with a standing headstone, were recorded in the easternmost section of the focus area, approximately 280 m northwest of the proposed security facility (existing structure to be repurposed). **Graves are of High Significance, and a buffer radius of 100 m is recommended.**
2. Should it be impossible to avoid the graves during development, mitigation in the form of grave relocation could be undertaken. This is, however, a lengthy and costly process. Grave relocation specialists should be employed to manage the liaison process with the communities and individuals who, by tradition or familial association, might have an interest in these graves or burial grounds, as well as manage the permit acquisition from the SAHRA Burial Grounds and Graves (BGG) Unit and the arrangements for the exhumation and re-interment of the contents of the graves, at the cost of the applicant and in accordance with any regulations made by the responsible heritage resources authority.
3. The remains of a stone foundation and the occurrence of metal material are of low significance and not conservation-worthy. Therefore, no further mitigation is required.
4. No other significant heritage sites or features were identified within the surveyed sections of the development footprint. The areas are densely overgrown, which impedes visibility. However, even though the sites are disturbed, and no heritage resources were located, we recommend a final site walk-down after clearing vegetation. Based on the survey results, the development will not impact heritage resources.
5. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of Low significance in palaeontological terms. Therefore, the proposed development will not lead to damaging impacts on the palaeontological resources of the area. The development construction may thus be

permitted to its whole extent, as the development footprint is not considered sensitive regarding palaeontological resources. However, the Chance Find Protocol must be implemented if fossil remains are discovered during any construction phase, either on the surface or uncovered by excavations (Butler 2023).

6. Although all possible care has been taken to identify sites of cultural importance during the investigation of study areas, it is always possible that hidden or sub-surface sites could be overlooked during the assessment. If during construction, any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) must be alerted as per section 35(3) of the NHRA. If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490) must be alerted immediately as per section 36(6) of the NHRA. Depending on the nature of the finds, a professional archaeologist or palaeontologist must be contacted as soon as possible to inspect the findings. If the newly discovered heritage resources are of archaeological or palaeontological significance, a Phase 2 rescue operation may be required, subject to permits issued by SAHRA. UBIQUE Heritage Consultants and its personnel will not be held liable for such oversights or costs incurred due to such oversights.

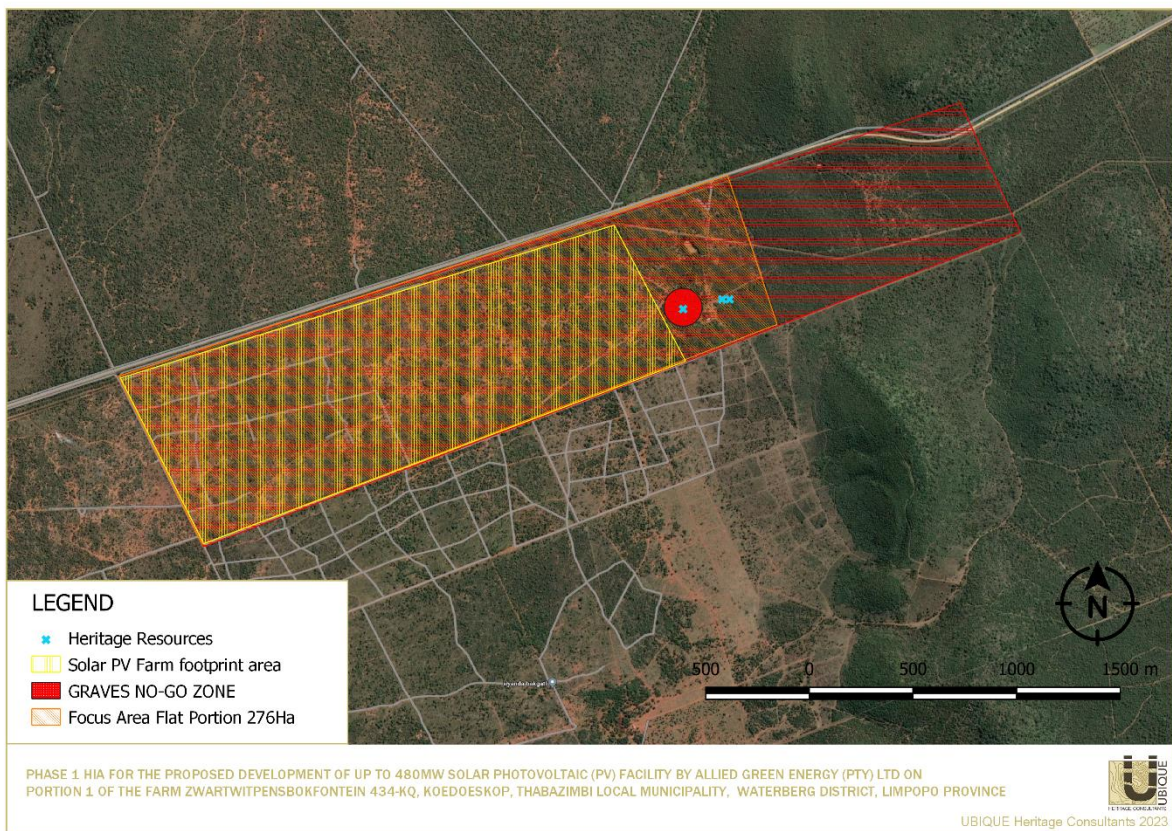


Figure 12 Map indicating the recommended buffer zone around the graves.

10. CONCLUSION

This HIA has identified graves which the development may negatively impact. Accordingly, the proposed Solar PV development on Portion 1 of the Farm Zwartwitpensbokfontein 434-KQ, Koedoeskop, Thabazimbi Local Municipality, Waterberg District, Limpopo Province, may continue, provided the recommendations stipulated within this report, and the subsequent decision by SAHRA, are followed.



11. BIBLIOGRAPHY

- Badenhorst, S. 2010. Descent of Iron Age Farmers on Southern Africa during the last 2000 years. *African Archaeological Review* 27:87–106.
- Bandama, F. 2013. The Archaeology and technology of metal production In The Late Iron Age of the southern Waterberg, Limpopo Province, South Africa. Unpublished PhD Thesis. University of Cape Town.
- Barnard, A. 1992. *Hunters and Herders of southern Africa: A Comparative Ethnography of the Khoisan peoples*. Cambridge: Cambridge University Press.
- Bergh, J.S. 1992. Die vestiging van die Voortrekkers noord van die Vaalrivier tot 1840. *Historia* 37: 38-47.
- Birkholtz, P & Birkholtz, H. 2017. The proposed development of two open mining pits 62e/60e (Dishaba) and 36w (Tumela) at the Amandelbult Mining Complex located north of Northam, Thabazimbi Local Municipality, Waterberg District Municipality, Limpopo Province.
- Bonner, P. 2002. *Kings, commoners and concessionaries: The evolution and dissolution of the nineteenth-century Swazi State*. Cambridge: Cambridge University Press.
- Butler, E. 2023. Palaeontological Impact Assessment Mmehane Township Formalisation In Thabazimbi, Limpopo Province: Unpublished report: Banzai Environmental.
- Chewins, L. 2016. The relationship between trade in southern Mozambique and state formation: Reassessing Hedges on cattle, ivory and brass. *Journal of Southern African Studies* 42: 725-741.
- Choudhury, A., Sengupta, D., Ramsay, M. & Schlebusch, C. 2021. Bantu-speaker migration and admixture in southern Africa. *Human Molecular Genetics* 30: 56-63.
- Deats, M.J & Seligmann, P. 1964. Pillar extraction at Thabazimbi Iron Ore Mine with special reference to blasting methods. *Journal of the Southern African Institute of Mining and Metallurgy* 64: 535-562.
- Fourie, W. 2007. Proposed Estate development on portions of the farm Doornhoek 318 KQ, Thabazimbi, Limpopo Province. Unpublished Heritage Impact Assessment Report.
- Fourie, W. 2012. Kumba Iron Ore Thabazimbi Mine Mostert Tunnel Level Cave (MTC) Wachteenbietjesdraai 350 KQ and Kwaggashoek 345 KQ Heritage Impact Report on proposed mining activities of project Phoenix.
- Gaigher, S. 2007. Proposed housing project on the Farm Doornhoek 318 KQ, Limpopo Province. Unpublished Heritage Impact Assessment Report.
- Gaigher, S. 2016. Heritage Impact Assessment Report for the Proposed Haakdoorn drift Opencast Activities at the Anglo American Platinum's Amandelbult Mine at Thabazimbi, Limpopo Province. Unpublished Heritage Impact Assessment Report.
- Hall, M. 1987. *The changing past: Farmers, kings and traders in southern Africa. 200-1860*. Cape Town: David Philip.
- Huffman, T.N. 2006. Archaeological Mitigation of the Rhino Mine. Unpublished report.

- Huffman, T.N. 2006. Maise grindstones, Madikwe pottery and ochre mining in precolonial South Africa. *Southern African Humanities* 18: 51-70.
- Huffman, T. N. 2007. *Handbook to the Iron Age*. Pietermaritzburg: University of Kwazulu-Natal Press.
- Huffman, T.N., Whitelaw, G., Tarduno, J.A., Michael K. Watkeys, M.K., & Woodborne, S. 2020. The Rhino Early Iron Age site, Thabazimbi, South Africa, *Azania: Archaeological Research in Africa* 55: 360-388.
- Kruger, N. 2021. Ces: Proposed Sturdee Energy Ppc Dwaalboom Solar Project on Portions of the farms Schoongezicht 238KP and Jakhalskraal 239KP, Thabazimbi Local Municipality, Limpopo Province.
- Lombard, M., Wadley, L., Deacon, J., Wurz, S., Parsons, I., Mohapi, M. Swart, J. & Mitchell, P. 2012. South African and Lesotho Stone Age sequence updated. *South African Archaeological Bulletin* 67: 123-144.
- Miller, S. 2017. 1st Phase Cultural Resource Essay: For the farms Donkerpoort 448 KQ, Randstephne 455 KQ and Waterval 443 KQ Thabazimbi, Limpopo Province.
- Mitchell, P. 2002. *The archaeology of Southern Africa*. Cambridge: Cambridge University Press.
- Maguire, R. & van Wyk, C. 2009. Phase 1 Archaeological Impact Assessment (Aia) for Portion 81 Of The Farm Doornhoek 318-Kq, Thabazimbi, Limpopo Province.
- Mohlamme, J.S. 1999. Traditional leaders of the Bakgatla-ba-ga-Kgafela and their succession story. *Historia* 44: 328-344.
- Parsons, N. 1999. Not Quite All Quiet on the North West Frontier: Khama's Bangwato and the Waterberg Commando. *South African Historical Journal* 41: 44-55.
- Raper, P. E. 1987. *Dictionary Of Southern African Place Names*. Head, Onomastic Research Centre, HSRC.
- Ross, R. 1999. *A concise history of South Africa*. Cambridge: Cambridge University Press.
- Sadr, K. 2008. Invisible herders: the archaeology of Khoekhoe pastoralists. *Southern African Humanities* 20: 179-203.
- Stapleton, T.J. 2010. *A Military History of South Africa: From the Dutch-Khoi Wars to the End of Apartheid: From the Dutch-Khoi Wars to the End of Apartheid*. ABC-CLIO.
- Val, A., De la Peña, P., Duval, M., Bansal, S., Colino, F., Culey, J., Hodgskiss, T., Morrissey, P., Murray, A., Murungi, M. & Neumann, F.H., 2021. The place beyond the Trees: renewed excavations of the Middle Stone Age deposits at Olieboomspoot in the Waterberg Mountains of the South African Savanna Biome. *Archaeological and Anthropological Sciences* 13: 1-32.
- Van Doornum, B.L. 2008. Sheltered from change: hunter-gatherer occupation of Balerno Main Shelter, Shashe-Limpopo confluence area, South Africa. *Southern African Humanities* 20: 249-84.
- Van Schalkwyk, J.A. 1994. A Survey of Archaeological and Cultural Historical Resources in the Amandelbult Mining Lease Area. An unpublished report by the National Cultural History Museum.
- Van der Walt, J. 2016. Archaeological Impact Assessment for the proposed Thabazimbi Ext 69 Development, Limpopo Province.
- Vig, P.S. 2018. Hunters and after Riders: A History of Hunting and the Making of Race in the Waterberg, 1840s–Present. Unpublished PhD dissertation: University of Minnesota.

Wadley, L. 2015. Those marvellous millennia: The Middle Stone Age of southern Africa. *Azania: Archaeological Research in Africa* 50: 155-226.

Wadley, L., Murungi, M.L., Witelson, D., Bolhar, R., Bamford, M., Sievers, C., Val, A. & De La Pena, P. 2016. Steenbokfontein 9KR: A middle stone age spring site in Limpopo, South Africa. *South African Archaeological Bulletin* 71: 130-145.

WEB

<https://sahris.sahra.org.za/declaredsites> (Accessed 17/04/2023).

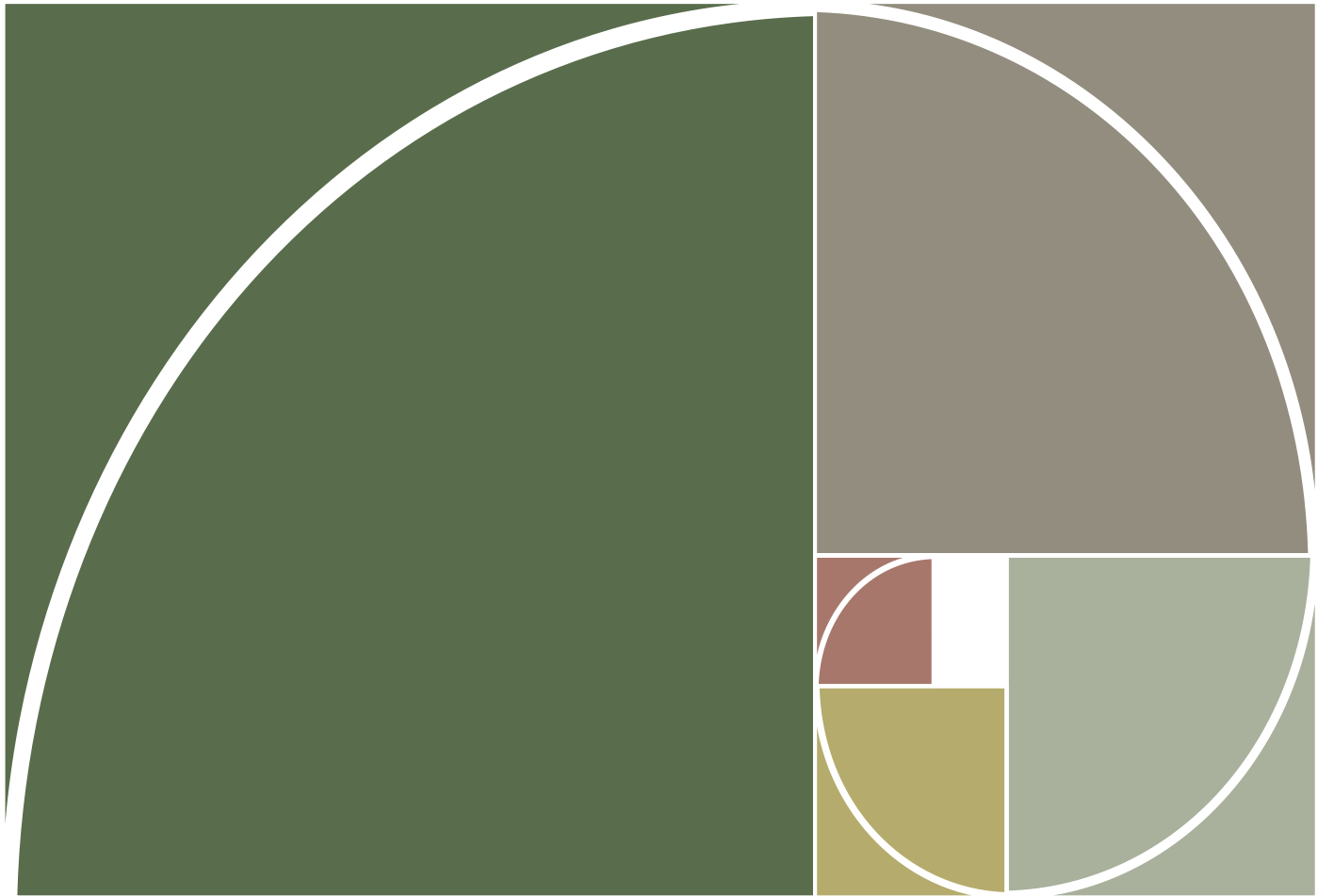
<https://sahris.sahra.org.za/allsitesfinder> (Accessed 17/04/2023).

