SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE HEUWELTJIES WIND ENERGY FACILITY, NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

Heritage Impact Assessment

DFFE Reference: 14/12/16/3/3/2/2263
Report Prepared by: **PGS Heritage Pty Ltd**
Issue Date: 28 August 2023
Version No.: 1

Declaration of Independence

- I, Wouter Fourie, declare that –
- General declaration:
- I act as the independent heritage practitioner 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 heritage 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 from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise 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;

HERITAGE CONSULTANT: PGS Heritage (Pty) Ltd

CONTACT PERSON: Wouter Fourie – Heritage Specialist

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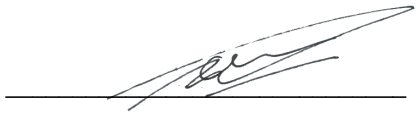
SIGNATURE: 

ACKNOWLEDGEMENT OF RECEIPT

Report Title	PROPOSED CONSTRUCTION OF THE HEUWELTJIES WIND ENERGY FACILITY, NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA		
Control	**Name**	**Signature**	**Designation**
Author	**Wouter Fourie**		**Principal Heritage Specialist**
Reviewed			**SiVEST/Environmental Division**

Date:	28 August 2023
Document Title:	Heritage Impact Report
Author:	Wouter Fourie
Revision Number:	1
Checked by:	
For:	SiVEST Environmental Division

PGS confirms that this HIA report is done in accordance with the QMS implemented by PGS Heritage. The report structure and format followed is that of SIVEST Environmental as per the appointment scope and deliverable of SIVEST. The authors did implement the PGS HIA SOP and requirements

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PROPOSED CONSTRUCTION OF THE HEUWELTJIES WIND ENERGY FACILITY, NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

HERITAGE IMPACT ASSESSMENT

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd (PGS) has been appointed by SiVEST (Pty) Ltd (hereafter referred to as "SiVEST"), on behalf of South African Mainstream Power Developments (Pty) Ltd (hereafter referred to as "Mainstream"), to assess the proposed construction of the up to 240MW Heuweltjies Wind Energy Facility (WEF) near Beaufort West in the Western Cape Province of South Africa.

1. SITE NAME

The Heuweltjies WEF and associated infrastructure.

2. LOCATION

The proposed WEF is located approximately 70km south of Beaufort West in the Western Cape Province. It is within the Prince Albert Local Municipality, in the Central Karoo District Municipality (**Figure *1***).

The WEF application site is approximately 4017.6 hectares (ha) in extent and incorporates the following farm portions:

- Remainder of the Farm Witpoortje No 16
- Portion 8 of the Farm Klipgat No 114

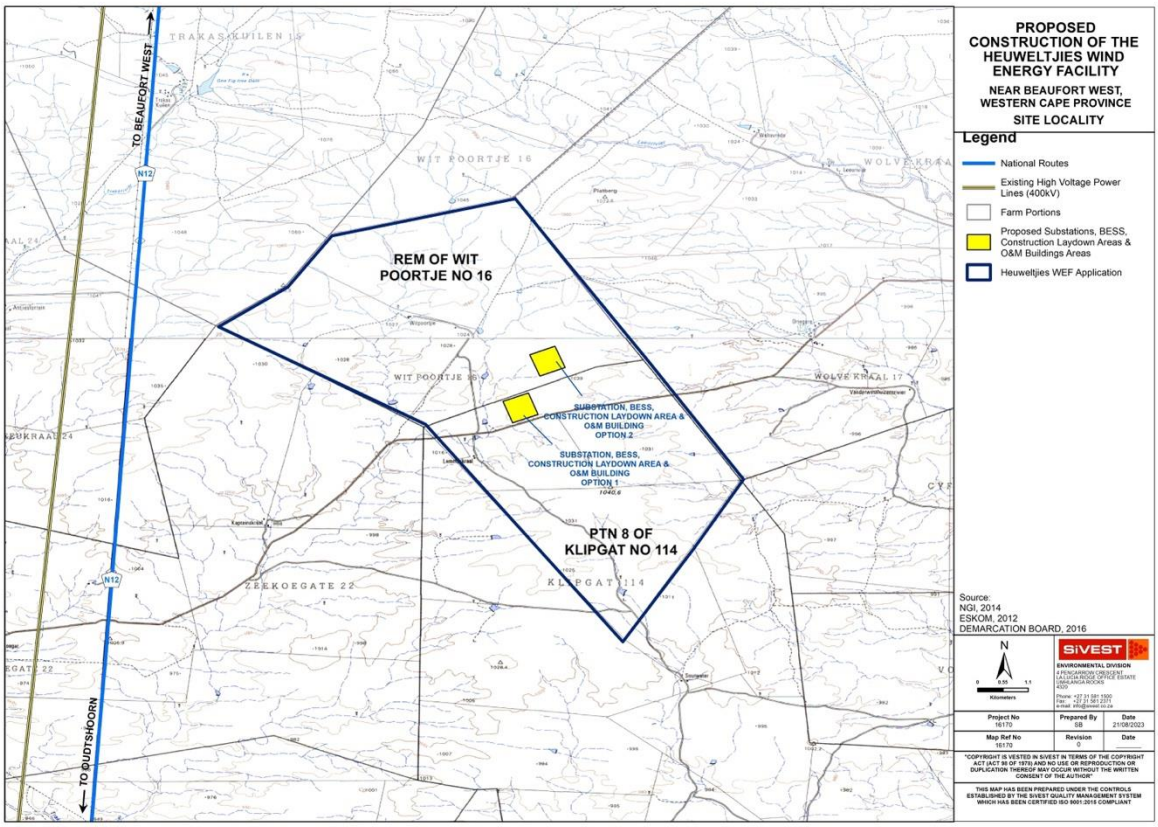


Figure 1: Locality of Heuweltjies study area.

3. DESCRIPTION OF THE PROPOSED DEVELOPMENT

It is anticipated that the proposed Heuweltjies WEF will comprise of up to thirty eight (38) wind turbines with a maximum total energy generation capacity of up to approximately 240MW (**Figure *2***). The electricity generated by the proposed WEF development will be fed into the national grid via a 132kV overhead power line.

The 132kV overhead power line will however require a separate EA and will be subject to a separate Basic Assessment (BA) process, which will be undertaken in parallel to the EIA process as far as possible. A BESS will be located next to the onsite 11-33/132kV substation.

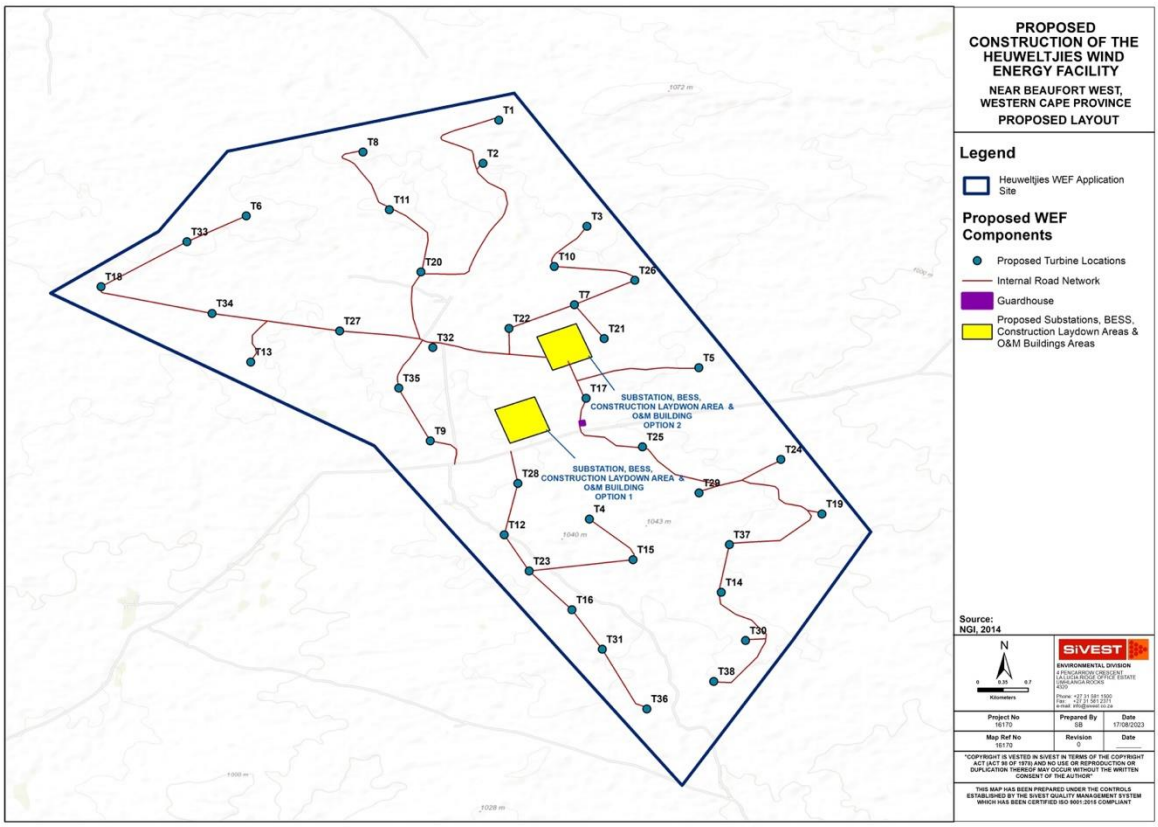


Figure 2: Proposed layout and development area for Heuweltjies WEF and associated infrastructure.

4. HERITAGE RESOURCES IDENTIFIED

The fieldwork conducted for the evaluation of the possible impact of the new Heuweltjies WEF has revealed the presence of twenty-seven (27) tangible heritage resources.

1.1 Burial Grounds and graves

Two (2) sites with burial grounds (**H006, H016**) were rated as having high heritage significance.

1.2 Historical structures

Five (5) structures (**H001, H002, H008, H014, H014/1**) were rated as having medium heritage significance and three (3) structures (**H007, H015, H017**) were rated as having low heritage significance.

1.3 Archaeological features

Three (3) Stone Age sites (**H013, H013/1, H013/3**) were rated as having medium heritage significance.

Fourteen (14) find spots (**H003-5, H009-12, H018-24**) comprise a number of low-density Stone Age surface artefact scatters and were rated as having low heritage significance. These are primarily from the Middle Stone Age (MSA), although both Later Stone Age (LSA) and earlier Early Stone Age (ESA) material was identified. All of these artefact assemblages occur in heavily deflated and eroded areas, so their scientific potential and heritage significance is somewhat lowered. Based on findings from a range of other heritage reports in the area, these types of sites are to be expected in this region.

The pre-construction and construction phase of the proposed WEF will entail extensive surface clearance as well as excavations into the superficial sediment cover and underlying bedrock (e.g. for widened or new access roads, wind turbine foundations, hardstanding areas, on-site substation, underground cables, construction laydown area, O&M building and BESS). The possible pre-construction impacts calculated on the tangible cultural heritage resources is overall MODERATE NEGATIVE rating but with the implementation of the recommended buffers and management guidelines will be reduced to a LOW NEGATIVE impact.