<https://screening.environment.gov.za/> (Accessed 17/04/2023).

<https://sahris.sahra.org.za/map/palaeo> (Accessed 17/04/2023).

APPENDIX A

PALAEONTOLOGICAL IMPACT ASSESSMENT PROPOSED KOEDOESKOP
SOLAR PV FACILITY NEAR THABAZIMBI, LIMPOPO PROVINCE



PALAEONTOLOGICAL IMPACT ASSESSMENT

PROPOSED KOEDOESKOP SOLAR PV
FACILITY NEAR THABAZIMBI,
LIMPOPO PROVINCE

August 2023

COMPILED FOR:
UBIQUE HERITAGE CONSULTANTS

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 favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting 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 favourable 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 offence 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:

A handwritten signature in black ink, appearing to read "Elize Butler", written in a cursive style.

The heritage impact assessment report 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.

<i>Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)</i>		
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 A	-
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 2 – refer to Appendix A	-
(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 References	-
(cA) An indication of the quality and age of base data used for the specialist report	Section 5 – Geological and Palaeontologica I history	-
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8	-

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.
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 1;7 & 9	
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 8 Approach and Methodology	-
(f) details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1;5 & 9	
(g) An identification of any areas to be avoided, including buffers	Section 1 & 9	
(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 Limitation	-
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 1 and 9	

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.
(k) Any mitigation measures for inclusion in the EMPr	Section 10	
(l) Any conditions for inclusion in the environmental authorisation	Section 1 and 9	
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 1 and 9	
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 1 and 9	
(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	Section 1 and 12	-
(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

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.
		Assessment (EIA) and Environmental Management Plan (EMP) process.
(p) A summary and copies of any comments that were received during any consultation process	N/A	Not applicable. To date, no comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	N/A	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3 compliance with SAHRA guidelines	

EXECUTIVE SUMMARY

Banzai Environmental was appointed by UBIQUE Heritage Consultants to conduct the Palaeontological Impact Assessment (PIA) to assess the Koedoeskop Solar Power Plant (SPP) near Thabazimbi in Limpopo Province. In accordance with the National Environmental Management Act 107 of 1998 (NEMA) and to comply with the National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), this PIA is necessary to confirm if fossil material could potentially be present in the planned development area, to evaluate the potential impact of the proposed development on the Palaeontological Heritage and to mitigate possible damage to fossil resources.

The Thabazimbi geological map indicates that the proposed Koedoeskop SPP is underlain by a small portion of Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup), while the largest portion is underlain by the Daspoort Formation of the Pretoria Group. However, updated geology (compiled by the Council for Geosciences) refined the geology and indicates that the development is underlain by Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) and the Timeball Hill and Rooihogte Formations of the Pretoria Group (Transvaal Supergroup).

The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High, while that of the Daspoort Formation is High (Almond *et al.*, 2013; SAHRIS website). The suggested location is classified as having a Very High Palaeontology Theme Sensitivity in the DEA Screening Report.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 27 August 2023. No fossiliferous outcrop was detected in the proposed development. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of Low significance in palaeontological terms. 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 to its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

However, if fossil remains are discovered during any phase of construction, either on the surface or uncovered by excavations, the Chance Find Protocol must be implemented. These discoveries must be secured and the ECO/site manager ought to alert SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that appropriate mitigation (documented and collection) can be undertaken by a professional palaeontologist. The specialist would need

a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university), and all fieldwork and reports must meet the minimum standards for palaeontological impact studies developed by SAHRA.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies required by SAHRA.

Impact Summary

Environmental parameter	Issues	Rating prior to mitigation	Average	Rating post mitigation	Average
Planning Stage	No Impact		No Impact		No Impact
Construction Stage	Destroy or permanently seal-in fossils at or below the surface that are then no longer available for scientific study	42	Negative Medium impact	28	Negative Low impact
Operational Phase	No Impact		No Impact		No Impact
Decommissioning Phase	No Impact		No Impact		No Impact

It is therefore considered that the proposed Koedoeskop Solar PV Facility in Limpopo will not lead to detrimental impacts on the palaeontological reserves of the area. Thus, the construction of the development may be authorised to its whole extent.

TABLE OF CONTENT

1	INTRODUCTION.....	1
2	QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR	2
3	LEGISLATION	2
3.1	National Heritage Resources Act (25 of 1999)	2
4	METHODS AND TERMS OF REFERENCE	3
4.1	Assumptions and Limitations	5
5	GEOLOGICAL AND PALAEOLOGICAL HISTORY	6
6	ADDITIONAL INFORMATION CONSULTED	17
7	SITE VISIT.....	17
8	IMPACT ASSESSMENT METHODOLOGY.....	19
8.1	Summary of Impact Tables	23
9	FINDINGS AND RECOMMENDATIONS.....	23
10	CHANCE FINDS PROTOCOL.....	24
11	BIBLIOGRAPHY	26

LIST OF FIGURES

Figure 1: Regional locality of the proposed 275MW Solar PV Facility near Thabazimbi in Limpopo Province.	1
Figure 2: Close up of proposed 275MW Solar PV Facility near Thabazimbi in Limpopo Province. 1	
Figure 3: Extract of the 1:250 000 Thabazimbi 2426 (1974) Geological Map (Council for Geosciences, Pretoria) indicates that the proposed Koedoeskop solar PV Facility is underlain by the Malmani Subgroup (T2, blue; Chuniespoort Group Transvaal Supergroup as well as the Daspoort Formation (T3dS, brown) (Pretoria Group, Transvaal Supergroup).	9
Figure 4: Updated Geology (Groenewald et al., 2014) indicates that the Koedoeskop Solar PV plant is underlain by the Malmani Subgroup, Penge Formation as well as the Timeball Hill and Rooihoogte Formations.	12
Figure 5: Extract of the 1: 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed township development.	13
Figure 6: Palaeontological Sensitivity of the Koedoeskop Solar PV Facility generated by the National Environmental Web-bases Screening Tool.	14
Figure 7: Stratigraphy of the Transvaal Supergroup of the Transvaal Basin. The proposed development is indicated in blue (Eriksson, et al. 2006).	16
Figure 8: Stratigraphy and depositional settings if the Timeball Hill Formation at the base of the Pretoria succession (Catuneanu and Eriksson 2002).	17
Figure 9: View over the development footprint indicates lush vegetation and no evidence of a visible rocky outcrop.	18

LIST OF TABLES

<i>Table 1: Checklist for Specialist studies conformance with Appendix 6 of the EIA Regulations of 2014 (as amended)</i>	<i>iv</i>
<i>Table 2: Legend of the Thabazimbi 2426 (1974) Geological Map (Council for Geosciences, Pretoria) indicating the geology of the proposed Mmehane township development in Thabazimbi in Limpopo Province.</i>	<i>10</i>
<i>Table 3: Extract of the Palaeotechnical Report of the Limpopo Province (Groenewald, et al., 2014).</i>	<i>11</i>
<i>Table 4: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website)</i>	<i>15</i>
<i>Table 5: The Rating System</i>	<i>19</i>
<i>Table 6: Summary of Impacts</i>	<i>23</i>

Appendix A: CV

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 that lived in the geological past (other than fossil fuels or fossiliferous rock intended for industrial use) and any site which comprises fossilised remains or traces of past life.

LIST OF ABBREVIATIONS

BA	Basic Assessment
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
CA	National Competent Authority
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EMPr	Environmental Management Programme
ESO	Environmental Site Officer
HIA	Heritage Impact Assessment
Ma	Millions of years ago
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PIA	Palaeontological Impact Assessment
PL	Powerline
PSSA	Palaeontological Society of South Africa
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
S&EIA	Scoping & Environmental Impact Assessment
ToR	Terms of Reference

1 INTRODUCTION

The proposed 275 MW Koedoeskop Solar PV Facility is planned on Portion 1 of the farm Zwartwitpensbokfontein 434-KQ near Thabazimbi in Limpopo Province (Figure 1-2).

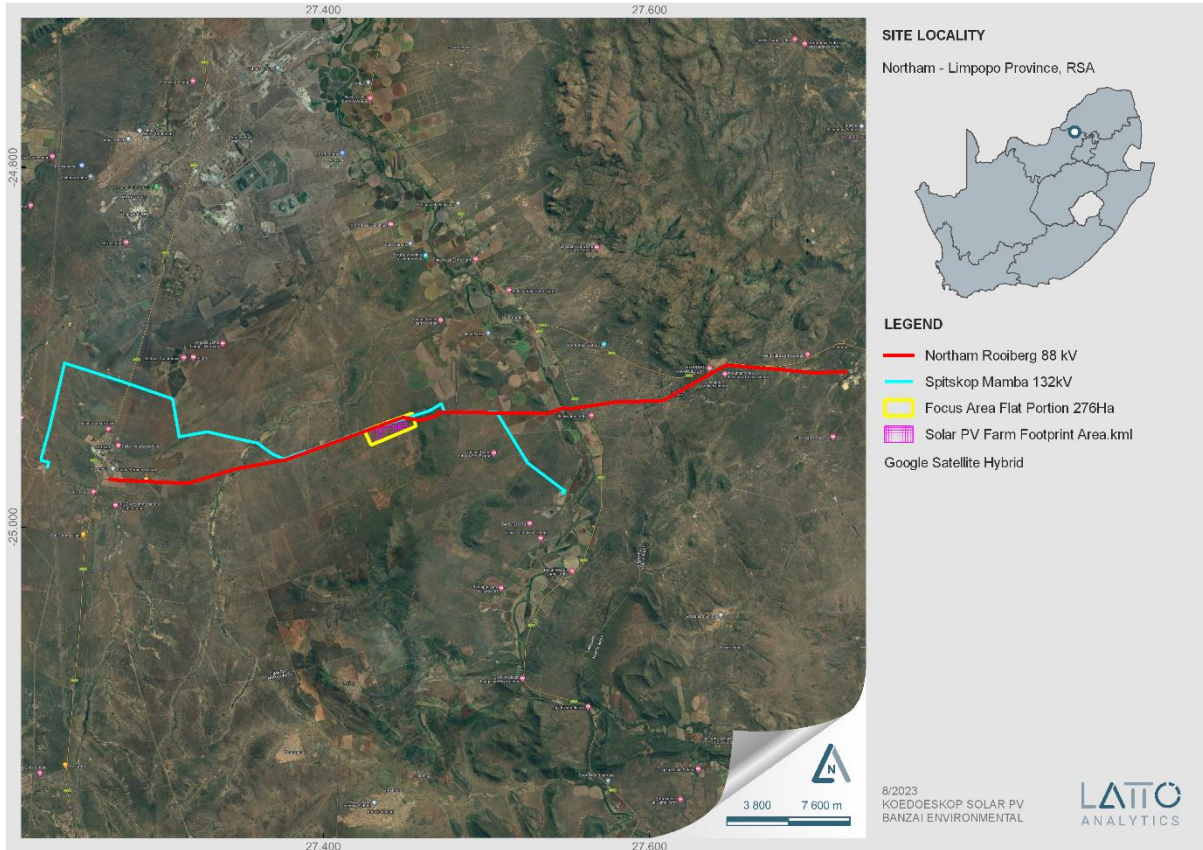


Figure 1: Regional locality of the proposed 275MW Solar PV Facility near Thabazimbi in Limpopo Province.

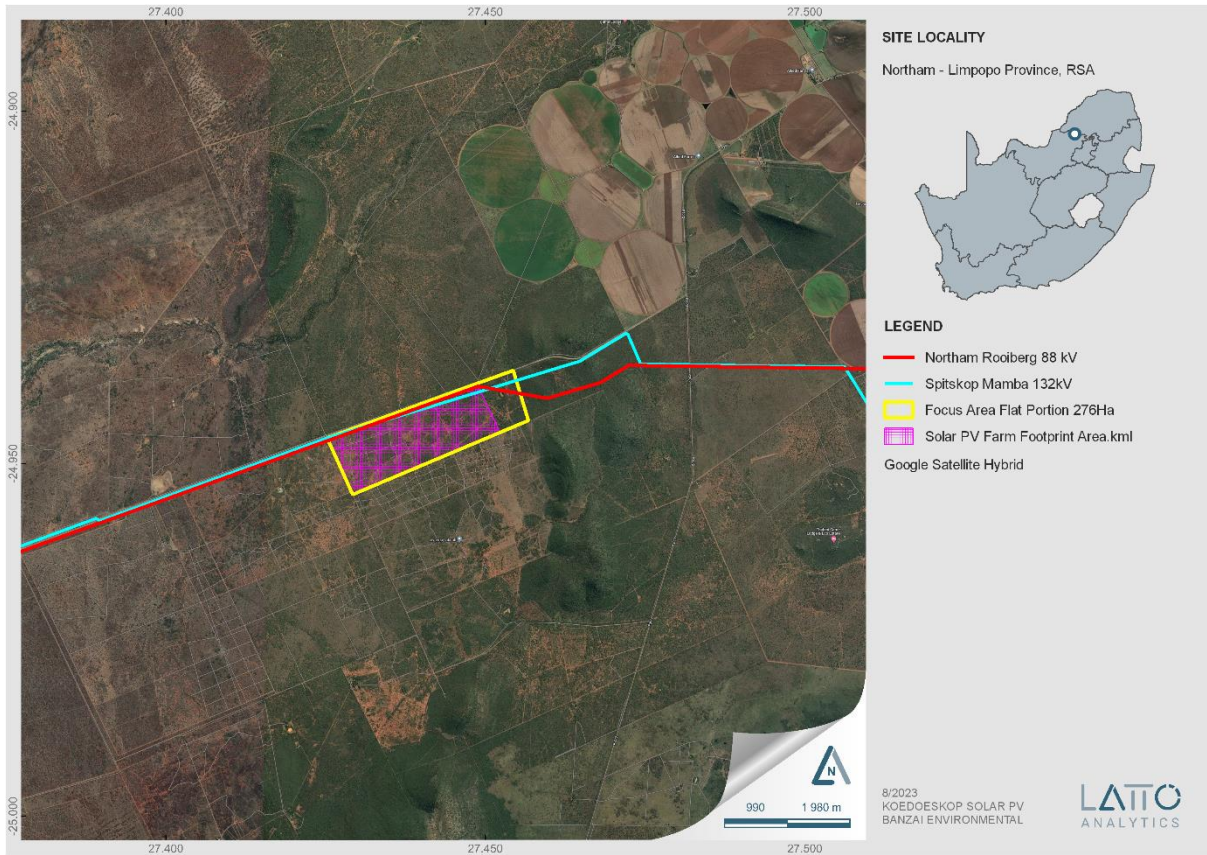


Figure 2: Close-up of proposed 275MW Solar PV Facility near Thabazimbi in Limpopo Province.