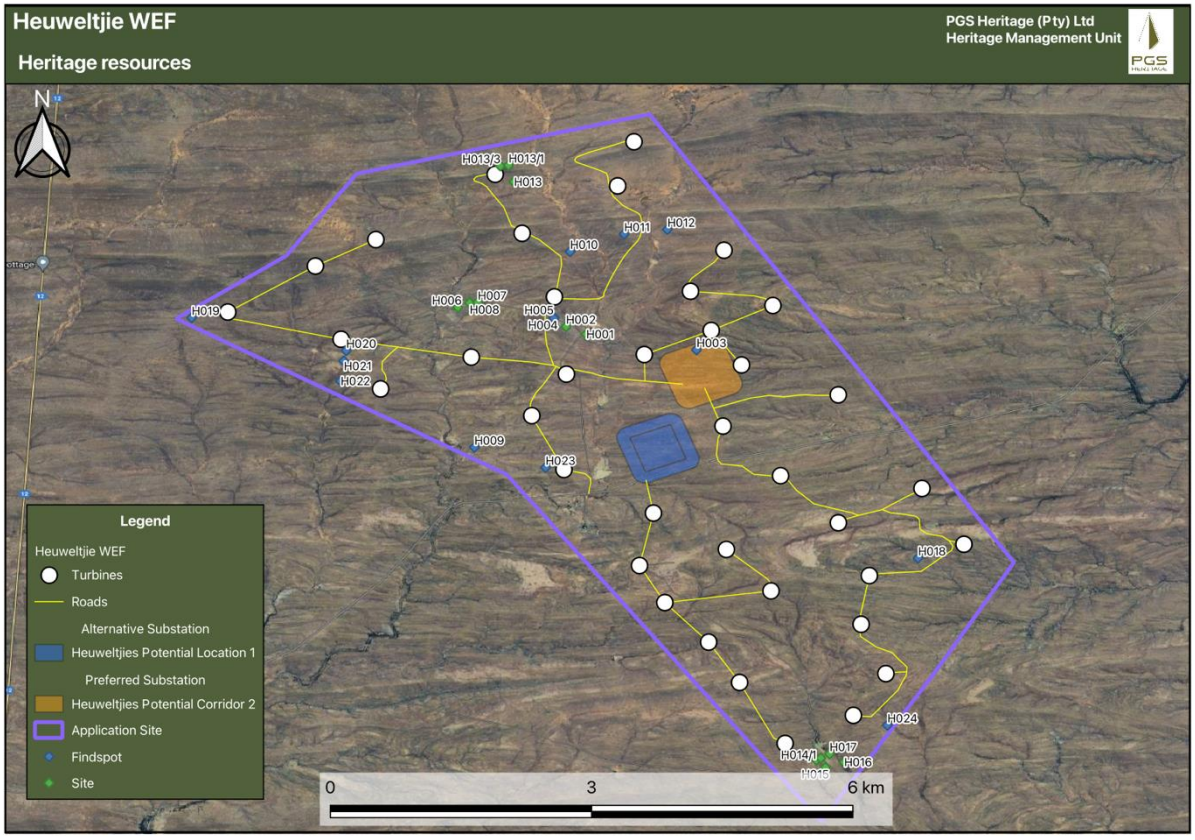


Figure 3: Tangible heritage resources identified

1.4 Palaeontological resources

The Heuweltjies WEF and associated Infrastructure project area is underlain by continental (fluvial / lacustrine) sediments of the Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup) which are of Middle Permian age. These bedrocks contain sparse, unpredictable to locally concentrated vertebrate fossils as well as rare trace fossils (*e.g.,* tetrapod trackways and burrows) and plant material of scientific and conservation value. Very few new fossil vertebrate sites - most notably a partial, articulated pareiasaur reptile skeleton - have been recorded during within the WEF project area during the short site visit, while several more sites have previously been mapped in the vicinity during recent palaeontological surveys of adjoining WEF project areas. These palaeontological sites, together with their sedimentological context, provide important data for on-going research into the pattern and causes of the Middle Permian Mass Extinction Event on land around 260 million years ago. All of the recorded fossil sites lie *outside* the WEF and associated Infrastructure project footprints.

No vulnerable Very High Sensitivity or No-Go palaeontological sites or areas have been identified within the WEF and associated Infrastructure project areas. The single known pareiasaur reptile skeleton site lies along a stream bank and is therefore already protected within the standard ecological buffer zone. Since all known fossil sites can be readily mitigated – if necessary - through professional recording and collection of fossil material in the pre-construction phase, no recommendations for micro-siting of infrastructure such as wind turbine, pylon positions or access roads are therefore made here. There are no preferences on palaeontological heritage grounds for specific site options for the WEF on-site substation and construction laydown area, given their similar geological and palaeontological context.

In terms of palaeontological heritage resources, the proposed Heuweltjies WEF and associated Infrastructure development is assigned an overall impact significance rating (Construction Phase) of NEGATIVE MEDIUM without mitigation and NEGATIVE LOW following mitigation. Residual negative impacts may be partially offset by improvements to the local palaeontological database as a result of professional mitigation of chance fossil finds. No significant further impacts on fossil heritage resources are anticipated in the planning, operational and decommissioning phases. The No-Go Option is likely to have a neutral impact significance. Anticipated cumulative impacts in the context of several planned or authorized renewable energy projects in the region are assessed as NEGATIVE MEDIUM without mitigation and NEGATIVE LOW after mitigation. These cumulative impacts fall within acceptable limits.

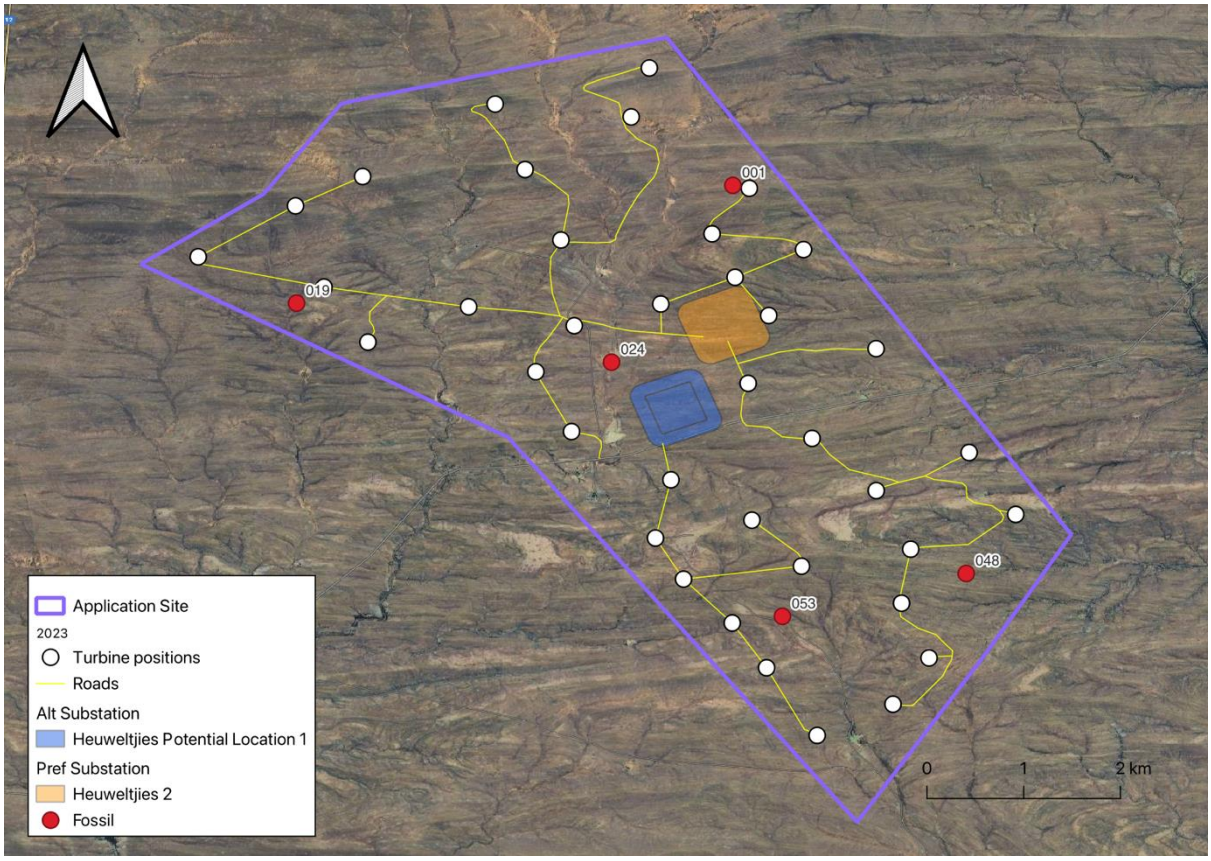


Figure 4: Palaeontological resources identified

1.5 Cultural Landscape

The Koup region is a significant cultural landscape that reflects the relationship between man and nature over a period of time. This relationship has generally been sustainable, where biodiversity and ecological systems have been maintained in the utilisation of the landscape expressed in specific land use patterns. The surrounding land use indicates a social appreciation of the natural environment with low impact stock farming with limited farmstead crop cultivation. The vastness and relative homogenous nature of the cultural landscape is, however, often undervalued. If careful contextual planning is not followed, it will rapidly result in a cluttered wasteland. This does not mean that development is discouraged, but rather that the implementation of wind and solar energy farms should be planned holistically. It is the duty of the planning department to consider this application in terms of other renewable energy developments that are planned/proposed for the Koup area, notably the proposed RE developments included in the cumulative impact section of this report.

Conservation: to protect the natural resources (water, air, land, sand, fishes, etc.), ecosystems (reefs, fynbos), biological abundance (flora and fauna), landscapes and the local culture.

Development: to protect social and economic progress, without damaging or depleting the natural resources (sustainable development).

The findings of the CLA report, coupled with the proposed layout for development of the project area, which considers appropriate placement in terms of wind energy capacity, concludes that the

development can be permitted within the site if the report's recommendations are followed. The mitigating recommendations in this report consider the ecological, aesthetic, historic and socio-economic value lines that underpin the layers of significance that combine to create the character of the place and the cultural landscape of the Koup.

These recommendations include road and farmstead complex buffers which incorporate cultivated areas and graves, steep slope and ridgeline no-go areas as well as consideration of the unique land form of the site, CBA and ESA no-go areas, as well as mechanisms to support the non-landowner residents that live on the site in being able to continue their indigenous land use patterns, knowledge and social systems. These mitigations will reduce the impact on the surrounding landscape and heritage resources but due to the high visual impact of the turbines, largely a result of their height, the negative impact to the cultural landscape cannot be removed, only reduced from very high to moderate.

1.6 Recommendations

The calculated impact, as summarised in **Section 9** of this report, confirms the impact of the new Heuweltjies WEF will be reduced with the implementation of the mitigation measures. This finding in addition to the implementation of a chance finds procedure, as part of the EMPr, will mitigate possible impacts on unidentified heritage resources.

Tangible heritage recommendations are to be implemented in conjunction with the **Table 16** and

Table 17**.**

The following mitigation measures will be required:

- 50m buffer zones around grave sites (**H006, H016**)
- 30m buffer zone around farmsteads (**H001, H002, H008, H014 (H014/1)**)
- 30m buffer zone around historical structures (**H007, H015, H017**)
- 30m buffer zones around Stone Age sites with a medium heritage significance (**H013, H013/1, H013/3**)
- An induction and training program on managing archaeological resources must be included in the induction programs for the Environmental Control/Site Officer working on the project.
- An assessment of the footprint areas must be done if the project is to commence immediately pre-construction and any findings must be handled through the Chance finds protocol.
- A chance finds protocol must be developed that includes the process of work stoppage, site protection, evaluation and informing HWC of such finds and a final process of mitigation implementation.
- If (*and only if*) the WEF receives Environmental Authorization, the approved layout of the WEF and associated Infrastructure must be, immediately pre-construction, cross-checked by a qualified palaeontological specialist to determine what level of additional palaeontological surveying, monitoring or mitigation is necessary for these projects, if any.
- Should a palaeontological heritage study of selected, potentially sensitive and previously unsurveyed sectors of the authorised footprint be recommended at this stage, this should involve the recording and judicious collection by a professional palaeontologist of valuable fossil material as well as relevant geological data (e.g., on stratigraphic context, preservation style / taphonomy) within or close to (within ~10 m) the project footprint in the Pre-Construction Phase. Since mitigation through professional recording and collection is almost invariably feasible for fossil sites.
- During the construction phase, the Chance Fossil Finds Protocol summarised in Appendix 2 of the PIA should be fully implemented.
- The qualified palaeontologist responsible for the mitigation work during the construction phase will need to submit beforehand a Work Plan for approval by Heritage Western Cape (HWC) and, following completion of mitigation, a Mitigation Report must be submitted to HWC for consideration.

1.7 Cultural Landscape Heritage Indicators

The conclusion of this CLA study has culminated in the map (Figure 49) showing proposed WEF development layout with the following heritage indicators and development buffers:

- A 1000m buffer to either side of the N12 for turbine and infrastructure placement (800m no-go turbine buffer and 200m high sensitivity buffer where turbine placement is subject to specialist approval, if required) – layout proposed in this report has been assessed and approved and any further changes will require review and approval by the specialist;
- 300m buffer to either side of identified significant historic regional road for turbine placement, substation and laydown area (200m no-go turbine buffer and 100m high sensitivity buffer where turbine placement is subject to specialist approval, if required)

- 800m buffer around Trakaskuilen and Lammerkraal farmsteads and 300m buffer around Klipgat and Witpoortjie ruin cultural landscape features for turbine placements (single turbines at the edges of some of these buffers are acceptable); and
- existing roads to be used with minimal upgrade as far as possible;
- no-go areas on koppie and steep slopes (over 10%) for all infrastructure
- riverine corridors 100m buffer.

Further, the following changes to the current proposed layout is recommended:

- Substation option 2 is preferable as it is located further from the regional road.
- Substation Option 1 is acceptable if all infrastructure, other than roads, underground cabling and guard house, are kept out of the historic 200m no-go buffer on final construction.

Further socio-economic impact assessment is recommended to consider heritage:

- Potential impact of WEF development on any non-landowner residents of the site needs to be assessed within the EIA Public Participation Process, to the approval of the heritage consultant, to determine the impact of the development on the historical residents of the area as an integral part of the cultural landscape.

Further heritage indicators and recommendations for construction/ decommissioning and operational phases unsuitable for mapping have been made in the CLA (Please see **Table 18**) and are necessary for the identified negative impacts to be reduced from very high to medium negative impact of the proposed Heuweltjies WEF and associated infrastructure on the cultural landscape.

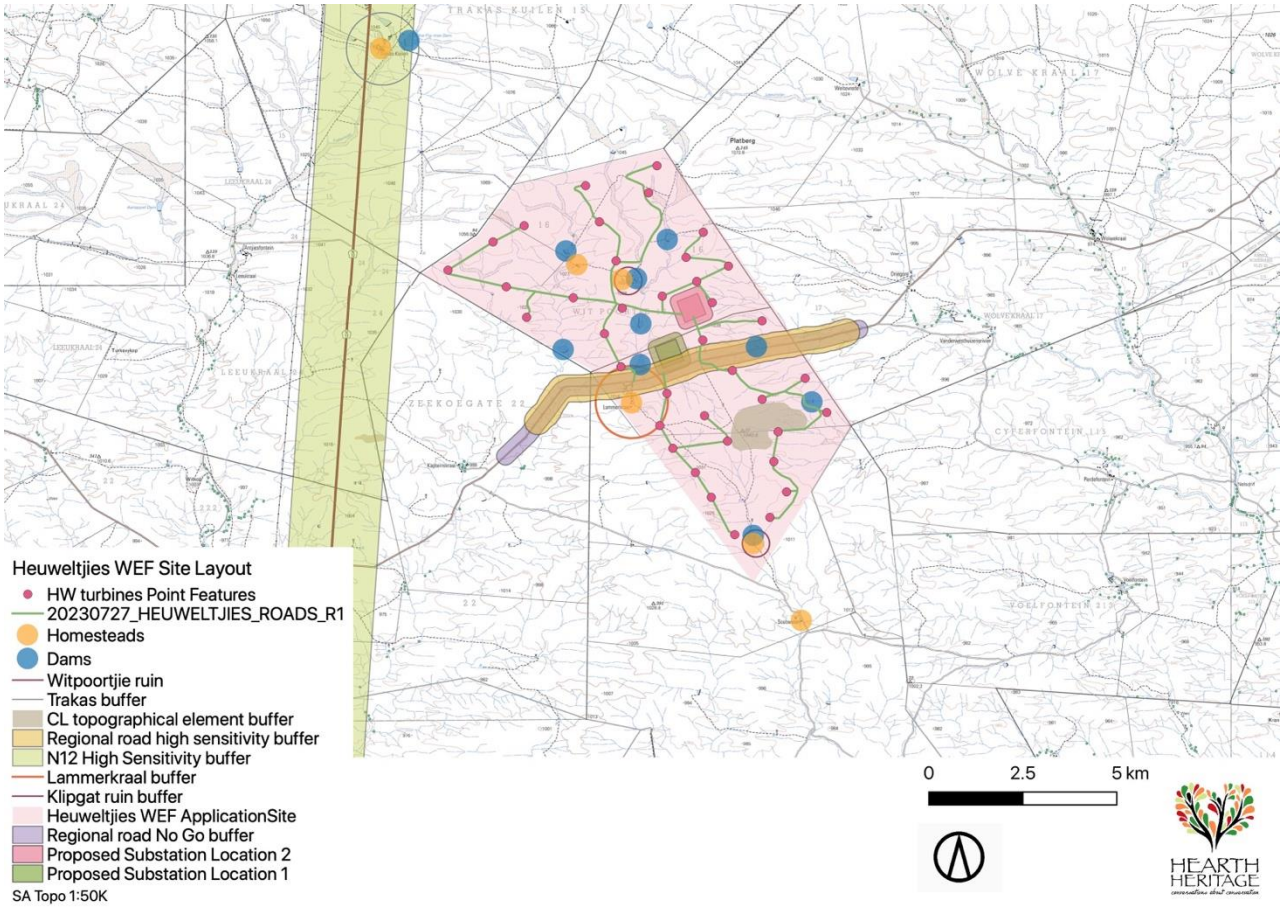


Figure 5: Cultural Landscapes Assessment heritage indicators and buffers map for proposed Heuweltjies WEF project (Note: 100m/ flood line riverine corridor buffers not indicated). Internal roads marked in red are not acceptable and have not considered recommendations in BA CLA.

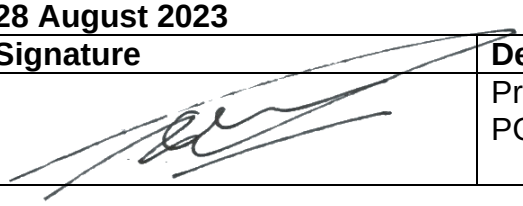
1.8 General

If heritage resources are discovered during site clearance, construction activities must stop in the vicinity, and a qualified archaeologist must be appointed to evaluate and recommend mitigation measures.

With the recommended CLA buffers in place and all other recommendations followed, the overall impact on the cultural landscape for the proposed Heuweltjies WEF and associated infrastructure can be reduced from very high to moderate. The proposed project layout can be accepted in terms of cultural landscape assessment.

The overall impact of the Heuweltjies WEF, on the heritage resources, is seen as acceptable after the recommendations have been implemented and therefore, impacts can be mitigated to acceptable levels allowing for the development to be granted environmental authorisation.

2. AUTHOR AND DATE

Date:	**28 August 2023**	
Name	**Signature**	**Designation**
Wouter Fourie		Principal Heritage Specialist PGS Heritage

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) - REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page ii of Report- Contact details and company Section 1.2 and **Appendix A**
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page ii
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2, 6 and 7
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 8, 9 and 10
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2 and 6
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 7 and 8
g) an identification of any areas to be avoided, including buffers;	Section 8 and 12
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;	**Figure 42**, **Figure 43**, **Figure 44**, Section 8
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Executive Summary and Section 9, 10, 11
k) any mitigation measures for inclusion in the EMPr;	Section 8, 11 and 12
l) any conditions for inclusion in the environmental authorisation;	Section 8, 11 and 12
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8, 11 and 12

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Report**
n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Executive Summary; Section 12
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	
q) any other information requested by the competent authority.	
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	NEMA Appendix 6 and GN648

SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE HEUWELTJIES WIND ENERGY FACILITY, NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

Heritage Impact Assessment

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Glossary of Terms

Archaeological resources

This includes:

- material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
- rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
- wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
- features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

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

Early Stone Age

The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

Heritage resources

This means any place or object of cultural significance and can include (but not limited to) as stated under Section 3 of the NHRA,

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

Holocene

The most recent geological time period which commenced 20 000 years ago.

Late Stone Age

The archaeology of the last 30 000 years associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with iron-working and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age between 20 000-300 000 years ago, associated with early modern humans.