2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Mrs. Elize Butler conducted the current study. For developments in the Free State, KwaZulu-Natal, Eastern, Central, and Northern Cape, Northwest, Gauteng, Limpopo, and Mpumalanga, she has completed almost 300 palaeontological impact assessments. She has an MSc (*cum laude*) in Zoology with a focus in Palaeontology from the University of the Free State in South Africa, and she has more than 30 years of experience in the field. She has knowledge of finding, collecting, and curating fossils. She began conducting PIAs in 2014 and has been a member of the Palaeontological Society of South Africa (PSSA) since 2006.

3 LEGISLATION

3.1 National Heritage Resources Act (25 of 1999)

Cultural Heritage in South Africa, including 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 m² 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

This PIA assesses the development's potential impact on the fossil heritage. This Palaeontological Assessment is part of the HIA Report. The PIA's goals are to: 1) identify the palaeontological significance of the rock formations in the footprint; 2) evaluate the palaeontological magnitude of the formations; 3) clarify the impact on fossil heritage; and 4) make recommendations for how the developer might protect and minimize potential harm to fossil heritage, according to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports".

Calculations of the palaeontological state of each rock segment and the potential impact of development on fossil history take into account the palaeontological status of the rocks, the type of development, and the amount of bedrock removed.



The Provisional DFFE Screening Tool, the SAHRIS Palaeosensitivity map, all Palaeontological Impact Assessment reports for the same area, Google Earth images, topographical and geological maps, as well as academic articles about specimens from the development area and Assemblage Zones, are all used to create scoping reports.

When the development footprint has a moderate to high palaeontological sensitivity, a field-based assessment is necessary. A desktop or field assessment of the exposed rock is used to evaluate the significance of the proposed development's impact, and recommendations for more research or mitigation are made. Excavations for the project often only take place during the building phase, changing the terrain and destroying or permanently encasing fossils at or below the ground surface. Then, access to Fossil Heritage will no longer be available for academic study.

When doing a site investigation, a palaeontologist examines the local development as well as the quantity and variety of fossils found there. This can be demonstrated by looking at representative fossiliferous rock exposures (most igneous and metamorphic rocks are not fossiliferous, whereas sedimentary rocks contain fossil heritage). Examined rock exposures frequently contain a sizeable portion of the stratigraphic unit, which is primarily made up of recently exposed (unweathered) rock. These exposures may be man-made (such as quarries, open building excavations, even railway and road cuttings) or natural (such as cliffs, and dongas as well as rocky outcrops along stream or river banks). It is usual practice for palaeontologists to record well-preserved fossils (GPS, and stratigraphic data) during field assessment examinations.

Although mitigation is often done prior to construction, it may take place if potentially fossiliferous bedrock is revealed. Fossil collection and documentation are examples of mitigation. A permit from SAHRA must be obtained before beginning any fossil excavation, and the material must be stored at an authorized facility. When mitigation is used correctly, it is possible to have a positive impact by raising awareness of the palaeontological past of the area.

By physically evaluating bedrock outcrops to determine their lithology and fossil richness and crisscrossing the development footprint, one can assess an area's fossil potential. Because the presence of fossils at the surface is so unexpected, an average sample size of the region is investigated. To be clear, however, the lack of fossils in a development footprint does not automatically suggest that there is no paleontologically important material present on the site (on or below the 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 the proposed project and provide information regarding the developer and consultant who commissioned the study;
- Describe the 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 geology of the area is the focal point of geological maps, and the sheet explanations of the Geological Maps were not intended to focus on palaeontological heritage. Many inaccessible areas of South Africa have never been examined by palaeontologists, and data is typically dependent solely on aerial pictures. Locality and geological information in museums and university databases are out of date, and data acquired in the past is not always adequately documented.



Comparable Assemblage Zones in other places are also used to provide information on the existence of fossils in areas that have not before been recorded. When similar Assemblage Zones and geological formations are used for Desktop studies, it is commonly assumed that exposed fossil exists within the footprint. As a result, a field assessment will improve the accuracy of the desktop evaluation.

5 GEOLOGICAL AND PALAEOLOGICAL HISTORY

The geology of the proposed Koedoeskop Solar PV Facility near Thabazimbi in Limpopo is depicted on the 1: 250 000 Thabazimbi 2426 (1974) Geological Map (Council for Geosciences, Pretoria) (**Figure 3, Table 2**). This map indicates that a small portion in the east of the study area is underlain by the Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (T2, blue; Chuniespoort Group, Transvaal Supergroup), while the largest portion of the development is underlain by the Daspoort Formation (T3dS, brown) of the Pretoria Group (Transvaal Supergroup) However, updated geology (mapped by the Council of Geosciences, Pretoria) is depicted in **Figure 4** and indicates that the Malmani Subgroup, (Littleton and Penge Formations), as well as the Timeball Hill and Rooihogte Formations (Pretoria Group) is represented in the development footprint.

The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) (**Figure 5, Table 4**) indicates that the Palaeontological Sensitivity of the Malmani Subgroup is Very High (Almond et al., 2013; SAHRIS website). The Palaeotechnical Report of the Limpopo Province (Groenewald et al., 2014) allocates a High Palaeontological Sensitivity to the Malmani Subgroup in this area and shows that it is represented by the Lyttelton Formation (**Table 6**).

The Precambrian Transvaal Supergroup (**Figure 7**) is approximately 2550-2050 Ma years old (Bekker et al. 2008; Catuneanu et al. 1999) (Late Archaean to Early Proterozoic) and is about 15 km thick. This Supergroup consists of sedimentary, volcanic and unmetamorphosed clastic rocks. The sandstone-dominated Magaliesberg Formation overlies the mudrocks of the Silverton Formation, and in turn, the Silverton Formation overlies the sandstone-dominated Daspoort Formation. Erickson, et al., 1993 suggested that the Daspoort Formation probably indicates the beginning of a marine transgression that regulated the deposition of the shales of the Silverton Formation as well as the sandstones of the Magaliesburg Formation. Evidence for this suggestion is the existence of thin stromatolitic carbonates and cherts at the top of the Daspoort Formation passing into compressed transgressive chert or dolomite covered by shales of the Silverton Formation.

The Timeball Hill Formation comprises of conglomerates, diamictite, quartzite, minor lavas with lacustrine and fluvio-deltaic mudrocks, while the overlying Klapperkop Member of the Timeball Hill Formation consists of conglomerate, quartzite, shale and siltstone (Groenewald 2014). Catuneanu &



Eriksson (2002) are of the opinion that the Timeball Hill Formation was deposited within a deep marine basin (Figure 8).

The Timeball Hill Formation is known to contain stromatolites and is associated with thin carbonate interbeds within turbidite sequences in the lower part of the formation (Catuneanu & Eriksson 2002). Stromatolites have not been recorded from the overlying fluvio-deltaic Klapperkop Quartzite Member. Other subunits in the Pretoria Group comprising stromatolites possibly also contain organic-walled microfossils.

The Malmani Subgroup carbonates of the Transvaal Basin comprise an assortment of stromatolites (microbial laminates), ranging from supratidal mats to intertidal columns and large subtidal domes (Eriksson *et al.* 2006). Stromatolites are layered mounds, columns and sheet-like sedimentary rocks. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (simplest form of modern carbon-based life). Stromatolites are first found in Precambrian rocks and are known as the earliest known fossils. These algae photosynthesised in the low oxygen atmosphere and deposited layer upon layer of calcium sulphate, magnesium sulphate and calcium carbonate as well as other compounds to form these domes. Researchers have examined and classified the stromatolite structures but seldom find preserved algal cells. The oxygen atmosphere that we depend on today was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

Stromatolites and oolites from the Transvaal Supergroup have been described by various authors (Eriksson and Altermann, 1998). Detailed descriptions of South African Archaean stromatolites are available in the literature (Altermann, 2001; Buick, 2001; and Schopf, 2006). The Malmani stromatolites literature includes articles by Truswell and Eriksson (1972, 1973, 1975), Eriksson and MacGregor (1981), Eriksson and Altermann (1998), Sumner (2000), Schopf (2006).

The Malmani Subgroup succession is about 2 km-thick and consists of a series of formations of oolitic and stromatolitic carbonates (limestones and dolomites), black carbonaceous shales and minor secondary cherts. The Malmani Dolomites also consist of historic lime mines and palaeocave fossil deposits. Dolomite (limestone rock) forms in warm, shallow seas from slow-gathering remains of marine microorganisms and fine-grained sediment. Dolomites of the Malmani Subgroup have a higher magnesium content than other limestones. These materials contain high levels of calcium carbonate and are often referred to as *carbonates*.



Currently, very few palaeontologists study stromatolites but geologists find the stromatolites interesting because they reveal the change from a reducing environment (that is, an oxygen-poor) to an oxidizing environment (oxygen-rich). This transition is known as the Great Oxygen Event (Eroglu et al., 2017).

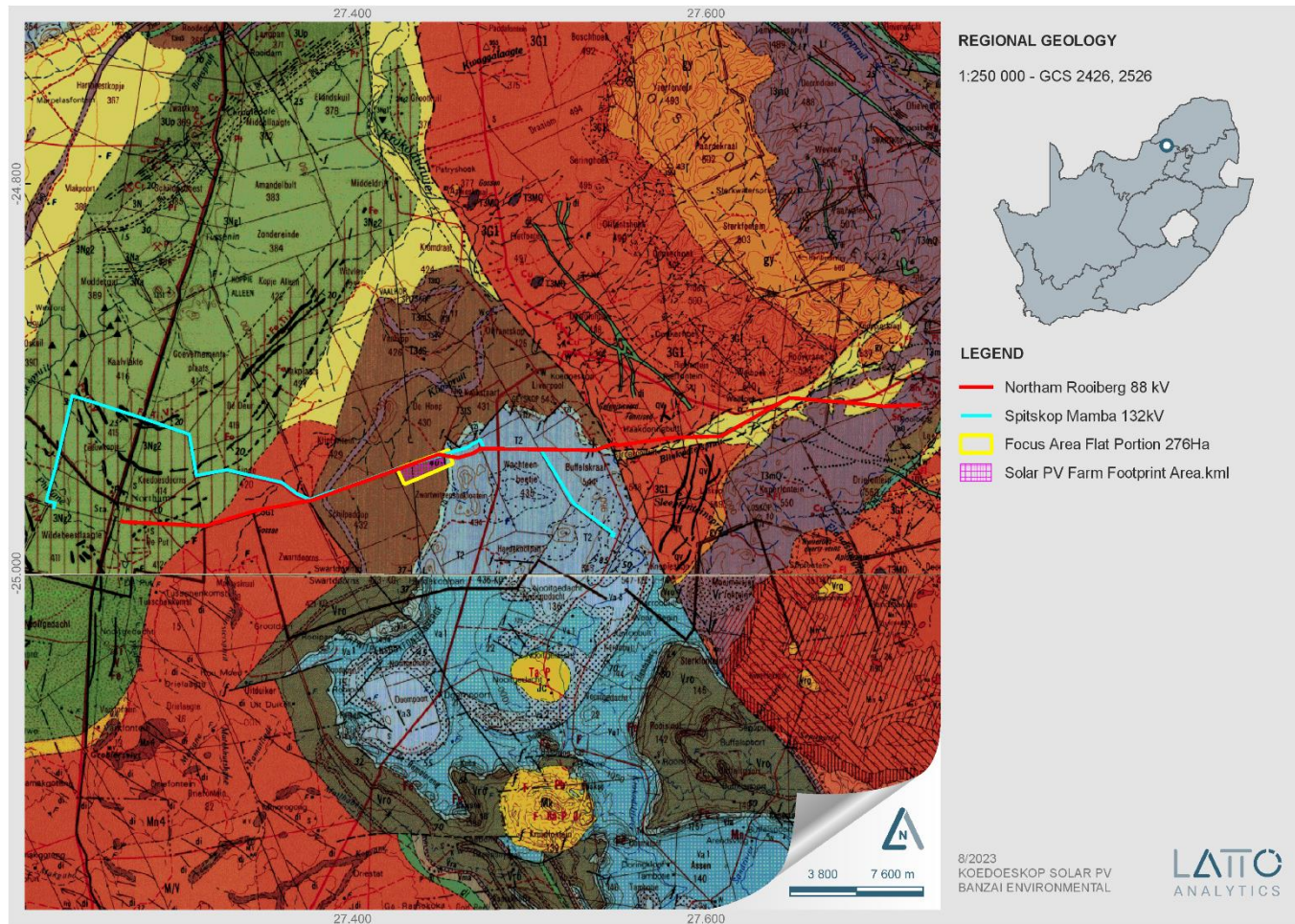


Figure 3: Extract of the 1:250 000 Thabazimbi 2426 (1974) Geological Map (Council for Geosciences, Pretoria) indicates that the proposed Koedoeskop solar PV Facility is underlain by the Malmani Subgroup (T2, blue; Chuniespoort Group Transvaal Supergroup) as well as the Daspoort Formation (T3dS, brown) (Pretoria Group, Transvaal Supergroup).



Table 2: Legend of the Thabazimbi 2426 (1974) Geological Map (Council for Geosciences, Pretoria) indicating the geology of the proposed Mmehane township development in Thabazimbi in Limpopo Province.

Relevant sediment is indicated in red.