Heritage Site

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

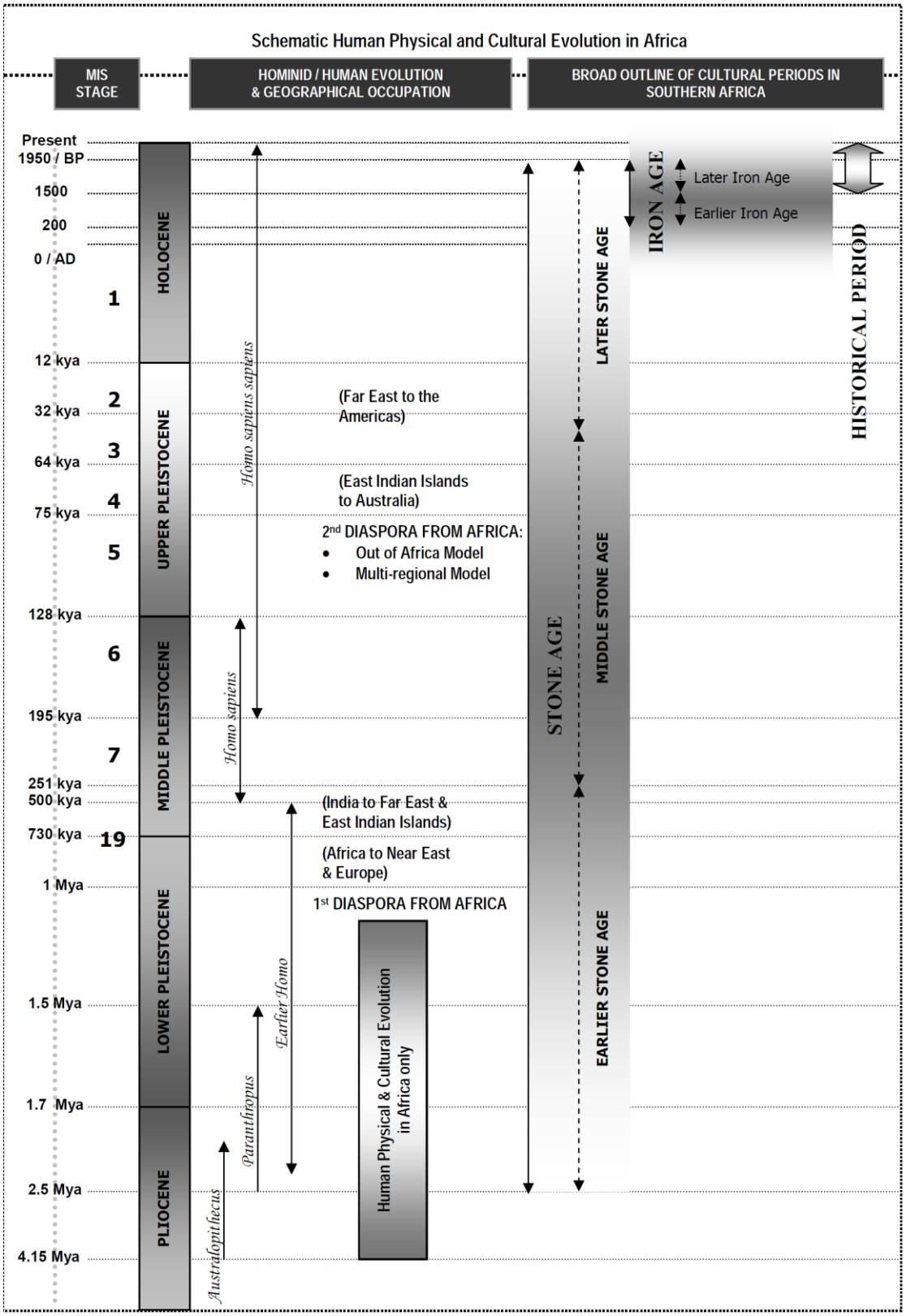


Figure 6: Human and Cultural Timeline in Africa (Morris, 2008).

List of Abbreviations

Abbreviations	Description
AIA	Archaeological Impact Assessment
APHP	Association of Professional Heritage Practitioners
ASAPA	Association of South African Professional Archaeologists
BESS	Battery Energy Storage System
CRM	Cultural Resource Management
DFFE	Department of Forestry, Fisheries and Environment
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GN	Government Notice
GPS	Global Positioning System
HIA	Heritage Impact Assessment
HWC	Heritage Western Cape
I&AP	Interested & Affected Party
LSA	Late Stone Age
LIA	Late Iron Age
Mainstream	South African Mainstream Power Developments (Pty) Ltd
MSA	Middle Stone Age
MIA	Middle Iron Age
NCA	National Competent Authority
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
O&M	Operation and Maintenance
PGS	PGS Heritage (Pty) Ltd
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
SIVEST	SiVEST (PTY) Ltd
WEF	Wind Energy Facility

SiVEST SA (PTY) LTD

PROPOSED CONSTRUCTION OF THE HEUWELTJIES WIND ENERGY FACILITY, NEAR BEAUFORT WEST, WESTERN CAPE PROVINCE, SOUTH AFRICA

Heritage Impact Assessment

1. INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) has been appointed by SiVEST SA (Pty) Ltd (hereafter referred to as "SiVEST"), on behalf of South Africa Mainstream Renewable Power Developments (Pty) Ltd (hereafter referred to as "Mainstream"), to assess the proposed construction of the up to 240MW Heuweltjies Wind Energy Facility (WEF) near Beaufort West in the Western Cape Province.

The overall objective of the development is to generate electricity using renewable energy technology capturing wind energy to feed into the National Grid.

It is anticipated that the proposed Heuweltjies WEF will comprise of up to thirty eight (38) wind turbines with a maximum total energy generation capacity of up to approximately 240MW. The electricity generated by the proposed WEF development will be fed into the national grid via a 132kV overhead power line (this will form part of a separate Basic Assessment application, and as such is not included in this report).

1.1 Scope of the Study

The study aims to identify possible heritage resources in the proposed development area. The Heritage Impact Assessment (HIA) incorporates the findings of the Archaeological, Palaeontological and Cultural Landscapes Assessments and aims to assist the developer in managing the discovered heritage resources in a responsible manner to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act (Act 25 of 1999) (NHRA).

1.2 Specialist Credentials

This HIA was compiled by PGS.

The staff at PGS has a combined experience of nearly 90 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake

heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Wouter Fourie, the Project Coordinator, is registered with the ASAPA as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners (APHP).

For the Archaeological Impact Assessment (AIA) the archaeologists consisted of:

- Ms. Nikki Mann, the author of this report, graduated with her Master's degree (MSc) in Archaeology and is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA).

- Ruan van der Merwe, field archaeologist, holds a BA (Hons) in Archaeology.

- Wynand van Zyl, field archaeologist, holds a BA (Hons) in Archaeology.

The Palaeontological Impact Assessment (PIA) was completed by Dr John Almond, a specialist palaeontologist with over 40 years of experience in palaeontological research and teaching in Europe, South Africa and elsewhere. He also has more than 20 years of experience in the palaeontological heritage impact assessment sector in the RSA and has been involved with numerous PIAs in the Karoo region and elsewhere.

The Cultural Landscape Assessment (CLA) was completed by Emmylou Rabe Bailey.
Emmylou Rabe Bailey, director of Hearth Heritage consultancy (est 2009), has over 15 years of experience in the heritage field, in the public and private sectors. Emmylou holds an MA in Archaeology and Heritage Conservation from the University of Leicester, UK (2008), specialising in the assessment, conservation and representation of archaeological resources and cultural landscapes. Emmylou is an Accredited Professional Heritage Practitioner and Executive Committee member with the Association of Professional Heritage Practitioners (APHP) and registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist. She also sits on Heritage Western Cape Council and the HWC Archaeology, Palaeontology and Meteorites Permitting Committee as well as the ICOMOS International Scientific Committees for Archaeological Heritage Management and Cultural Landscape as an Expert Member.

2. ASSESSMENT METHODOLOGY

The applicable maps, tables and figures, are included as stipulated in the NHRA (no 25 of 1999), the NEMA (no 107 of 1998). The methodology for each sub-study is included below and taken directly from the AIA, PIA and CLA.

2.1 AIA methodology

Step I – Literature Review: A detailed archaeological and historical overview of the study area and surroundings were undertaken. This work was augmented by an assessment of reports and data contained on the South African Heritage Resources Information System (SAHRIS). Additionally, an assessment was made of the available historic topographic maps. All these desktop study components were undertaken to support the fieldwork.

Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by 2 qualified archaeologists (four days in February 2021), aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

Step III – The final step involved the recording and documentation of relevant archaeological resources, the assessment of resources in terms of the HIA criteria and report writing, as well as mapping and constructive recommendations.

2.2 PIA methodology

2.2.1 Information sources

The desktop and field-based palaeontological heritage study of the Heuweltjies WEF and associated Infrastructure project area was based on the following information resources:

1. A detailed project outline, kmz files, screening report and maps provided by SiVEST Environmental Division and PGS Heritage;

2. A desktop review of:
    a. the relevant 1:50 000 scale topographic maps (3222DC Amandelhoogte & 3322BA Seekoegat) as well as the 1:250 000 scale topographic maps 3222 Beaufort West and 3322 Oudtshoorn),
    b. Google Earth© satellite imagery,

c. published geological and palaeontological literature, including 1:250 000 geological maps (3222 Beaufort West, 3322 Oudtshoorn) and relevant geological sheet explanations (Johnson & Keyser 1979, Toerien 1979) as well as
d. several previous and on-going fossil heritage (PIA) assessments in the Great Karoo region to the south of Beaufort West by the author listed in the References (especially Almond 2022d);

3. The author's field experience with the formations concerned and their palaeontological heritage (*cf* Almond & Pether 2008 and PIA reports listed in the References); and

4. A two-day field assessment of the Heuweltjies WEF project area, including portions of all land parcels involved, by the author and two experienced field assistants (Ms Madelon Tusenius, *Natura Viva* cc and Ms Hedi Stummer, previously of Iziko Museums, Cape Town), during the period 3 and 4 November 2020. Subsequent to the original fieldwork within the Heuweltjies WEF project area, a short palaeontological visit to review fossil finds was made by the author in the company of Professor Bruce Rubidge and Dr Marc van den Brandt of Wits University, Johannesburg. Two further palaeontological field studies were also undertaken in the adjoining Beaufort West WEF and Trakas WEF project areas which are mainly of relevance to the Heuweljies Grid Connection Infrastructure project (*cf* Almond 2018 and 2022d).

5. The season in which the site visit took place has no critical bearing on the palaeontological study, although palaeontological fieldwork in the Karoo winter was somewhat hampered by shorter days, occasional rain and low-angle light, making fossils more difficult to discern and to photograph effectively.

2.2.2 Study approach

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations, members *etc.*) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (consultation with professional colleagues as well as examination of institutional fossil collections may play a role here, or later following scoping during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development (provisional tabulations of palaeontological sensitivity of all formations in the Western Cape have already been compiled by J. Almond and colleagues; *e.g.* Almond & Pether 2008) and are shown on the palaeosensitivity map on the SAHRIS (South African Heritage Resources Information System) website. The likely impact of the development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most

notably the extent of fresh bedrock excavation and ground clearance envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field assessment study by a professional palaeontologist is usually warranted.

The focus of palaeontological field assessment is *not* simply to survey the development footprint or even the development area as a whole (*e.g.* farms or other parcels of land concerned in the development). Rather, the palaeontologist seeks to assess or predict the diversity, density and distribution of fossils within and beneath the study area, as well as their heritage or scientific interest. This is primarily achieved through a careful field examination of one or more *representative* exposures of all the sedimentary rock units present (*N.B.* Metamorphic and igneous rocks rarely contain fossils). The best rock exposures are generally those that are easily accessible, extensive, fresh (*i.e.* unweathered) and include a large fraction of the stratigraphic unit concerned (*e.g.* formation). These exposures may be natural or artificial and include, for example, rocky outcrops in stream or river banks, cliffs, quarries, dams, dongas, open building excavations or road and railway cuttings. Consolidated as well as uncemented superficial deposits, such as alluvium, scree or wind-blown sands, may occasionally contain fossils and should also be included in the field study where they are well-represented in the study area. It is occasional practice for impact palaeontologists to collect representative, well-localised (*e.g.* GPS and stratigraphic data) samples of fossil material during field assessment studies. In order to do so, a fossil collection permit from Heritage Western Cape (HWC) is required and all fossil material collected must be properly curated within an approved repository (usually a museum or university collection).

Note that while fossil localities recorded during field work within the study area itself are obviously highly relevant, most fossil heritage here is embedded within rocks beneath the land surface or obscured by surface deposits (soil, alluvium, *etc.*) and by vegetation cover. In many cases where levels of fresh (*i.e.* unweathered) bedrock exposure are low, the hidden fossil resources have to be *inferred* from palaeontological observations made from better exposures of the same formations elsewhere in the region but outside the immediate study area. Therefore a palaeontologist might reasonably spend far *more* time examining road cuts and borrow pits close to, but outside, the study area / project footprint than within the study area / project footprint itself. Field data from localities even further afield (*e.g.* an adjacent province) may also be adduced to build up a realistic picture of the likely fossil heritage within the study area.

Given 1) the large project areas concerned with the Heuweltjies WEF and associated Grid Connection Infrastructure projects (separately assessed) and (2) the extensive bedrock exposure in this region of the Great Karoo, the palaeontological heritage field study largely entailed the examination of selected potentially fossiliferous sites with good Beaufort Group mudrock exposure – especially along drainage lines as well as gentler hillslopes and erosion gullies. Since previous field experience shows that in the lower part of the Beaufort Group outcrop area important fossil sites may also occur in association with

crevasse splay and channel sandstones, a representative selection of such sites as well as good sections through Late Caenozoic alluvial deposits were also examined. It is emphasised that it is simply *not* practicable to record all, or even a major portion, of fossil sites within such a large area within the course of a few days' fieldwork, and that the occurrence of fossils at surface in the Great Karoo has a large element of unpredictability. Several fossil sites were discovered simply by chance. It is therefore inevitable that the recent site visit can only hope to locate a *representative subsample* of surface fossil sites present within the WEF project areas. The absence of recorded sites within an area does *not* therefore mean that palaeontologically significant material is not present there, either on or beneath the ground surface.

2.3 CLA methodology

- DFFE Screening Tool.
- Review of Desktop Beaufort West Heritage Survey and Beaufort West Municipal SDF.
- Review of Central Karoo District Spatial Development Framework.
- Review of relevant Archaeological Impact Assessment (AIA), Heritage Impact Assessment (HIA), Visual Impact Assessment (VIA) and Socio-economic Impact Assessment reports (SEIA) on the proposed Koup 1 and adjacent Koup 2 proposed WEF's as well as other relevant assessment reports from the surrounding area;
- Review of relevant academic literature and articles on cultural landscape assessment;
- Review of relevant academic literature and articles on the cultural heritage of the regional study area;
- Review of relevant policies and legislation on cultural landscapes assessment, scenic drives and route assessment and heritage assessment in EIA process;
- Review of historic and current maps of the study area and surrounds;
- Review of REDZs Strategic Environmental Assessment (SEA) reports (DEA, 2015); and
- Review of relevant international cultural landscapes best practice.

2.3.1 Preliminary field survey

The field survey of cultural landscape elements was conducted by a cultural landscapes specialist (archaeologist / anthropologist / heritage specialist) over 4 days from 25-28 November 2021 (summer). Survey was conducted in a vehicle on existing farm access roads and on foot where no vehicle access was possible. Cultural heritage resources and cultural landscape elements falling within and adjacent to the proposed development footprint were identified, mapped and photographed where appropriate. The season for fieldwork did not impact the research for this study.

2.3.2 Recording

Recording and documentation of relevant cultural heritage and cultural landscape elements, the assessment of resources in terms of the specialist requirements for CLA criteria, report writing, mapping and recommendations.

The significance of the cultural landscape is based on the examination of the

- processes (spatial pattern, land uses, response to natural features and cultural traditions);
- components (circulation, boundaries, vegetation, structural types, cluster arrangements, archaeological types, small-scale elements); and
- perceptual qualities (views and aesthetics), which are then utilized to identify and assess the relationships between the patterns of human use, the natural environment and cultural beliefs and attitudes.

Evaluation of provisionally identified heritage elements' significance according to World Heritage Convention Operational Guidelines (2017) and National Heritage Resources Act (NHRA) (Act 25 of 1999) as is required as part of the BA process.

2.3.3 Grading

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

Heritage Western Cape (2016), uses a system in which resources of local significance are divided into Grade IIIA – high significance, Grade IIIB – medium significance and Grade IIIC - low local or contextual significance, with a Not Conservation Worthy (NCW) grading for sites of very low or no significance and generally not requiring mitigation or other interventions).

It should be noted that without further research and investigation of the intangible and living heritage found at the Heuweltjies study site or surrounding area, a valuable and true assessment of the significance of the heritage resources and elements is not possible, and any grading assigned is subject to further work to confirm the proposed gradings. Notwithstanding, this report has drawn from other research to inform gradings and is confident that the proposed gradings herein have considered the most common significance assignments.

2.3.4 Sensitivity mapping for cultural landscapes (SEA, 2015)

Landscape sensitivity was determined as part of this study through the identification of natural, scenic and cultural resources which have aesthetic, social and economic value to the local community, the region, and society as a whole. The resources considered include features of topographic, geological or cultural interest, together with landscape grain or complexity. Protected landscapes, such as national parks, nature reserves, game parks or game farms, as well as heritage sites, add to the cultural value of an area and were thus considered as essential criteria in the determination of landscape sensitivities. Landscape sensitivity was further determined by taking into account existing receptors in the area including settlements, national roads, arterial roads, scenic routes, and tourist destinations such as guest farms and resorts.

2.3.5 Community engagement

Limited interviews with tenants and labourers on the properties proposed for development and land owners around the proposed development were done as part of the cultural landscape assessment to identify any values associated with identified heritage resources and to ascertain whether any meaningful intangible heritage resources are associated with any of the built structures or natural features. Further research/ other studies beyond the brief of this BA would be required to determine the significance of the intangible or living heritage of the Koup cultural landscape. The findings of this report must be shared with identified interested and affected parties in the EIA public participation process in order to further ascertain any intangible cultural resources that may exist on the landscape that have not been identified. Notably it is critical that the non-landowner residents on and surrounding the properties proposed for development also be included as I&APs in the process.

2.4 Site Significance classification standards

Site significance classification standards use is based on the heritage classification of s3 in the NHRA and developed for implementation keeping in mind the grading system approved by SAHRA for archaeological impact assessments. The update classification and rating system as developed by Heritage Western Cape (2016) is implemented in this report

Site significance classification standards prescribed by the Heritage Western Cape Guideline (2016), were used for the purpose of this report (**Table 1** and **Table *2***).

Table 1: Rating system for archaeological resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Langebaanweg (West Coast Fossil Park), Cradle of Humankind	May be declared as a National Heritage Site managed by SAHRA. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Highest Significance
II	Heritage resources with special qualities which make them significant, but do not fulfil the criteria for Grade I status. Current examples: Blombos, Paternoster Midden.	May be declared as a Provincial Heritage Site managed by HWC. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	Exceptionally High Significance
III	Heritage resources that contribute to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. Current examples: Varschedrift; Peers Cave; Brobartia Road Midden at Bettys Bay	Resource must be retained. Specific mitigation and scientific investigation can be permitted in certain circumstances with sufficient motivation.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree.	Resource must be retained where possible where not possible it must be fully investigated and/or mitigated.	Medium Significance
IIIC	Such a resource is of contributing significance.	Resource must be satisfactorily studied before impact. If the recording already done (such as in an HIA or permit application) is not sufficient, further recording or even mitigation may be required.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant or the consultant and approved by the authority.	No research potential or other cultural significance

Table 2: Rating system for built environment resources

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
I	Heritage resources with qualities so exceptional that they are of special national significance. Current examples: Robben Island	May be declared as a National Heritage Site managed by SAHRA.	Highest Significance
II	Heritage resources with special qualities which make them significant in the context of a province or region, but do not fulfil the criteria for Grade I status. Current examples: St George's Cathedral, Community House	May be declared as a Provincial Heritage Site managed by HWC.	Exceptionally High Significance
II	Such a resource contributes to the environmental quality or cultural significance of a larger area and fulfils one of the criteria set out in section 3(3) of the Act but that does not fulfil the criteria for Grade II status. Grade III sites may be formally protected by placement on the Heritage Register.		

Grading	Description of Resource	Examples of Possible Management Strategies	Heritage Significance
IIIA	Such a resource must be an excellent example of its kind or must be sufficiently rare. These are heritage resources which are significant in the context of an area.	This grading is applied to buildings and sites that have sufficient intrinsic significance to be regarded as local heritage resources; and are significant enough to warrant that any alteration, both internal and external, is regulated. Such buildings and sites may be representative, being excellent examples of their kind, or may be rare. In either case, they should receive maximum protection at local level.	High Significance
IIIB	Such a resource might have similar significances to those of a Grade III A resource, but to a lesser degree. These are heritage resources which are significant in the context of a townscape, neighbourhood, settlement or community.	Like Grade IIIA buildings and sites, such buildings and sites may be representative, being excellent examples of their kind, or may be rare, but less so than Grade IIIA examples. They would receive less stringent protection than Grade IIIA buildings and sites at local level.	Medium Significance
IIIC	Such a resource is of contributing significance to the environs These are heritage resources which are significant in the context of a streetscape or direct neighbourhood.	This grading is applied to buildings and/or sites whose significance is contextual, i.e. in large part due to its contribution to the character or significance of the environs. These buildings and sites should, as a consequence, only be regulated if the significance of the environs is sufficient to warrant protective measures, regardless of whether the site falls within a Conservation or Heritage Area. Internal alterations should not necessarily be regulated.	Low Significance
NCW	A resource that, after appropriate investigation, has been determined to not have enough heritage significance to be retained as part of the National Estate.	No further actions under the NHRA are required. This must be motivated by the applicant and approved by the authority. Section 34 can even be lifted by HWC for structures in this category if they are older than 60 years.	No research potential or other cultural significance

3. ASSUMPTIONS AND LIMITATIONS

3.1 AIA - Assumptions and Limitations

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

The fieldwork focussed on the identification of archaeological resources within the application area and needed to assess the final layout of the WEF. The mitigation measures included and proposed for the EMPR for the WEF should address this limitation.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out in **Section 5**.

3.2 PIA – Assumptions and Limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant (“mappable”) bedrock units as well as major areas of superficial “drift” deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil etc.), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;

4. The extensive relevant palaeontological “grey literature” - in the form of unpublished university theses, impact studies and other reports (e.g., of commercial mining companies) - that is not readily available for desktop studies;
5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.
6. In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:
    (a) underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
    (b) overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc.).
7. Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails inferring the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist. In the present case, site visits to the various loop and borrow pit study areas in some cases considerably modified our understanding of the rock units (and hence potential fossil heritage) represented there.

In the case of the present study area in the southern Great Karoo region due south of Beaufort West (Western Cape) exposure of potentially fossiliferous bedrocks is very limited, due to extensive cover by superficial sediments and karroid *bossieveld* vegetation. However, sufficient exposures were examined to allow a realistic assessment of the palaeontological sensitivity of the key rock units (See Appendix 1 and Satellite image in Figure 36), while a substantial amount of relevant geological and palaeontological data is available from previous PIAs in the region (See, for example, References under Almond and Appendix 1). Confidence levels for this assessment are accordingly rated as Medium. Comparatively few academic palaeontological studies have been carried out in the region so any new data from impact studies here are of scientific interest (*cf* an ongoing research project on late Middle Permian fossil assemblages in the Main Karoo Basin by Professor Bruce Rubidge at Wits University and colleagues)

3.3 CLA – Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork and study undertaken, it is necessary to realise that the cultural landscape elements identified during fieldwork do not necessarily represent all the possible elements present in the area. Various factors account for this, including the layered histories associated with the area, specifically in terms of intangible and living heritage resources associated to the cultural landscape. Fieldwork was thorough enough for the purpose of this study, to pick up on the sense of place and character of the area, in order to assess impact of the development on the cultural landscape and propose mitigation measures.

The following identified assumptions should be noted:

- That the reports and information provided to Hearth Heritage by the client and EAP are true and correct at the time of submission.
- That the development infrastructure will be removed and rehabilitation of the landscape completed as per the EMPr for these developments in the decommissioning phase and not recommissioned.
- That the status quo of the landscape was 'as usual' during the fieldwork period and that residents or labourers, stock or other relevant cultural elements were not altered for the survey period.