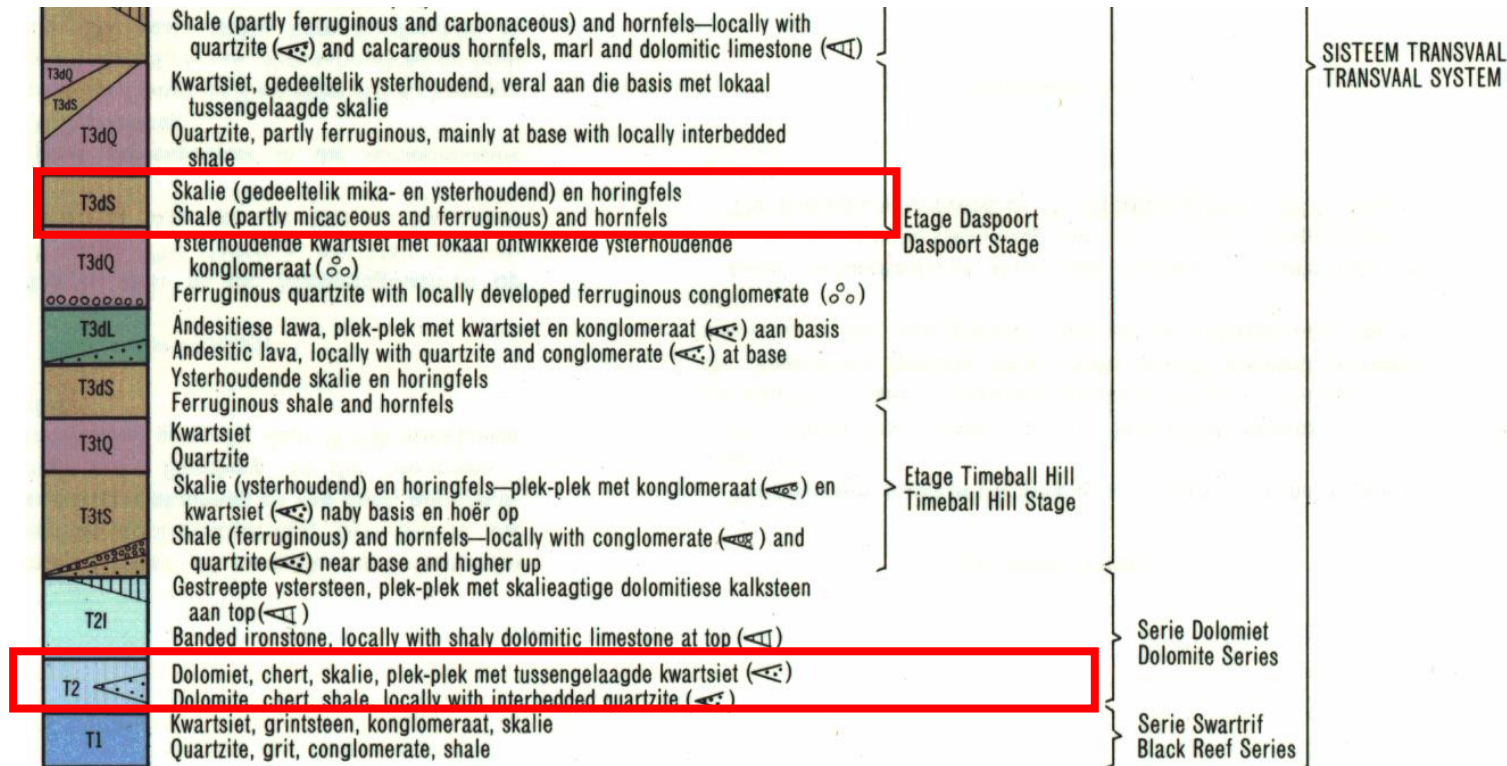




Table 3: Extract of the Palaeotechnical Report of the Limpopo Province (Groenewald, et al., 2014).

Relevant sediments are indicated in red polygons.

Region	Sub-Region	Formation	Age	Lithology	Fossil Record	Notes
TRANSVAAL	PRETORIA (V01, V03, V07, V09)	MAKOPAN	Salie Sloot (Vso)	Mudstone	No fossils recorded	Pretoria Group subunits with stromatolites probably also contain microfossils. This may also apply to carbonaceous mudrocks. ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS WITHIN OUTCROP AREA OF CARBONATE SUBUNITS – i.e. LIMESTONES & DOLOMITES (breccias not individually mapped) Rooiberg Group was previously included within top of Transvaal Supergroup but now regarded as separate succession
			Rifffontein (Vrf)	Sandstone	No fossils recorded	
			Cyferfontein (Vcf)	Mudstone	No fossils recorded	
			Kwarnehoek (Vkh)	Sandstone and conglomerate	No fossils recorded	
		Rayton (Vr)	Quartzite and shales	No fossils recorded		
		Dullstroom (Vdb)	Volcanic rocks	No fossils recorded		
		Houtenbek (Vh)	Quartzite, limestone, chert	Stromatolites		
		Steenkampsberg (Vsq)	Quartzite and shales	No fossils recorded		
		Nederhorst (Vn; Vne)	Fine-grained hornfels and granite	No fossils recorded		
		Lakenvale (Vl; Vlm)	Alluvial sandstone	No fossils recorded		
		Vermont (Vve; Vve1; Vvm)	Mudrock and tuffs	Stromatolites		
		Magaliesberg (Vmg Vim)	Coastal sandstones with mudrocks	Microbial mat structures (Desiccated mats sometimes resemble trace fossils)		
		Intrusive Shelter Norite (Vsh; Vsh1)	Norite	No fossils recorded		
		Silverton (Vsi; Vsi1; Vsi3; Vsi3)	Lydenburg (Vsi; Vld; Vld1)	Shale, mudstone and carbonate layers	Stromatolites	
			Machadodorp (Vsm; Vsm1; Vsm2; Vmc)	Fine-grained tuff and basic lava	No fossils recorded	
Boven (Vso; Vbn; Vbn1)	Marine shale and mudrocks with tuff and minor carbonates		Stromatolites			
Igneous intrusions (Vdi)	Igneous intrusions	No fossils recorded				
Daspoort (Vds, Vhd, Vdq)	Alluvial, fluvial and deltaic sandstones and mudrocks, marine sediments in east	Stromatolites				
PRETORIA		Strubenkop (Vs, Vhd, Vst)	Lacustrine mudrocks with minor sandstone	No fossils recorded	ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS WITHIN OUTCROP AREA OF CARBONATE SUBUNITS – i.e. LIMESTONES & DOLOMITES (breccias not individually mapped)	
		Dwaalheuwel (Vdw, Vhd)	Alluvial sandstones, conglomerates and mudrocks	No fossils recorded		
		Hekpoort (Vh, Vhd, Vha)	Volcanics (basalts, pyroclastics) with minor lacustrine shales	No fossils recorded		
		Boshoek (Vb)	Sandstones, conglomerates, diamictite (alluvial fans, slumps)	No fossils recorded		
		Timeball Hill (Vt; Vti)	Klapperkop (Vkp)	Lacustrine and fluvio-deltaic mudrocks with diamictite, conglomerates, quartzite, minor lavas. Shale, siltstone, conglomerate, quartzite		Stromatolites
		Rooihoogte (Vt)	Basal breccio-conglomerates, quartzites, mudrocks, carbonates (alluvial fan, lakes, karst infill)	No fossils recorded		
Duitschland (Vd)	Conglomerate	No fossils recorded				
CHUNIESPOORT	Malmant (Vmr; Vmd; Vmas; Vma1; Vma4; Vma7)	Penge (Vp; Vpe)	Iron-rich shale	Stromatolites	Stromatolites in Makapansgat Valley ALERT FOR POTENTIALLY FOSSILIFEROUS LATE CAENOZOIC CAVE BRECCIAS WITHIN "TRANSVAAL DOLOMITE" OUTCROP AREA (breccias not individually mapped)	
		Lyttelton (Vly)	Stromatolitic carbonates (limestones / dolomites), minor secondary cherts, mudrocks including carbonaceous shales	Range of shallow marine to intertidal stromatolites (domes, columns etc), organic-walled microfossils		

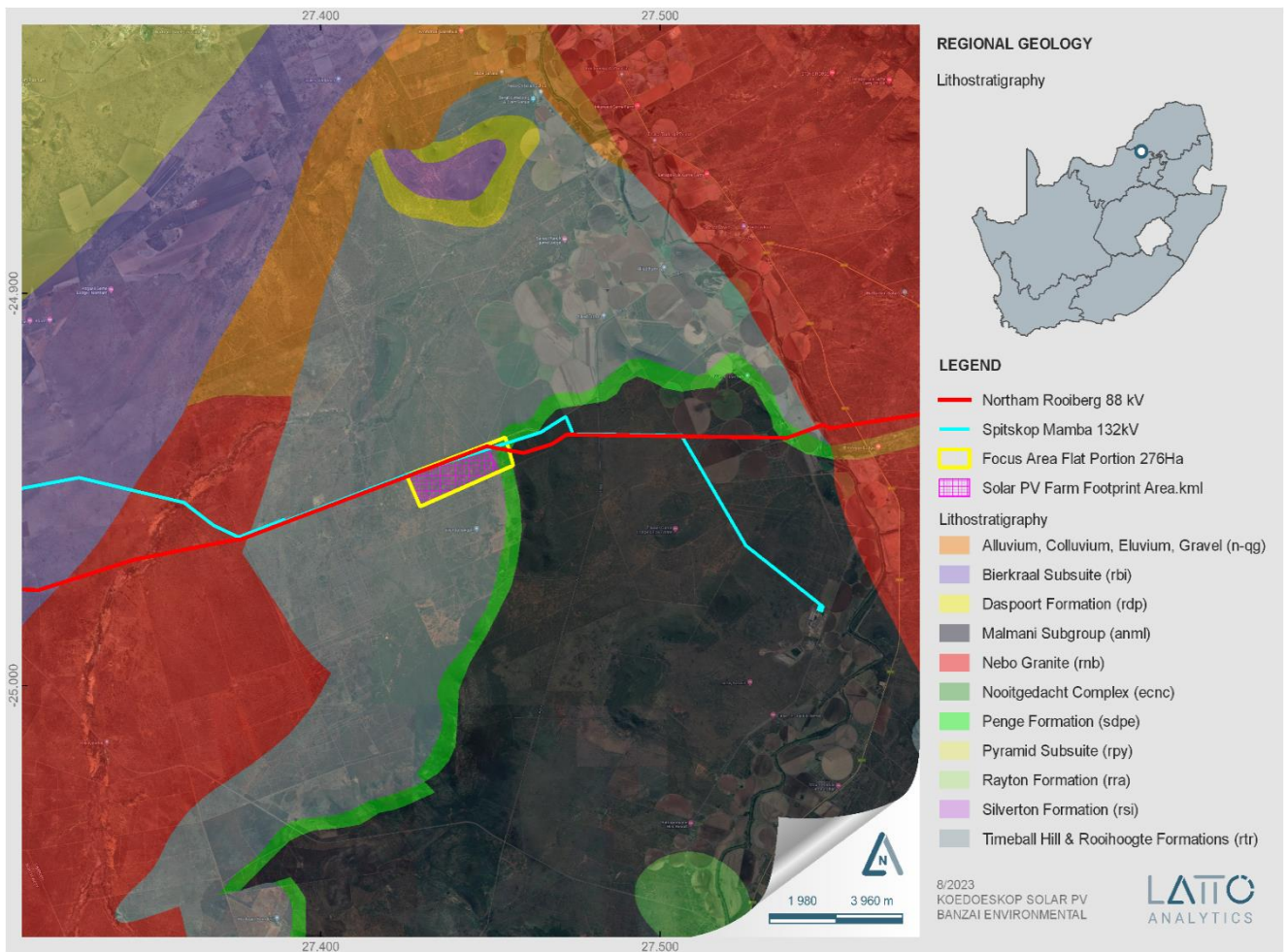


Figure 4: Updated Geology (Groenewald et al., 2014) indicates that the Koedoeskop Solar PV plant is underlain by the Malmani Subgroup, Penge Formation as well as the Timeball Hill and Rooihoogte Formations



The SAHRIS Palaeosensitivity map (Figure 5) indicates that the proposed study area is underlain by sediments with Very High (red) and High (orange) Palaeontological Sensitivity.