The following identified limitations should be noted:

- Only 2 previous specialist cultural landscapes research for the immediate area was available for proposed adjacent Koup 1 and 2 WEF's, however HIA studies in the area have been done and were consulted for information. Similarities to landscape character and elements in the region to other areas where CLA studies have been done, allowed for use of these studies in analysis and recommendations for development in this report (Jansen and Franklin, 2020).
- No stakeholder participation was conducted to determine intangible or living heritage resources for the purposes of the cultural landscape assessment.
- Due to the historical layering of the landscape and associated history and memory of conflict, dispossession and disempowerment, the values attributed to the landscape and heritage resources are varied and do not necessarily align to give a definitive single significance to the site. Perceptions of sense of place vary over time and place and from one individual to the next depending on their relationship to the landscape and the proposed development. Without a detailed and extensive consultation process with all potential stakeholders, including non-landowners (labourers, tourists, youth), the full significance of the cultural landscape and impact of the proposed development on it, cannot be accurately determined. The depth and complexity of values assigned to heritage resources in this landscape is beyond the scope of this report for the BAR, but should be further developed in the EIA process through stakeholder engagement by qualified heritage specialists to determine the full impact of the proposed

development on the cultural landscape and inform mitigation accordingly.

- At the time of undertaking the visual study no information was available regarding the type and intensity of lighting that will be required for the proposed WEF and therefore the potential impact of lighting at night was not assessed at a detailed level. However, lighting requirements are relatively similar for all WEF's and as such, general measures to mitigate the impact of additional light sources on the ambiance of the nightscape were provided in the VIA (Schwartz, 2021).

4. TECHNICAL DESCRIPTION

4.1 Project Location

The proposed WEF and associated infrastructure is located approximately 70km south of Beaufort West in the Western Cape Province and is within the Prince Albert Local Municipality in the Central Karoo District Municipality (**Figure 7**).

Figure 7: Regional Context Map.

4.1.1 WEF

The WEF application site, as shown on the locality map below (**Figure 8**) is approximately 4017.6 hectares (ha) in extent and incorporates the following farm portions:

- Remainder of the Farm Witpoortje No 16
- Portion 8 of the Farm Klipgat No 114

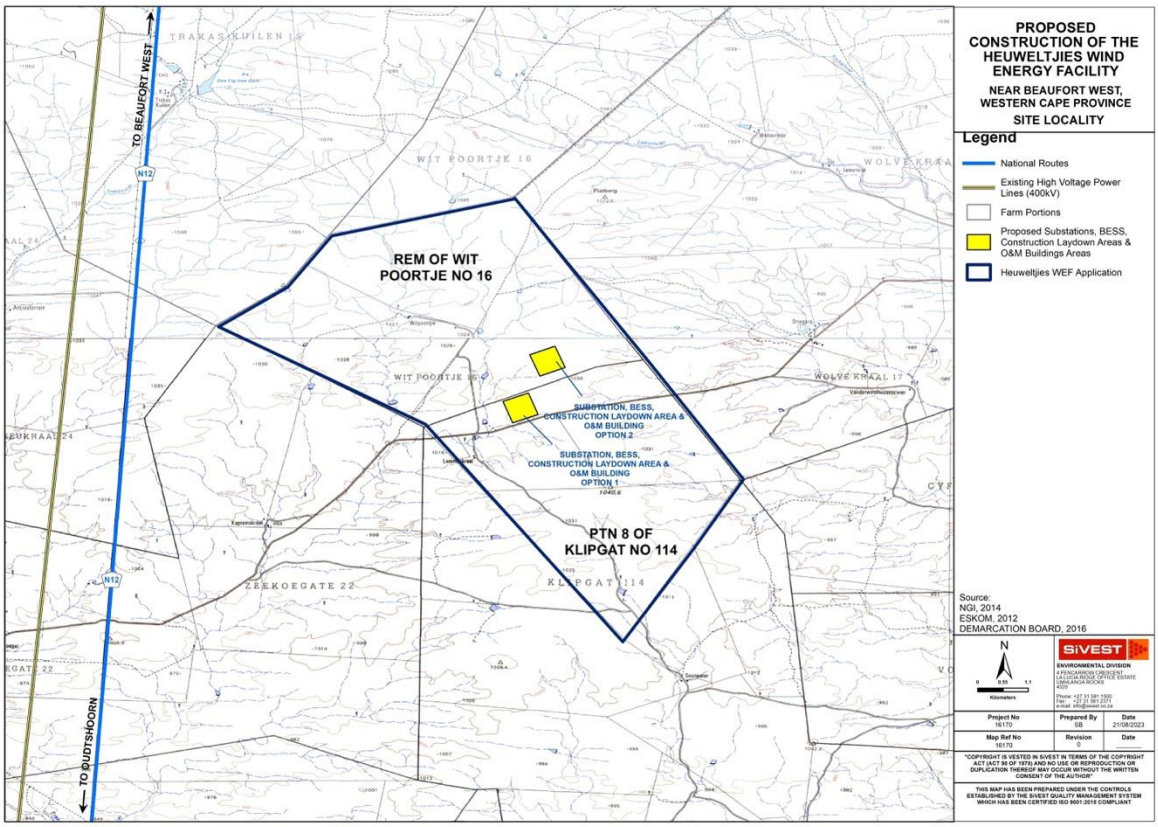


Figure 8: Heuweltjies WEF Site Locality.

4.2 Project Description

It is anticipated that the proposed Heuweltjies WEF will comprise a maximum of up to thirty eight (38) wind turbines with a maximum total energy generation capacity of up to approximately 240MW. The electricity generated by the proposed WEF development will be fed into the national grid via a 132kV overhead power line. The 132kV overhead power line will however require a separate EA and is subject to a separate BA process, which is currently being undertaken in parallel to this EIA process.

4.2.1 Wind Farm Components

- Up to thirty eight (38) wind turbines, with a maximum export capacity of approximately 240MW. This will be subject to allowable limits in terms of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). The final number of turbines and layout of the WEF will, however, be dependent on the outcome of the Specialist Studies conducted during the EIA process;
- Each wind turbine will have a hub height of up to 120m and 200m and rotor diameter of up to approximately 200m;
- Permanent compacted hard standing areas / platforms (also known as crane pads) of approximately 90m x 50m (total footprint of approx. 4 500m2) per turbine during construction and for on-going maintenance purposes for the lifetime of the proposed development;

- Each wind turbine will consist of a foundation of up to approximately 15m x 15m in diameter. In addition, the foundations will be up to approximately 3m in depth;
- Electrical transformers (690V/33kV) adjacent to each wind turbine (typical footprint of up to approximately 2m x 2m) to step up the voltage to 11-33kV;
- Associated infrastructure of approximately 25ha which includes;
    - One (1) new 11-33kV/132kV IPP on-site substation including associated equipment and infrastructure the proposed substation will be a step-up substation and will include an Eskom portion and an IPP portion, hence the substation has been included in the WEF EIA and in the grid infrastructure (substation and 132kV overhead power line) BA to allow for handover to Eskom. Following construction, the substation will be owned and managed by Eskom.
    - A Battery Energy Storage System (BESS) will be located next to the onsite 11-33kV/132kV substation. .
    - One (1) construction laydown / staging area of up to approximately 3ha. It should be noted that no construction camps will be required in order to house workers overnight as all workers will be accommodated in the nearby town.
    - Operation and Maintenance (O&M) buildings, including offices, a guard house, operational control centre, O&M area / warehouse / workshop and ablution facilities to be located on the site identified for the substation.
- The wind turbines will be connected to the proposed substation via medium voltage (11-33kV) underground cabling and overhead power lines.
- Road servitude of 8m and a 20m underground cable or overhead line servitude.
- The main access road will be approximately 8 - 12 m wide. During construction the internal and access roads will be up to 13.5m in some parts (i.e. for bringing in transformers etc), after construction they will be rehabilitated back down to 8m or less. Turns will have a radius of up to 50m for abnormal loads (especially turbine blades) to access the various wind turbine positions. It should be noted that the proposed application site will be accessed via the N12 National Route. During operation, internal roads with a width of up to approximately 5m (excluding reserves) wide will provide access to each wind turbine. Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
-
- A wind measuring lattice (approximately 140m in height) mast has already been strategically placed within the wind farm application site in order to collect data on wind conditions;
- No new fencing is envisaged at this stage. Current fencing is standard farm fence approximately 1-1.5m in height. Fencing might be upgraded (if required) to be up to approximately 2m in height; and
- Water will either be sourced from existing boreholes located within the application site or will be trucked in, should the boreholes located within the application site be limited.

4.3 Alternatives

4.3.1 Wind Energy Facility

No other activity or site alternatives are being considered. Renewable Energy development in South Africa is highly desirable from a social, environmental and development point of view and a wind energy facility is considered suitable for this site due to the high wind resource in this area.

The choice of technology selected for the Heuweltjies WEF is based on environmental constraints and technical and economic considerations. No other technology alternatives are being considered as wind energy facilities are more suitable for the site than other forms of renewable energy due to the high wind resource.

The size of the wind turbines will depend on the development area and the total generation capacity that can be produced as a result. The choice of turbine to be used will ultimately be determined by technological and economic factors at a later stage.

Design and layout alternatives will be considered and assessed as part of the EIA. These include alternatives for the Substation locations also including for the on-site substation (Eskom and IPP portions), construction laydown area, BESS and O&M buildings. The proposed layout is shown in **Figure 9** below.

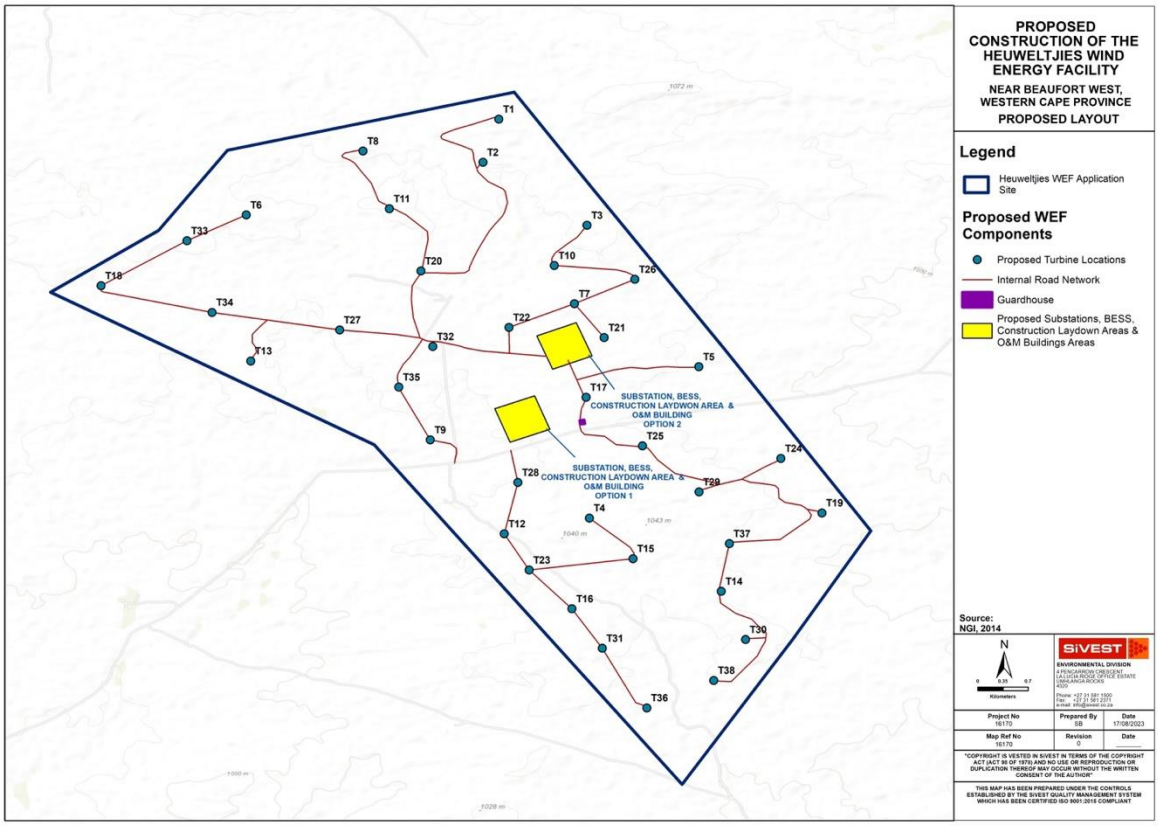


Figure 9: Layout and development area

4.3.2 No-go Alternative

The 'no-go' alternative is the option of not undertaking the proposed WEF and associated infrastructure projects. Hence, if the 'no-go' option is implemented, there would be no development, and thus no

associated environmental impacts on the site or the surrounding area. It provides the baseline against which other alternatives are compared and will be considered throughout the report.

5. LEGAL REQUIREMENT AND GUIDELINES

5.1 Statutory Framework: The National Heritage Resources (Act 25 of 1999)

The NHRA has applicability, as the study forms part of an overall HIA in terms of the provisions of Section 34, 35, 36 and 38 of the NHRA and forms part of a heritage scoping study that serves to identify key heritage resources, informants, and issues relating to the palaeontological, archaeological, built environment and cultural landscape, as well as the need to address such cases during the impact assessment phase of the HIA process.

5.1.1 Section 35 – Archaeology, Palaeontology and Meteorites

According to Section 35 (Archaeology, Palaeontology and Meteorites) and Section 38 (Heritage Resources Management) of the NHRA, PIAs and AIAs are required by law in the case of developments in areas underlain by potentially fossiliferous (fossil-bearing) rocks, especially where substantial bedrock excavations are envisaged, and where human settlement is known to have occurred during prehistory and the historic period.

5.1.2 Section 36 – Burial Grounds & Graves

A section 36 permit application is made to the Heritage Western Cape (HWC) or the competent provincial heritage authority which protects burial grounds and graves that are older than 60 years and must conserve and generally care for burial grounds and graves protected in terms of this section, and it may make such arrangements for their conservation as it sees fit. HWC must also identify and record the graves of victims of conflict and any other graves which it deems to be of cultural significance and may erect memorials associated with these graves and must maintain such memorials. A permit is required under the following conditions:

Permitting requirements for burial grounds and graves older than 60 years (prehistoric) and historic burials to the HWC:

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.

d) 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.

5.1.3 Section 38 HIA as a Specialist Study within the EIA in Terms of Section 38(8)

A section 38 (Heritage Impact Assessments) application to HWC is required when the proposed development triggers one or more of the following activities:

a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
a) the construction of a bridge or similar structure exceeding 50 m in length;
b) any development or other activity which will change the character of a site,
    i. exceeding 5 000 m2 in extent; or
    ii. Involving three or more existing erven or subdivisions thereof; or
    iii. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
    iv. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
c) the re-zoning of a site exceeding 10 000 m2 in extent; or
d) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority.

In this instance, the heritage assessment for the property is to be undertaken as a component of the EIA for the project. Provision is made for this in terms of Section 38(8) of the NHRA, which states that:

This is an HIA submitted to the relevant authority (DEA) in terms of Section 38(8) of the National Heritage Resources Act. The commenting authority is HWC.

An HIA report is required to identify, and assess archaeological resources as defined by the Act, assess the impact of the proposal on the said archaeological resources, review alternatives and recommend mitigation (see methodology above).

Section 38 (3) Impact Assessments are required, in terms of the statutory framework to conform to basic requirements as laid out in Section 38(3) of the NHRA. These are:

- The identification and mapping of heritage resources in the area affected.
- The assessment of the significance of such resources.
- The assessment of the impact of the development on the heritage resources.
- An evaluation of the impact on the heritage resources relative to sustainable socio/economic benefits.
- Consideration of alternatives if heritage resources are adversely impacted by the proposed development.
- Consideration of alternatives.
- Plans for mitigation in the future.

5.1.4 Notice 648 of the Government Gazette 45421

Although minimum standards for archaeological (2007) and paleontological (2012) assessments[1] were published by SAHRA and Heritage Western Cape[2][3], GN.648 requires sensitivity verification for a site selected on the national web based environmental screening tool for which no specific assessment protocol related to any theme has been identified. The requirements for this Government Notice (GN) are listed in **Table 3** and the applicable section in this report noted. The screening tool indicated a **low** archaeological and cultural heritage significance (**Figure 10**).

Table 3: Reporting requirements for GN648

GN 648	Relevant section in report	Where not applicable in this report
2.2 (a) a desktop analysis, using satellite imagery;	Section 7	
2.2 (b) a preliminary on-site inspection to identify if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web-based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.	Section 6	-

[1] South African Heritage Resources Agency. 2007. *Minimum Standards: Archaeological and Palaeontological Components of Impact Assessment Reports*. May 2007.
[2] Heritage Western Cape. 2016. *Guide for Minimum Standards for Archaeology and Palaeontology Reports Submitted to Heritage Western Cape*. June 2016.
[3] Heritage Western Cape 2016. *Guidelines for Heritage Impact Assessments required in terms of Section 38 of the National Heritage Resources Act (Act 25 of 1999).*

2.3(a) confirms or disputes the current use of the land and environmental sensitivity as identified by the national web- based environmental screening tool;	Section 6	-
2.3(b) contains motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity;	Section 6 provides a description of the current use and confirms/doesn't confirm the status in the screening report.	-

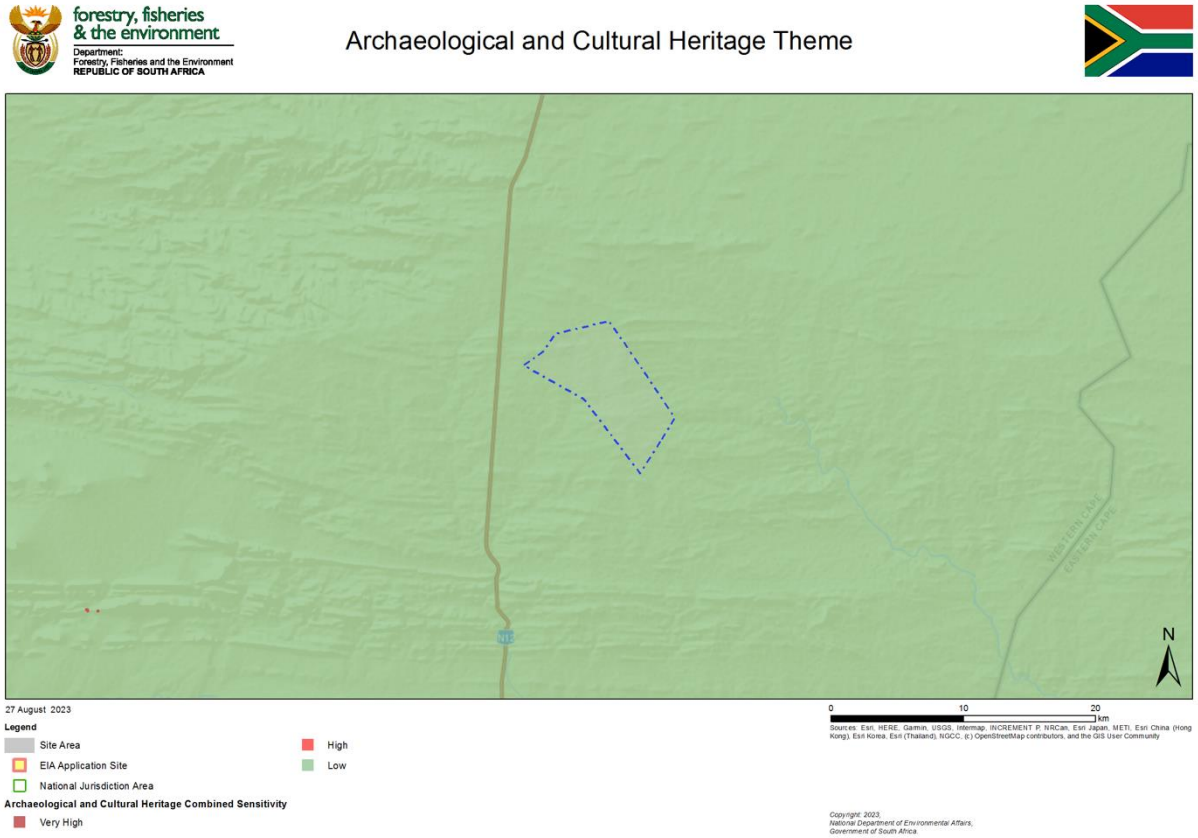


Figure 10: DFFE Screening tool outcome indicating low *archaeological and cultural heritage* significance

The PIA further states that *the Heuweltjies WEF project area has an overall LOW Palaeosensitivity as far as palaeontological heritage is concerned. The potential for rare, and largely unpredictable, unrecorded fossil sites preserved within bedrocks and consolidated older alluvial sediments within the project areas cannot be entirely discounted, however. The palaeosensitivity mapping shown by the DFFE Screening Tool is accordingly contested here.*