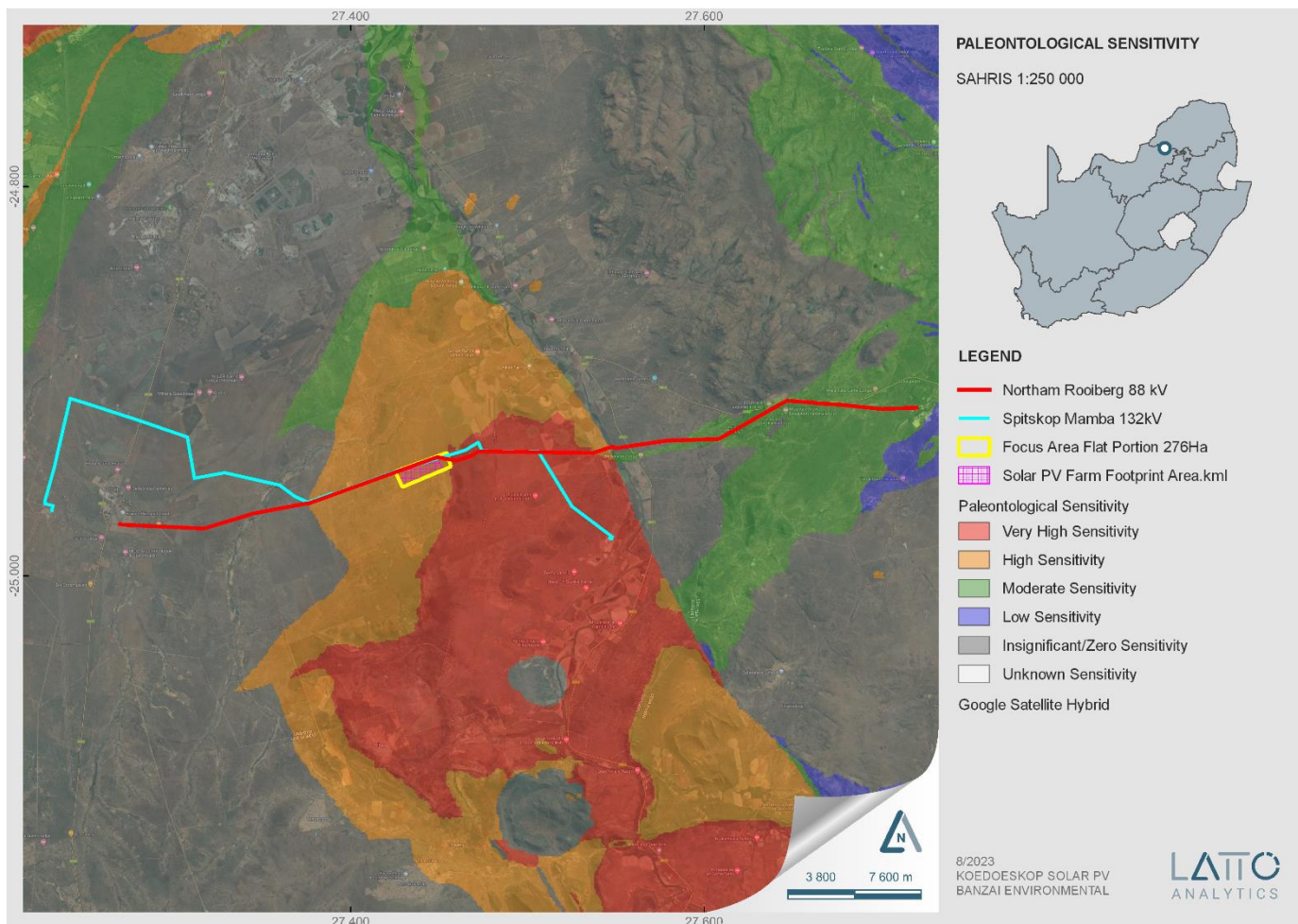
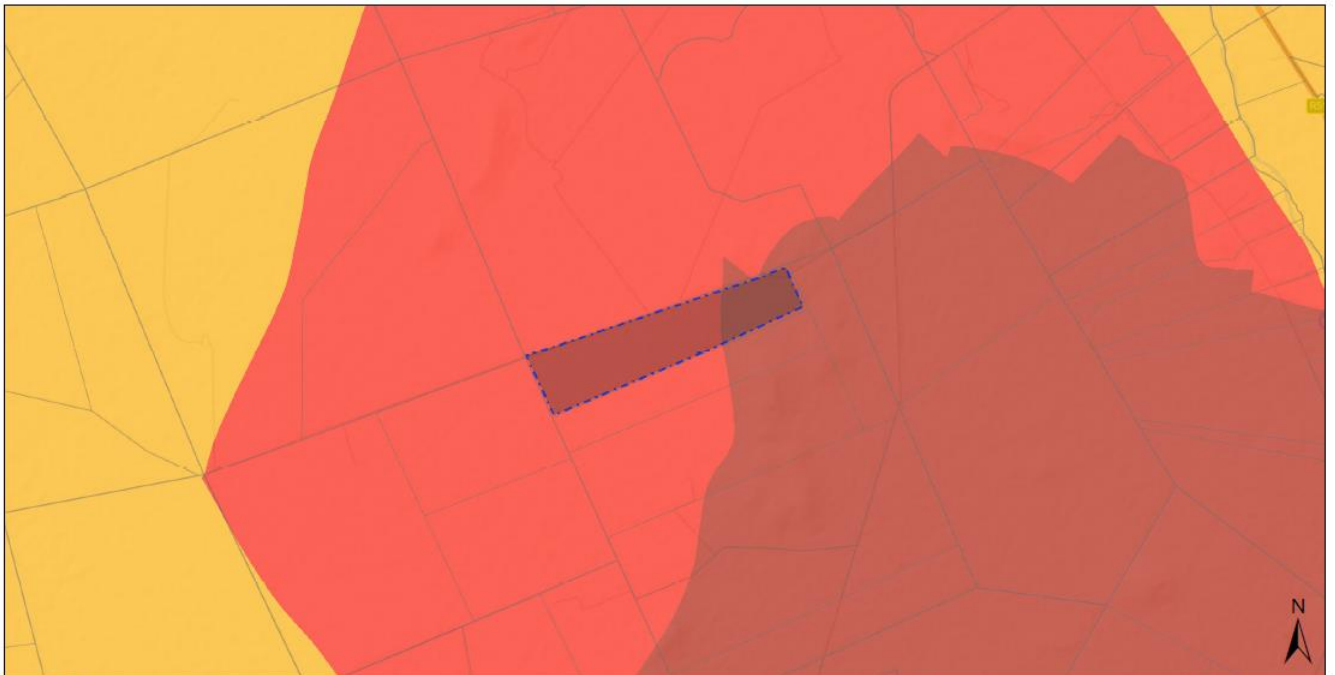


Figure 5: Extract of the 1: 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the proposed township development.



29 August 2023

Legend

- | | | | |
|---------------------------------------|--------------|--|-----|
| Koedoeskop Solar PV area | Erven | Public Place | Low |
| Site Area | Farm Portion | Paleontology Combined Sensitivity | |
| EIA Application Development Footprint | Farm | Very High | |
| EIA Application Site | Agri Holding | High | |
| National Jurisdiction Area | | Medium | |

0 2.75 5.5
km
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Swi Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

Copyright 2023
National Department of Environmental Affairs,
Government of South Africa.

Figure 6: Palaeontological Sensitivity of the Koedoeskop Solar PV Facility generated by the National Environmental Web-bases Screening Tool.

The National Environmental Web-bases Screening Tool indicates that the development is underlain by sediments with a Very High (dark red) and High (red) Palaeontological Sensitivity.



Table 4: Palaeontological Sensitivity according to the SAHRIS PalaeoMap (Almond et al, 2013; SAHRIS website)

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

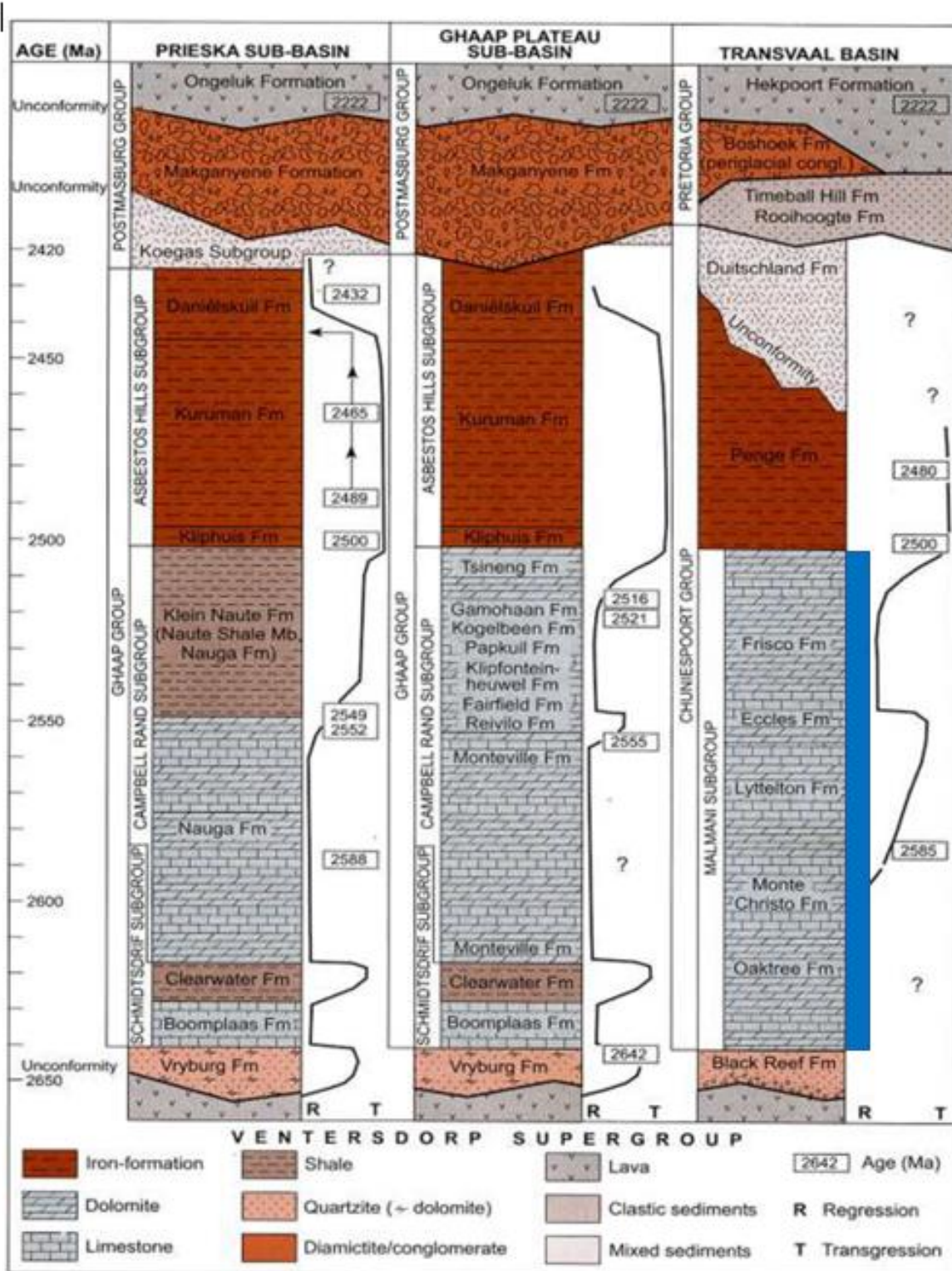


Figure 7: Stratigraphy of the Transvaal Supergroup of the Transvaal Basin. The proposed development is indicated in blue (Eriksson, et al. 2006).

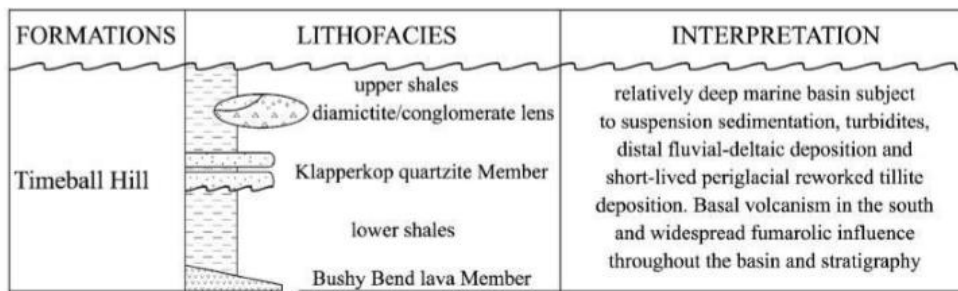


Figure 8: Stratigraphy and depositional settings of the Timeball Hill Formation at the base of the Pretoria succession (Catuneanu and Eriksson 2002).

6 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)
- A Google Earth map with polygons of the proposed development was obtained from Ubique Consultants.
- 1:250 000 1: 250 000 Thabazimbi 2426 (1974) Geological Map (Council for Geosciences, Pretoria)
- Palaeotechnical report of the Limpopo Province (Groenewald et al., 2014)

7 SITE VISIT

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 27 August 2023. The site is very overgrown with lush vegetation as well as trees. No fossiliferous outcrops were detected in the development footprint.



Figure 9: View over the development footprint indicates lush vegetation and no evidence of a visible rocky outcrop.



8 IMPACT ASSESSMENT METHODOLOGY

Impact assessment must take account of the nature, scale and duration of impacts on the environment, whether such impacts are positive or negative. Each impact is also assessed according to the following project phases:

- Construction;
- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact, the following criteria is used:

Table 5: The Rating System

NATURE		
The Nature of the Impact is the possible destruction of fossil heritage		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be experienced.		
1	Site	The impact will only affect the site.
2	Local/district	Will affect the local area or district.
3	Province/region	Will affect the entire province or region.
4	International and National	Will affect the entire country.
PROBABILITY		
This describes the chance of occurrence of an impact.		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).



2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).

DURATION

This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity.

1	Short term	The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite.

INTENSITY/ MAGNITUDE

Describes the severity of an impact.

1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/component still



3		continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

REVERSIBILITY

This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity.

1	Completely reversible	The impact is reversible with implementation of minor mitigation measures.
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.

IRREPLACEABLE LOSS OF RESOURCES

This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.

1	No loss of resource	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.



4	Complete loss of resources	The impact is result in a complete loss of all resources.
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible cumulative impact	The impact would result in negligible to no cumulative effects.
2	Low cumulative impact	The impact would result in insignificant cumulative effects.
3	Medium cumulative impact	The impact would result in minor cumulative effects.
4	High cumulative impact	The impact would result in significant cumulative effects
SIGNIFICANCE		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula: (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity. The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.		
Points	Impact significance rating	Description
6 to 28	Negative low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive medium impact	The anticipated impact will have moderate positive effects.



51 to 73	Negative high impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive high impact	The anticipated impact will have significant positive effects.
74 to 96	Negative very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive very high impact	The anticipated impact will have highly significant positive

8.1 Summary of Impact Tables

Loss of fossil heritage will have a negative impact. Only the site will be affected by the proposed development. The expected duration of the impact is assessed as potentially permanent too long term. In the absence of mitigation procedures, the damage or destruction of any palaeontological materials will be permanent. Impacts on palaeontological heritage during the construction phase could potentially occur and are regarded as having a negatable probability. The magnitude of the impact on the fossil heritage will be low. The significance of the impact occurring will be low.

<i>Table 6: Summary of Impacts</i> (Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity							
	Extent	Duration	Magnitude	Reversibility	Irreplicable loss	Cumulative effect	Impact
Pre-Mitigation	1	4	2	4	4	2	30
Post-Mitigation	1	4	1	4	4	1	15

9 FINDINGS AND RECOMMENDATIONS

The Thabazimbi geological map indicates that the proposed Koedoeskop SPP is underlain by a small portion of Precambrian dolomites and associated marine sedimentary rocks of the Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup), while the largest portion is underlain by the Daspoort



Formation of the Pretoria Group. However, updated geology (compiled by the Council for Geosciences) refined the geology and indicates that the development is underlain by Malmani Subgroup (Chuniespoort Group, Transvaal Supergroup) and the Timeball Hill and Rooihoogte Formations of the Pretoria Group (Transvaal Supergroup).

The PalaeoMap of the South African Heritage Resources Information System (SAHRIS) indicates that the the Palaeontological Sensitivity of the Malmani Subgroup is Very High, while that of the Daspoort Formation is High (Almond *et al.*, 2013; SAHRIS website). The suggested location is classified as having a Very High Palaeontology Theme Sensitivity in the DEA Screening Report.

A site-specific field survey of the development footprint was conducted on foot and by motor vehicle on 27 August 2023. No fossiliferous outcrop was detected in the proposed development. The apparent rarity of fossil heritage in the proposed development footprint suggests that the impact of the development will be of Low significance in palaeontological terms. 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 to its whole extent, as the development footprint is not considered sensitive in terms of palaeontological resources.

However, if fossil remains are discovered during any phase of construction, either on the surface or uncovered by excavations, the Chance Find Protocol must be implemented. These discoveries must be secured and the ECO/site manager ought to alert SAHRA (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za) so that appropriate mitigation (documented and collection) can be undertaken by a professional palaeontologist. The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university), and all fieldwork and reports must meet the minimum standards for palaeontological impact studies developed by SAHRA.

Preceding any collection of fossil material, the specialist would need to apply for a collection permit from SAHRA. Fossil material must be curated in an accredited collection (museum or university collection), while all fieldwork and reports should meet the minimum standards for palaeontological impact studies required by SAHRA.

10 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 (including 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 is 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 uncover 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.

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 who in turn must report the find to his/her manager and the ESO or site manager. The ESO or site manager must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.



- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.
- Upon receipt of the preliminary report, the Heritage Agency will inform the ESO (or site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.
- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- If the fossil cannot be stabilized the fossil may be collected with extreme care by the ESO. Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once the Heritage Agency has issued the written authorization, the developer may continue with the development on the affected area.

11 BIBLIOGRAPHY

Almond, J., Pether, J, And Groenewald, G. 2013. South African National Fossil Sensitivity Map. SAHRA and Council for Geosciences. Schweitzer *et al.* (1995) pp p288.

Altermann, W. 2001. The oldest fossils of Africa – a brief reappraisal of reports from the *Archaean*. *African Earth Sciences* 33, 427-436.

Altermann, W. And Wotherspoon, J. McD. 1995. The carbonates of the Transvaal and Griqualand West sequences of the Kaapvaal craton, with special reference to the Lime Acres limestone deposit. *Mineralium Deposita* 30, 124-134.

Bamford, M.E., 2019. Palaeontological Impact Assessment for three proposed PV projects near Lichtenburg, Northwest Province.

Beukes, N.J. 1983. Palaeoenvironmental setting of iron formations in the depositional basin of the Transvaal Supergroup, South Africa. In: Trendall, A.F. & Morris, R.C. (Eds.) *Iron-formation: facts and problems*, 131-210. Elsevier, Amsterdam.

Beukes, N.J. 1986. The Transvaal Sequence in Griqualand West. In: Anhaeusser, C.R. & Maske, S. (Eds.) *Mineral deposits of Southern Africa*, Volume 1, pp. 819-828. Geological Society of South Africa.

Beukes, N.J., Lowe, D.R., 1989. Environmental control on diverse stromatolite morphologies in the 3000 Myr Pongola Supergroup, South Africa *Sedimentology* 36, 383--397.

Beukes, N.J. & Klein, C. 1990. Geochemistry and sedimentology of facies transition from the micro banded to granular iron-formation in the Early Proterozoic Transvaal Supergroup, South Africa. *Precambrian Research* 47, 99-139.

Buick, K. 2001. *Life in the Archaean*. In: Briggs, D.E.G. & Crowther, P.R. (eds.) *Palaeobiology II*, 13-21. Blackwell Science, London.



- Buttrick, D.B., Van Rooy, J.L. & Ligthelm, R. 1993. Environmental geological aspects of the dolomites of South Africa. *Journal of African Earth Sciences* 16, 53-61.
- Catuneanu, O. & Eriksson, P.G. 1999. The sequence stratigraphic concept and the Precambrian rock record: an example from the 2.7-2.1 Ga Transvaal Supergroup, Kaapvaal craton. *Precambrian Research* 97, 215-251.
- Du Toit, A. 1954. *The geology of South Africa*. xii + 611pp, 41 pls. Oliver & Boyd, Edinburgh.
- Eriksson, K.A. & Macgregor, I.M. 1981. Precambrian palaeontology of southern Africa. In: Hunter, D.R. (Ed.) *Precambrian of the southern hemisphere*, pp. 813-833. Elsevier, Amsterdam.
- Eriksson, P.G., Schweitzer, J.K., Bosch, P.J.A., Schreiber, U.M., Van Deventer, L. & Hatton, C.J. 1993. The Transvaal Sequence: an overview. *Journal of African Earth Sciences* 16, 22-51.
- Eriksson, P.G., Hattingh, P.J. & Altermann, W. 1995. An overview of the geology of the Transvaal Sequence and Bushveld Complex, South Africa. *Mineralia Deposita* 30, 98-111.
- Eriksson, P.G. & Altermann, W. 1998. An overview of the geology of the Transvaal Supergroup dolomites (South Africa). *Environmental Geology* 36, 179-188.
- Eriksson, P.G., Altermann, W. & Hartzler, F.J. 2006. The Transvaal Supergroup and its precursors. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) *The geology of South Africa*, pp. 237-260. Geological Society of South Africa, Marshalltown.
- Eroglu, S., Van Zuilen, M.A., Taubald, H., Drost, K., Will, M., Swanner, E.D., Beukes, N.J., Schoenberg, R., 2017. Depth--dependent $\delta^{13}\text{C}$ trends in platform and slope settings of the Campbell Rand--Malmani carbonate platform and possible implications for Early Earth oxygenation. *Precambrian Research* 302, 122--139.
- Fedorchuk, N.D., Dornbos, S.Q., Corsetti, F.A., Isbell, J.L., Petryshyn, V.A., Bowles, J.A., Wilmeth, D.T., 2016. Early non--marine life: Evaluating the biogenicity of Meso--proterozoic fluvial--lacustrine stromatolites. *Precambrian Research* 275, 105--118.
- Groenewald, G., And Groenewald, D., 2014. SAHRA Palaeotechnical Report: Palaeontological Heritage of the Limpopo Province. Pp1-20.
- Kent, L. E., 1980. Part 1: Lithostratigraphy of the Republic of South Africa, South West Africa/Namibia and the Republics of Bophuthatswana, Transkei, and Venda. SACS, Council for Geosciences, Pp 535-574.
- Klein, C. & Beukes, N.J. 1989. Geochemistry and sedimentology of a facies transition from limestone to iron formation deposition in the early Proterozoic Transvaal Supergroup, South Africa. *Economic Geology* 84, 1733-1774.
- Macrae, C. 1999. *Life etched in stone. Fossils of South Africa*. 305 pp. The Geological Society of South Africa, Johannesburg.
- Moore, J.M., Tsikos, H. & Polteau, S. 2001. Deconstructing the Transvaal Supergroup, South Africa: implications for Paleoproterozoic paleoclimate models. *African Earth Sciences* 33, 437-444.
- Marshak, S., 2005. *Earth. Portrait of a Planet*. 2nd Edition. W.W. Norton & CO., New York. 748 p
- Partridge, T.C., Botha, G.A. & Haddon, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) *The geology of South Africa*, pp. 585-604. Geological Society of South Africa, Marshalltown.



- Rubidge, B.S., 2008. Installation of water pipeline at Kliprivier – Palaeontological Impact Assessment. SAHRA 2012. Minimum standards: palaeontological component of heritage impact assessment reports, 15 pp. South African Heritage Resources Agency, Cape Town.
- Schopf, J.W. 2006. Fossil evidence of Archaean life. *Philosophical Transactions of the Royal Society of London (B)* 361, 869-885.
- Sumner, D.Y. & Beukes, N.J. 2006. Sequence stratigraphic development of the Neoproterozoic Transvaal carbonate platform, Kaapvaal Craton, South Africa. *South African Journal of Geology* 109, 11-22.
- Tankard, A.J., Jackson, M.P.A., Eriksson, K.A., Hobday, D.K., Hunter, D.R. & Minter, W.E.L. 1982. Crustal evolution of southern Africa – 3.8 billion years of earth history, xv + 523pp. Springer Verlag, New York.
- Truswell, J.F. & Eriksson, K.A. 1972. The morphology of stromatolites from the Transvaal Dolomite northwest of Johannesburg, South Africa. *Transactions of the Geological Society of South Africa* 75, 99-110.
- Tankard, A.J., Jackson, M.P.A., Eriksson, K.A., Hobday, D.K., Hunter, D.R. & Minter, W.E.L. 1982. Crustal evolution of southern Africa – 3.8 billion years of earth history, xv + 523pp. Springer Verlag, New York.
- VAN DER WESTHUIZEN, W.A., DE BRUIJN, H., MEINTJES, P.G., 2006. The Ventersdorp Supergroup. In: Johnson, M.R., Anhaeusser, C.R. and Thomas, R.J., (Eds). *The Geology of South Africa*. Geological Society of South Africa, Johannesburg / Council for Geoscience, Pretoria. pp 187-208.



Appendix A – Elize Butler CV

PROFESSION: Palaeontologist
YEARS' EXPERIENCE: 30 years in Palaeontology
EDUCATION: B.Sc Botany and Zoology, 1988
University of the Orange Free State

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

Management Course, 1991
University of the Orange Free State

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

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

MEMBERSHIP

Palaeontological Society of South Africa (PSSA) 2006-currently

EMPLOYMENT HISTORY

Part time Laboratory assistant	Department of Zoology & Entomology University of the Free State Zoology 1989-1992
Part time laboratory assistant	Department of Virology University of the Free State Zoology 1992
Research Assistant	National Museum, Bloemfontein 1993 – 1997
Principal Research Assistant and Collection Manager	National Museum, Bloemfontein 1998–2022

TECHNICAL REPORTS

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

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

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

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

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



- Butler, E. 2015. Palaeontological impact assessment of the proposed Orange Grove 3500 residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape. Bloemfontein.
- Butler, E. 2015. Palaeontological Impact Assessment of the proposed Gonubie residential development, Buffalo City Metropolitan Municipality East London, Eastern Cape Province. Bloemfontein.
- Butler, E. 2015. Palaeontological Impact Assessment of the proposed Ficksburg raw water pipeline. Bloemfontein.
- Butler, E. 2015. Palaeontological Heritage Impact Assessment report on the establishment of the 65 mw Majuba Solar Photovoltaic facility and associated infrastructure on portion 1, 2 and 6 of the farm Witkoppies 81 HS, Mpumalanga Province. Bloemfontein.
- Butler, E. 2015. Palaeontological Impact Assessment of the proposed township establishment on the remainder of portion 6 and 7 of the farm Sunnyside 2620, Bloemfontein, Mangaung metropolitan municipality, Free State, Bloemfontein.
- Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 1 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse729, near Vryburg, North West Province. Bloemfontein.
- Butler, E. 2015. Palaeontological Impact Assessment of the proposed Woodhouse 2 photovoltaic solar energy facilities and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.
- Butler, E. 2015. Palaeontological Impact Assessment of the proposed Orkney solar energy farm and associated infrastructure on the remaining extent of Portions 7 and 21 of the farm Wolvehuis 114, near Orkney, North West Province. Bloemfontein.
- Butler, E. 2015. Palaeontological Impact Assessment of the proposed Spectra foods broiler houses and abattoir on the farm Maiden Manor 170 and Ashby Manor 171, Lukhanji Municipality, Queenstown, Eastern Cape Province. Bloemfontein.
- Butler, E. 2016. Palaeontological Impact Assessment of the proposed construction of the 150 MW Noupoot concentrated solar power facility and associated infrastructure on portion 1 and 4 of the farm Carolus Poort 167 and the remainder of Farm 207, near Noupoot, Northern Cape. Prepared for Savannah Environmental. Bloemfontein.
- Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 1 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.
- Butler, E. 2016. Palaeontological Impact Assessment of the proposed Woodhouse 2 Photovoltaic Solar Energy facility and associated infrastructure on the farm Woodhouse 729, near Vryburg, North West Province. Bloemfontein.
- Butler, E. 2016. Proposed 132kV overhead power line and switchyard station for the authorised Solis Power 1 CSP project near Upington, Northern Cape. Bloemfontein.
- Butler, E. 2016. Palaeontological Impact Assessment of the proposed Senqu Pedestrian Bridges in Ward 5 of Senqu Local Municipality, Eastern Cape Province. Bloemfontein.



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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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



- Butler, E. 2017. Palaeontological Impact Assessment of the proposed upgrade of the 132kv and 11kv power line into a dual circuit above ground power line feeding into the Urania substation in Welkom, Free State Province. Bloemfontein.
- Butler, E. 2017. Palaeontological Desktop Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.
- Butler, E. 2017. Palaeontological Impact Assessment of the proposed diamonds alluvial & diamonds general prospecting right application near Christiana on the remaining extent of portion 1 of the farm Kaffraria 314, registration division HO, North West Province. Bloemfontein.
- Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Hartebeesfontein, near Panbult, Mpumalanga. Bloemfontein.
- Butler, E. 2017. Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Rustplaas near Piet Retief, Mpumalanga. Bloemfontein.
- Butler, E. 2018. Palaeontological Impact Assessment for the Proposed Landfill Site in Luckhoff, Letsemeng Local Municipality, Xhariep District, Free State. Bloemfontein.
- Butler, E. 2018. Palaeontological Impact Assessment of the proposed development of the new Mutsho coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.
- Butler, E. 2018. Palaeontological Impact Assessment of the authorisation and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.
- Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province. Bloemfontein.
- Butler, E. 2018. Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape. Bloemfontein.
- Butler, E. 2018. Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.
- Butler, E. 2018. Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province. Bloemfontein.
- Butler, E. 2018. Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.
- Butler, E. 2018. Palaeontological Field Assessment for the proposed re-alignment and de-commissioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.
- Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.
- Butler, E. 2018. Palaeontological field Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.
- Butler, E. 2018. Palaeontological desktop assessment of the proposed Mookodi – Mahikeng 400kV line, North West Province. Bloemfontein.



- Butler, E. 2018. Palaeontological Desktop Assessment for the proposed Thornhill Housing Project, Ndlambe Municipality, Port Alfred, Eastern Cape Province. Bloemfontein.
- Butler, E. 2018. Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328. Bloemfontein.
- Butler, E. 2018. Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng. Bloemfontein.
- Butler, E. 2018 Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.
- Butler, E. 2018. Palaeontological field assessment of the proposed development of the Wildealskloof mixed use development near Bloemfontein, Free State Province. Bloemfontein.
- Butler, E. 2018. Palaeontological Field Assessment of the proposed Megamor Extension, East London. Bloemfontein
- Butler, E. 2018. Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province. Bloemfontein.
- Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of a new 11kV (1.3km) Power Line to supply electricity to a cell tower on farm 215 near Delpportshoop in the Northern Cape. Bloemfontein.
- Butler, E. 2018. Palaeontological Field Assessment of the proposed construction of a new 22 kV single wood pole structure power line to the proposed MTN tower, near Britstown, Northern Cape Province. Bloemfontein.
- Butler, E. 2018. Palaeontological Exemption Letter for the proposed reclamation and reprocessing of the City Deep Dumps in Johannesburg, Gauteng Province. Bloemfontein.
- Butler, E. 2018. Palaeontological Exemption letter for the proposed reclamation and reprocessing of the City Deep Dumps and Rooikraal Tailings Facility in Johannesburg, Gauteng Province. Bloemfontein.
- Butler, E. 2018. Proposed Kalabasfontein Mine Extension project, near Bethal, Govan Mbeki District Municipality, Mpumalanga. Bloemfontein.
- Butler, E. 2018. Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.
- Butler, E. 2018. Palaeontological Desktop Assessment of the proposed Mookodi – Mahikeng 400kV Line, North West Province. Bloemfontein.
- Butler, E. 2018. Environmental Impact Assessment (EIA) for the Proposed 325mw Rondekop Wind Energy Facility between Matjiesfontein and Sutherland in the Northern Cape Province.
- Butler, E. 2018. Palaeontological Impact Assessment of the proposed construction of the Tooverberg Wind Energy Facility, and associated grid connection near Touws River in the Western Cape Province. Bloemfontein.
- Butler, E. 2018. Palaeontological impact assessment of the proposed Kalabasfontein Mining Right Application, near Bethal, Mpumalanga.



- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed Westrand Strengthening Project Phase II.
- Butler, E., 2019. Palaeontological Field Assessment for the proposed Sirius 3 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province
- Butler, E., 2019. Palaeontological Field Assessment for the proposed Sirius 4 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province
- Butler, E., 2019. Palaeontological Field Assessment for Heuningspruit PV 1 Solar Energy Facility near Koppies, Ngwathe Local Municipality, Free State Province.
- Butler, E., 2019. Palaeontological Field Assessment for the Moeding Solar Grid Connection, North West Province.
- Butler, E., 2019. Recommended Exemption from further Palaeontological studies for the Proposed Agricultural Development on Farms 1763, 2372 And 2363, Kakamas South Settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.
- Butler, E., 2019. Recommended Exemption from further Palaeontological studies: of Proposed Agricultural Development, Plot 1178, Kakamas South Settlement, Kai! Garib Municipality
- Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed Waste Rock Dump Project at Tshipi Borwa Mine, near Hotazel, Northern Cape Province:
- Butler, E., 2019. Palaeontological Exemption Letter for the proposed DMS Upgrade Project at the Sishen Mine, Gamagara Local Municipality, Northern Cape Province
- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed Integrated Environmental Authorisation process for the proposed Der Brochen Amendment project, near Groblershoop, Limpopo
- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed updated Environmental Management Programme (EMPr) for the Assmang (Pty) Ltd Black Rock Mining Operations, Hotazel, Northern Cape
- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed Kriel Power Station Lime Plant Upgrade, Mpumalanga Province
- Butler, E., 2019. Palaeontological Impact Assessment for the proposed Kangala Extension Project Near Delmas, Mpumalanga Province.
- Butler, E., 2019. Palaeontological Desktop Assessment for the proposed construction of an iron/steel smelter at the Botshabelo Industrial area within the Mangaung Metropolitan Municipality, Free State Province.
- Butler, E., 2019. Recommended Exemption from further Palaeontological studies for the proposed agricultural development on farms 1763, 2372 and 2363, Kakamas South settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.
- Butler, E., 2019. Recommended Exemption from further Palaeontological Studies for Proposed formalisation of Gamakor and Noodkamp low-cost Housing Development, Keimoes, Gordon Rd, Kai! Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.



- Butler, E., 2019. Recommended Exemption from further Palaeontological Studies for proposed formalisation of Blaauwskop Low-Cost Housing Development, Kenhardt Road, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.
- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed mining permit application for the removal of diamonds alluvial and diamonds kimberlite near Windsorton on a certain portion of Farm Zoelen's Laagte 158, Registration Division: Barkly Wes, Northern Cape Province.
- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed Vedanta Housing Development, Pella Mission 39, Khâi-Ma Local Municipality, Namakwa District Municipality, Northern Cape.
- Butler, E., 2019. Palaeontological Desktop Assessment for The Proposed 920 KWP Groenheuwel Solar Plant Near Augrabies, Northern Cape Province
- Butler, E., 2019. Palaeontological Desktop Assessment for the establishment of a Super Fines Storage Facility at Amandelbult Mine, Near Thabazimbi, Limpopo Province
- Butler, E., 2019. Palaeontological Impact Assessment for the proposed Sace Lifex Project, Near Emalahleni, Mpumalanga Province
- Butler, E., 2019. Palaeontological Desktop Assessment for the proposed Rehau Fort Jackson Warehouse Extension, East London
- Butler, E., 2019. Palaeontological Desktop Assessment for the proposed Environmental Authorisation Amendment for moving 3 Km of the Merensky-Kameni 132KV Powerline
- Butler, E., 2019. Palaeontological Impact Assessment for the proposed Umsobomvu Solar PV Energy Facilities, Northern and Eastern Cape
- Butler, E., 2019. Palaeontological Desktop Assessment for six proposed Black Mountain Mining Prospecting Right Applications, without Bulk Sampling, in the Northern Cape.
- Butler, E., 2019. Palaeontological field Assessment of the Filling Station (Rietvlei Extension 6) on the Remaining Portion of Portion 1 of the Farm Witkoppies 393JR east of the Rietvleidam Nature Reserve, City of Tshwane, Gauteng
- Butler, E., 2019. Palaeontological Desktop Assessment of The Proposed Upgrade of The Vaal Gamagara Regional Water Supply Scheme: Phase 2 And Groundwater Abstraction
- Butler, E., 2019. Palaeontological Desktop Assessment of The Expansion of The Jan Kempdorp Cemetery on Portion 43 Of Farm Guldenskat 36-Hn, Northern Cape Province
- Butler, E., 2019. Palaeontological Desktop Assessment of the Proposed Residential Development on Portion 42 Of Farm Geldunskat No 36 In Jan Kempdorp, Phokwane Local Municipality, Northern Cape Province
- Butler, E., 2019. Palaeontological Impact Assessment of the proposed new Township Development, Lethabo Park, on Remainder of Farm Roodepan No 70, Erf 17725 And Erf 15089, Roodepan Kimberley, Sol Plaatjies Local Municipality, Frances Baard District Municipality, Northern Cape
- Butler, E., 2019. Palaeontological Protocol for Finds for the proposed 16m WH Battery Storage System in Steinkopf, Northern Cape Province



- Butler, E., 2019. Palaeontological Exemption Letter of the proposed 4.5WH Battery Storage System near Midway-Pofadder, Northern Cape Province
- Butler, E., 2019. Palaeontological Exemption Letter of the proposed 2.5ml Process Water Reservoir at Gloria Mine, Black Rock, Hotazel, Northern Cape
- Butler, E., 2019. Palaeontological Desktop Assessment for the Establishment of a Super Fines Storage Facility at Gloria Mine, Black Rock Mine Operations, Hotazel, Northern Cape:
- Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed New Railway Bridge, and Rail Line Between Hotazel and the Gloria Mine, Northern Cape Province
- Butler, E., 2019. Palaeontological Exemption Letter of The Proposed Mixed Use Commercial Development on Portion 17 of Farm Boegoeberg Settlement Number 48, !Kheis Local Municipality in The Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological Desktop Assessment of the Proposed Diamond Mining Permit Application Near Kimberley, Sol Plaatjies Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological Desktop Assessment of the Proposed Diamonds (Alluvial, General & In Kimberlite) Prospecting Right Application near Postmasburg, Registration Division; Hay, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed diamonds (alluvial, general & in kimberlite) prospecting right application near Kimberley, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological Phase 1 Impact Assessment of the proposed upgrade of the Vaal Gamagara regional water supply scheme: Phase 2 and groundwater abstraction. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed seepage interception drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological Desktop Assessment letter for the Proposed PV Solar Facility at the Heineken Sedibeng Brewery, near Vereeniging, Gauteng. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological Phase 1 Assessment for the Proposed PV Solar Facility at the Heineken Sedibeng Brewery, near Vereeniging, Gauteng. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological field Assessment for the Proposed Upgrade of the Kolomela Mining Operations, Tsantsabane Local Municipality, Siyanda District Municipality, Northern Cape Province, Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.
- Butler, E., 2019. Palaeontological Desktop Assessment of the proposed feldspar prospecting rights and mining application on portion 4 and 5 of the farm Rozynen 104, Kakamas South, Kai! Garib Municipality, Zf Mgcawu District Municipality, Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.



Butler, E., 2019. Palaeontological Phase 1 Field Assessment of the proposed Summerpride Residential Development and Associated Infrastructure on Erf 107, Buffalo City Municipality, East London. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Impact Assessment for the proposed re-commission of the Old Balgay Colliery near Dundee, KwaZulu Natal.

Butler, E., 2019. Palaeontological Phase 1 Impact Assessment for the Proposed Re-Commission of the Old Balgay Colliery near Dundee, KwaZulu Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed Environmental Authorisation and Amendment Processes for Elandsfontein Colliery. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Impact Assessment and Protocol for Finds of a Proposed New Quarry on Portion 9 (of 6) of the farm Mimosa Glen 885, Bloemfontein, Free State Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Impact Assessment and Protocol for Finds of a proposed development on Portion 9 and 10 of the Farm Mimosa Glen 885, Bloemfontein, Free State Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Exemption Letter for the proposed residential development on the Remainder of Portion 1 of the Farm Strathearn 2154 in the Magisterial District of Bloemfontein, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Field Assessment for the Proposed Nigel Gas Transmission Pipeline Project in the Nigel Area of the Ekurhuleni Metropolitan Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment for five Proposed Black Mountain Mining Prospecting Right Applications, Without Bulk Sampling, in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E. 2019. Palaeontological Desktop Assessment for the Proposed Environmental Authorisation and an Integrated Water Use Licence Application for the Reclamation of the Marievale Tailings Storage Facilities, Ekurhuleni Metropolitan Municipality - Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Impact Assessment for the Proposed Sace Lifex Project, near Emalahleni, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment for the proposed Golfview Colliery near Ermelo, Msukaligwa Local Municipality, Mpumalanga Province

Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed Kangra Maquasa Block C Mining development near Piet Retief, in the Mkhondo Local Municipality within the Gert Sibande District Municipality. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2019. Palaeontological Desktop Assessment for the Proposed Amendment of the Kusipongo Underground and Opencast Coal Mine in Support of an Environmental Authorization and Waste Management License Application. Banzai Environmental (Pty) Ltd, Bloemfontein.



Butler, E., 2019. Palaeontological Exemption Letter of the Proposed Mamatwan Mine Section 24g Rectification Application, near Hotazel, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Proposed Environmental Authorisation and Amendment Processes for Elandsfontein Colliery. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Extension of the South African Nuclear Energy Corporation (Necsa) Pipe Storage Facility, Madibeng Local Municipality, North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Proposed Piggery on Portion 46 of the Farm Brakkefontien 416, Within the Nelson Mandela Bay Municipality, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological field Assessment for the proposed Rietfontein Housing Project as part of the Rapid Land Release Programme, Gauteng Province Department of Human Settlements, City of Johannesburg Metropolitan Municipality. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Choje Wind Farm between Grahamstown and Somerset East, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application for the Prospecting of Diamonds (Alluvial, General & In Kimberlite), Combined with A Waste License Application, Registration Division: Gordonia and Kenhardt, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Impact Assessment for the Proposed Clayville Truck Yard, Ablution Blocks and Wash Bay to be Situated on Portion 55 And 56 Of Erf 1015, Clayville X11, Ekurhuleni Metropolitan Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Hartebeesthoek Residential Development. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Mooiplaats Educational Facility, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Impact Assessment for the Proposed Monument Park Student Housing Establishment. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Proposed Standerton X10 Residential and Mixed-Use Developments, Lekwa Local Municipality Standerton, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Rezoning and Subdivision of Portion 6 Of Farm 743, East London. Banzai Environmental (Pty) Ltd, Bloemfontein. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment for the Proposed Matla Power Station Reverse Osmosis Plant, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application Without Bulk Sampling for the Prospecting of Diamonds Alluvial near Bloemhof on Portion 3 (Portion



1) of the Farm Boschpan 339, the Remaining Extent of Portion 8 (Portion 1), Portion 9 (Portion 1) and Portion 10 (Portion 1) and Portion 17 (Portion 1) of the Farm Panfontein 270, Registration Division: Ho, North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application Combined with a Waste Licence Application for the Prospecting of Diamonds Alluvial, Diamonds General and Diamonds near Wolmaransstad on the Remaining Extent, Portion 7 and Portion 8 Of Farm Rooibult 152, Registration Division: HO, North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Application With Bulk Sampling combined with a Waste Licence Application for the Prospecting of Diamonds Alluvial (Da), Diamonds General (D), Diamonds (Dia) and Diamonds In Kimberlite (Dk) near Prieska On Portion 7, a certain Portion of the Remaining Extent of Portion 9 (Wouter), Portion 11 (De Hoek), Portion 14 (Stofdraai) (Portion of Portion 4), the Remaining Extent of Portion 16 (Portion Of Portion 9) (Wouter) and the Remaining Extent of Portion 18 (Portion of Portion 10) of the Farm Lanyon Vale 376, Registration Division: Hay, Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Prospecting Right Area and Mining Permit Area near Ritchie on the Remaining Extent of Portion 3 (Anna's Hoop) of the Farm Zandheuvel 144, Registration Division: Kimberley, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment of the Proposed Okapi Diamonds (Pty) Ltd Mining Right of Diamonds Alluvial (Da) & Diamonds General (D) Combined with a Waste Licence Application on the Remaining Extent of Portion 9 (Wouter) of the Farm Lanyon Vale 376; Registration Division: Hay; Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Field Assessment of the Proposed Prospecting Right Application for the Prospecting of Diamonds (Alluvial & General) between Douglas and Prieska on Portion 12, Remaining Extent of Portion 29 (Portion of Portion 13) and Portion 31 (Portion of Portion 29) on the Farm Reads Drift 74, Registration Division; Herbert, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Mining Permit Application Combined with a Waste License Application for the Mining of Diamonds (Alluvial) Near Schweitzer-Reneke on a certain Portion of Portion 12 (Ptn of Ptn 7) of the Farm Doornhoek 165, Registration Division: HO, North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for Black Mountain Koa South Prospecting Right Application, Without Bulk Sampling, in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Impact Assessment of the Proposed AA Bakery Expansion, Sedibeng District Municipality, Gauteng. Banzai Environmental (Pty) Ltd, Bloemfontein.



Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Boegoeberg Township Expansion, Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Gariiep Township Expansion, Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Groblershoop Township Expansion, Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Grootdrink Township Expansion, Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Exemption Letter for the Proposed Opwag Township Expansion, Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Exemption Letter for the Proposed Topline Township Expansion, Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the Proposed Wegdraai Township Expansion, Kheis Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological field Assessment for the Proposed Establishment of an Emulsion Plant on Erf 1559, Hardustria, Harrismith, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, 2020. Part 2 Environmental Authorisation (EA) Amendment Process for the Kudusberg Wind Energy Facility (WEF) near Sutherland, Western and Northern Cape Provinces- Palaeontological Impact Assessment. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment Proposed for the Construction and Operation of the Battery Energy Storage System (BESS) and Associated Infrastructure and inclusion of Additional Listed Activities for the Authorised Droogfontein 3 Solar Photovoltaic (PV) Energy Facility Located near Kimberley in the Sol Plaatje Local Municipality, Francis Baard District Municipality, in the Northern Cape Province of South Africa. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Impact Assessment for the Proposed Development of a Cluster of Renewable Energy Facilities between Somerset East and Grahamstown in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Proposed Amaoti Secondary School, Pinetown, eThekweni Metropolitan Municipality KwaZulu Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.



Butler, E., 2021. Palaeontological Impact Assessment for the Proposed an Inland Diesel Depot, Transportation Pipeline and Associated Infrastructure on Portion 5 of the Farm Franshoek No. 1861, Swinburne, Free State Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed erosion control gabion installation at Alpine Heath Resort on the farm Akkerman No 5679 in the Bergville district Kwazulu-Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed Doornkloof Residential development on portion 712 of the farm Doornkloof 391 Jr, City of Tshwane Metropolitan Municipality in Gauteng, South Africa. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Proposed Expansion of the Square *Kilometre* Array (SKA) Meerkat Project, on the Farms Mey's Dam RE/68, Brak Puts RE /66, Swartfontein RE /496 & Swartfontein 2/496, in the Kareeberg Local Municipality, Pixley Ka Seme District Municipality, and the Farms Los Berg 1/73 & Groot Paardekloof RE /74, in the Karoo Hoogland Local Municipality, Namakwa District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for De Beers Consolidated Mines: Proposed Drilling on Portion 6 of Scholtzfontein 165 and Farm Arnotsdale 175, Herbert District in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for De Beers Consolidated Mines: Proposed Drilling on the Remaining Extent of Biessie Laagte 96, and Portion 2 and 6 of Aasvogel Pan 141, Near Hopetown in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for De Beers Consolidated Mines: Proposed Drilling in the North West Province: on Portions 7 (RE) (of Portion 3), 11, 12 (of Portion 3), 34 (of Portion 30), 35 (of Portion 7) of the Farm Holfontein 147 IO and Portions 1, 2 and the RE) of the Farm Kareeboschbult 76 Ip and Portions 1, 2, 4, 5, 6, (of Portion 3), 7 (of Portion 3), 13, 14, and the Re of the farm Oppaslaagte 100IP and portions 25 (of Portion 24) and 30 of the farm Slypsteen 102 IP. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Proposed Expansion of the Cavalier Abattoir on farm Oog Van Boekenhoutskloof of Tweefontein 288 JR, near Cullinan, City of Tshwane Metropolitan Municipality, Gauteng. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Proposed Doornkloof Residential Development on Portion 712 of the Farm Doornkloof 391 JR, City of Tshwane Metropolitan Municipality in Gauteng, South Africa. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed High Density Social Housing Development on part of the Remainder of Portion 171 and part of Portion 306 of the farm Derdepoort 326 JR, City of Tshwane. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Red Rock Mountain Farm activities on Portions 2, 3 and 11 of the Farm Buffelskloof 22, near Calitzdorp in the Western Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.



Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Mixed-use Development on a Part of Remainder of Portion 171 and Portion 306 of the farm Derdepoort 326 JR, City of Tshwane. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Proposed Realignment of the D 2809 Provincial Road as well as the Mining Right Application for the Glisa and Paardeplaats Sections of the NBC Colliery (NBC) near Belfast (eMakhazeni), eMakhazeni Local Municipality, Nkangala District Municipality, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed construction of Whittlesea Cemetery within Enoch Mgijima Local Municipality area, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the establishment of a mixed-use development on Portion 0 the of Erf 700, Despatch, Nelson Mandela Bay Municipality, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed East Orchards Poultry Farm, Delmas/Botleng Transitional Local Council, Mpumalanga. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed East Orchards Poultry Farm, Delmas/Botleng Transitional Local Council, Mpumalanga. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment to assess the proposed Gariep Road upgrade near Groblershoop, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Ngwedi Solar Plant which forms part of the authorised Paleso Solar Powerplant near Viljoenskroon in the Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Noko Solar Power Plant and power line which forms part of the authorised Paleso Solar Powerplant near Orkney in the North West. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Proposed Power Line as part of the Paleso Solar Power Plant near Viljoenskroon in the Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Thakadu Solar Plant which forms part of the authorised Paleso Solar Powerplant near Viljoenskroon in the Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the proposed Farming Expansions on Portions 50 of the Farm Rooipoort 555 JR, Portion 34 of the Farm Rooipoort 555 JR, Portions 20 and 49 of the Farm Rooipoort 555 JR and Portion 0(RE) of the Farm Oudou Boerdery 626 JR, Tshwane Metropolitan Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the proposed Saselamani CBD on the Remainder of Tshikundu's Location 262 MT, and the Remainder of Portion 1 of Tshikundu's Location



262 MT, Collins Chabane Local Municipality, Limpopo Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed expansions of the existing Molare Piggery infrastructure and related activities on Portion 0(Re) of the farm Arendsfontein 464 JS, Portion 0(Re) of the farm Wanhoop 443 JS, Portion 0(Re) of the farm Eikeboom 476 JS and Portions 2 & 7 of the farm Klipbank 467 JS within the jurisdiction of the Steve Tshwete Local Municipality, Mpumalanga Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Nchwaning Rail Balloon Turn Outs at Black Rock Mine Operations (BRMO) near Hotazel in the John Taolo Gaetsewe District Municipality in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Black Rock Mining Operations (BRMO) new rail loop and stacker reclaimer Project at Gloria Mine near Hotazel in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2020. Palaeontological Desktop Assessment for the proposed Nchwaning Rail Balloon Turn Outs at Black Rock Mine Operations (BRMO) near Hotazel in the John Taolo Gaetsewe District Municipality in the Northern Cape.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed utilization of one Borrow Pit for the planned Clarkebury DR08034 Road Upgrade, Engcobo Local Municipality, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Kappies Kareeboom Prospecting Project on Portion 1 and the Remainder of the farm Kappies Kareeboom 540, the Remainder of Farm 544, Portion 5 of farm 534 and Portion 1 of the farm Putsfontein 616, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Kameel Fontein Prospecting Project on the Remainder of the farm Kameel Fontein 490, a portion of the farm Strydfontein 614 and the farm Soetfontein 606, ZF Mgcawu District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Lewis Prospecting Project on Portions of the Farms Lewis 535, Spence 537, Wright 538, Symthe 566, Bredenkamp 567, Brooks 568, Beaumont 569 and Murray 570, John Taolo Gaetsewe District Municipality in the Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Construction of the Ganspan Pering 132kV Powerline, Phokwane Local Municipality, Frances Baard District Municipality in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Longlands Prospecting Project on a Portion of the farm Longlands 350, Frances Baard District Municipality, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.



Butler, E., 2021. Palaeontological Impact Assessment for the proposed development of 177 new units in the northern section of Mpongo Park in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Qhumanco Irrigation Project, Chris Hani District Municipality Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Raphuti Settlement Project on Portions of the Farm Weikrans 539KQ in the Waterberg District Municipality of the Limpopo Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Senqu Rural Project, Joe Gqabi District Municipality, Senqu Local Municipality, in the Eastern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed new Township development on portion of the farm Klipfontein 716 and farm Ceres 626 in Bloemfontein, Mangaung Metropolitan Municipality, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the ECDOT Borrow Pits and WULA near Sterkspruit, Joe Gqabi District Municipality in the Eastern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed SANRAL Stone Crescent Embankment Stabilisation Works along the N2 on the farm Zyfer Fonteyn 253 (Portion 0, 11 and 12RE) and Palmiet Rivier 305 (Portion 34, 36) near Grahamstown in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the Klein Rooipoort Trust Citrus Development, in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed Victoria West water augmentation project in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Campbell Sewer, Internal Reticulation, Outfall Sewer Line and Oxidation Ponds, located on ERF 1, Siyancuma Local Municipality in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed Development and Upgrades within the Great Fish River Nature Reserve, Eastern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for proposed Parsons Power Park a portion of Erf 1. within the Nelson Mandela Bay Municipality in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the proposed expansion of the farming operations on part of portions 7 and 8 of farm Boerboonkraal 353 in the Greater Tubatse Local Municipality of Sekhukhune District, Limpopo Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment to assess the proposed low-level pedestrian bridge, in Heilbron, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.



Butler, E., 2021. Palaeontological Desktop Assessment to assess the proposed township developments in Hertzogville, Malebogo, in Heilbron, Free State. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment for the proposed construction of Malangazana Bridge on Farm No.64 Nkwenkwana, Engcobo Local Municipality, Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment to assess the proposed Construction of Middelburg Integrated Transport Control Centre on Portion 14 of Farm 81 Division of Middelburg, Chris Hani District Municipality in the Eastern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment for the Witteberge Sand Mine on the remainder of farm Elandskrag Plaas 269 located in the Magisterial District of Laingsburg and Central Karoo District Municipality in the Western Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Impact Assessment (PIA) to assess the proposed Agrizone 2, Dube Trade Port in KwaZulu Natal Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2021. Palaeontological Desktop Assessment assessing the proposed Prospecting Right application without bulk sampling for the prospecting of Chrome ore and platinum group metals on the Remaining Extent of the farm Doornspruit 106, Registration Division: HO; North West Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the proposed Ennerdale Extension 2 Township Establishment on the Undeveloped Part of Portion 134 of the Farm Roodepoort 302IQ, City of Johannesburg Metropolitan Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the Construction of the ESKOM Mesong 400kV Loop-In Loop-Out Project, Ekurhuleni Municipality, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the Proposed Vinci Prospecting Right Application on the Remainder of the Farm Vinci 580, ZF Mgcawu District Municipality, in the Northern Cape Province, Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the proposed Farm 431 Mining Right Application (MRA), near Postmasburg, ZF Mgcawu District Municipality, in the Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Impact Assessment for the Leeuw Braakfontein Colliery Expansion Project (LBC) in the Amajuba District Municipality, KwaZulu-Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the proposed reclamation of the 5L23 TSF in Ekurhuleni, Gauteng Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment for the Proposed Mogalakwena Mine Infrastructure Expansion (near Mokopane in the Mogalakwena Local Municipality, Limpopo Province). Banzai Environmental (Pty) Ltd, Bloemfontein.



Butler, E., 2022. Palaeontological Desktop Assessment for the proposed 10km Cuprum to Kronos Double Circuit 132kV Line and Associated Infrastructure in Copperton in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Impact Assessment for the proposed Hoekplaas WEF near Victoria West in the Northern Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment (PDA) assessing the proposed Prospecting Right Application without bulk sampling for the Prospecting of Diamonds Alluvial (DA), Diamonds General (D), Diamonds in Kimberlite (DK) & Diamonds (DIA) on the Remaining Extent of the Farm Goede Hoop 547, Remaining Extent of the Farm 548, Remaining Extent of Portion 2 and Portion 3 of the Farm Skeyfontein 536, Registration Division: Hay, Northern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Impact Assessment for the proposed extension of Duine Weg Road between Pellsrus and Marina Martinique as well as a Water Use Authorisation (WUA) for the project. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Proposed Mimosa Residential Development and Associated Infrastructure on Fairview Erven, in Gqeberha (Port Elizabeth), Nelson Mandela Bay Metropolitan Municipality, Eastern Cape Province. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Impact Assessment for the Witteberge Sand Mine on the remainder of farm Elandskrag Plaas 269 located in the Magisterial District of Laingsburg and Central Karoo District Municipality in the Western Cape. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E., 2022. Palaeontological Desktop Assessment to assess the Palaeontology for the Somkhele Anthracite Mine's Prospecting Right Application, on the Remainder of the Farm Reserve no 3 No 15822 within the uMkhanyakude District Municipality and the Mtubatuba Local Municipality, KwaZulu Natal. Banzai Environmental (Pty) Ltd, Bloemfontein.

Butler, E. 2022. Palaeontological Desktop Assessment to assess the proposed Altina 120 MW Solar Photovoltaic (PV) Project near Orkney in the Free State

Butler, E. 2022. Palaeontological Desktop Assessment to assess the proposed SERE Solar Photovoltaic Plant Phase 1A and associated infrastructure in the Western Cape Province.

Butler, E. 2022. Palaeontological Impact Assessment for the proposed development of a 10 MW Solar Photovoltaic (PV) Plant and associated grid connection infrastructure on Portion 9 of the Farm Little Chelsea 10, Eastern Cape Province.

Butler, E. 2022. Palaeontological Desktop Assessment to assess the proposed Dominion 1 Solar Park, located on the Remaining Extent of Portion 18 of Farm 425, near Klerksdorp within the North-West Province.

Butler, E., 2022. Palaeontological Desktop Assessment to assess the proposed Dominion 2 Solar Park, located on the Remaining Extent of Portion 8 of Farm 425, near Klerksdorp within the North-West Province.



Butler. E., 2022. Palaeontological Desktop Assessment to assess the proposed Dominion 3 Solar Park, located on the Remaining Extent of Portion 11 of Farm 425, and Remaining Extent of Portion 31 of Farm 425 near Klerksdorp within the North-West Province

Butler. E., 2022. Palaeontological Impact Assessment to assess the Delta Solar Power Plant on the remaining extent of the farm Kareefontein No. 340, Dr Ruth Segomotsi Mompati District Municipality, Lekwa-Teemane Local Municipality near Bloemhof in the North West Province

Butler. E., 2022. Palaeontological Impact Assessment to assess the Sonneblom Solar Power Plant (SPP) on Portion 1 of the farm Blydschap No. 504 within the Mangaung Metropolitan Municipality, southeast of Bloemfontein in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Naos Solar PV One Project near Viljoenskroon in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Naos Solar PV Two Project near Viljoenskroon in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Naos Solar PV Two Project near Viljoenskroon in the Free State

Butler. E., 2022. Palaeontological Impact Assessment for the Ngwedi Solar Power near Viljoenskroon in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the Noko Solar Power Plant and power line near Orkney in the North West.

Butler. E., 2022. Palaeontological Impact Assessment for the Proposed Power Line as part of the Paleso Solar Power Plant near Viljoenskroon in the Free State

Butler. E., 2022. Palaeontological Impact Assessment for the Thakadu Solar Plant which near Viljoenskroon in the Free State

Butler. E., 2022. Palaeontological Impact Assessment of the Kentani, Braklaagte, Klipfontein, Klipfontein 2, Leliehoek and Sonoblomo PV Facilities located near Dealsville in the Free State Province

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Harvard 1 Solar Photovoltaic (PV) facility on Portion 5 of Farm Spes Bona no 2355, Mangaung Metropolitan Municipality in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for proposed Harvard 2 Solar Photovoltaic (PV) facility on Portion 8 of Farm Spes Bona No 2355, Mangaung Metropolitan Municipality in the Free State.

Butler. E., 2022. Palaeontological Impact Assessment for the proposed Doornrivier Solar 1, southwest of Matjhabeng (formerly Virginia) in the Free State

Butler. E., 2022. Palaeontological Desktop Assessment for the proposed Leeuwbosch PV solar photovoltaic (PV) plant and associated infrastructure on Portion 37 of the Farm Leeuwbosch No. 44 near Leeudoringstad within the Maquassi Hills Local Municipality in the Dr Kenneth Kaunda District Municipality in the North West Province.