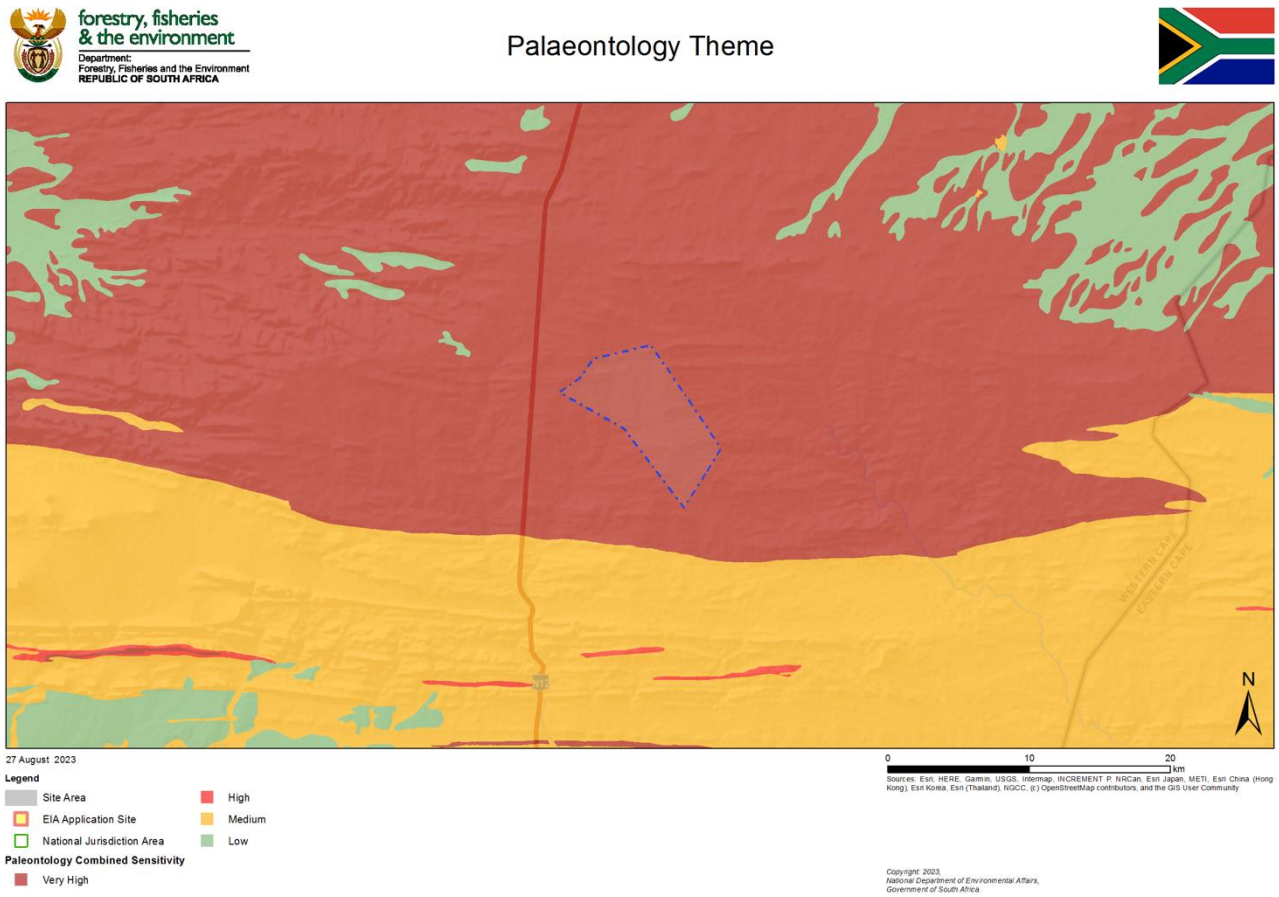


Figure 11: Provisional paleontological sensitivity map for the Heuweltjies WEF project area based on the DFFE Screening Tool indicating that the entire project area is of Very High Palaeosensitivity. Due to the scarcity of well-preserved, scientifically important fossils over much of this region, based on desktop studies and fieldwork, it is inferred that most parts of the project areas are in practice of LOW palaeontologically sensitivity. Areas underlain by thick alluvial sediments here are generally of LOW sensitivity, although important concentrations of Caenozoic mammal remains might occur here. The palaeosensitivity mapping shown by the DFFE Screening Tool is contested here.

5.1.5 NEMA – Appendix 6 requirements

The HIA report has been compiled considering the National Environmental Management Act (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) Appendix 6 requirements for specialist reports as indicated in the table on page vi and vii of this report.

6. DESCRIPTION OF THE RECEIVING ENVIRONMENT

A field survey was conducted by two archaeologists from PGS in February 2021. The general vicinity of the proposed development area was assessed.

The proposed development area is located approximately 70km south of the town of Beaufort West in the Western Cape Province. The study area is located within an arid and sparsely vegetated region of the Karoo which is currently experiencing a drought. This has resulted in farms in the area being restricted to farming small numbers of livestock which include Dorper sheep, cattle and game which include kudu, gemsbok and small buck.

The study area is underlain by Karoo Supergroup sedimentary rocks. Rock types encountered include hornfels, CCS (chert), mudstones, siltstone, carbonates and fine-grained sandstones, some of which have been silicified and metamorphosed. In terms of the topography, the study area comprises relatively flat portions of land which have undergone extensive erosion with the development of occasional scree slopes. here are also remnants of rocky ridges. The flat sandy plains (often bioturbated) with areas of sheet wash are frequently cut by ephemeral streams. The soils were predominately sandy with gravel and large rock fragments.

The vegetation of the study area is typical of the Nama-Karoo biome and comprises grasses, stunted shrubs and thorn trees which are established along stream courses (Palmer & Hoffman, 1997). Therefore, the archaeological visibility of the area was ideal for surveying.

The study area is serviced by the formal N12, graded gravel roads and farm tracks. Photographs of the general study area are provided below.

Figure 12: General view of the topography of the study area.

Figure 13: General view of bioturbated rocky sands.

Figure 14: View of sparse vegetation within a deflation zone.

Figure 15: View of a typical rocky ridge.

Figure 16: General view of outwash plain.

7. BACKGROUND RESEARCH

The previous section provided a topographical description of the proposed development area. This section seeks to describe the historical origins of the receiving environment.

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore, an internet literature search was conducted, and relevant archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

7.1 Archival/Historical Maps

Historical topographic maps (1:50 000) for various years (1965, 1987, 2005) were available for utilisation in the background study. These maps were assessed to observe the development of the area, as well as the location of possible historical structures and burial grounds. The study area was overlain on the map sheets to identify structures or graves situated within or immediately adjacent to the study area that could possibly be older than 60 years and thus protected under Section 34 and 36 of the NHRA.

There were several structures identified within the vicinity of the proposed development area.

7.1.1 1: 50 000 Topographical Map 3222DC and 3322BA - First Edition 1965

A section of the First Edition of the 3222DC (AMANDELHOOGTE) and 3322BA (SEEKOEGAT) Topographical Sheet is depicted in **Figure 17** and **Figure 18.** This map sheet was based on aerial photography undertaken in 1962, was surveyed in 1965 and was printed by the Trigonometrical Survey Office in 1966.

Several sites containing structures (incl. farmstead) and a ruin are depicted in the vicinity of the study area. All these identified sites are likely to be at least 56 years old.

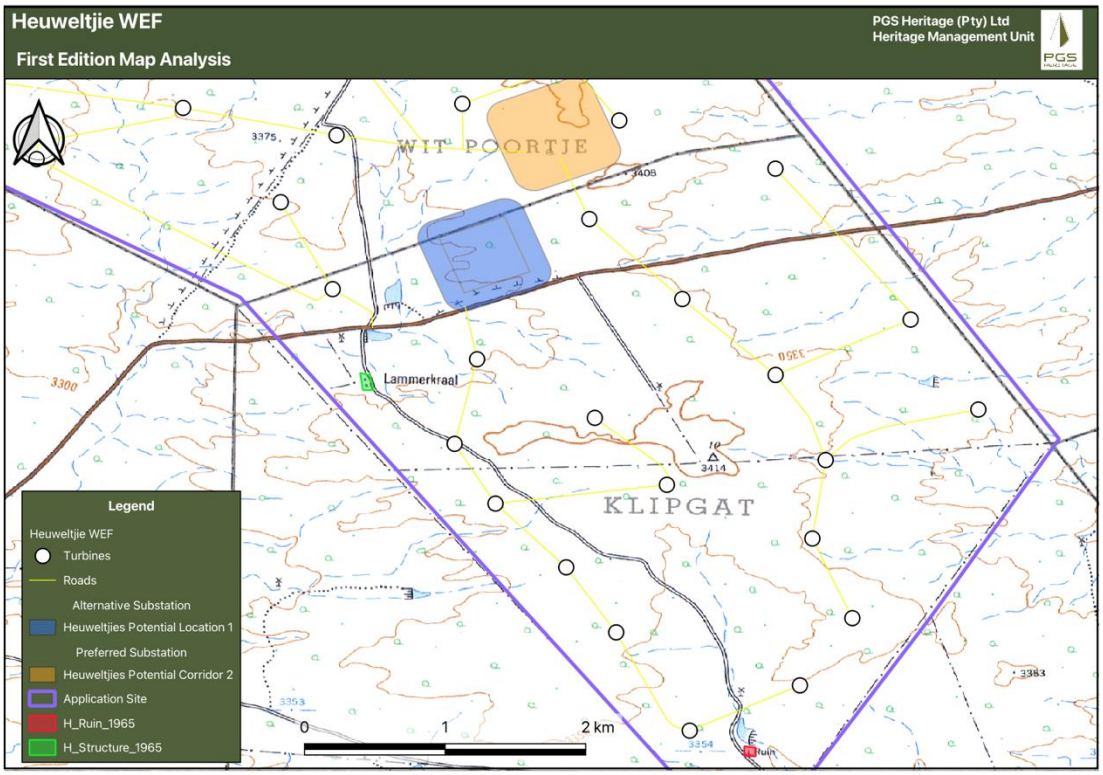


Figure 17: First Edition of 3222DC Topographic Map 1: 50 000 dating to 1965, showing the proposed Heuweltjies WEF, with two possible heritage features (Farmstead: green polygon; structure: blue polygon) located within the project area.

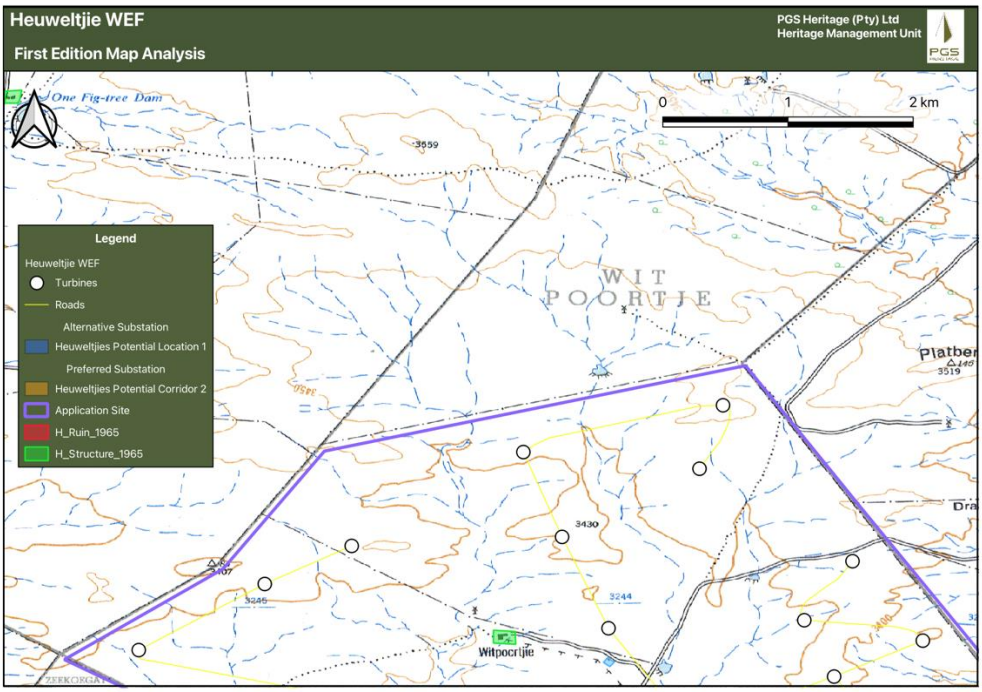


Figure 18: First Edition of 3322BA Topographic Map 1: 50 000 dating to 1965, showing the proposed Heuweltjies WEF, with two possible heritage features (farmstead: green polygon; ruin: red polygon) located within the project area.

7.2 Aspects of the area's history

7.2.1 Previous Heritage Studies in area

It is well known that the Karoo contains a long and rich archaeological record dating from the ESA to the historic period. However, vast areas of the region have yet to be subjected to systematic analytical research.

Scatters of ESA through to LSA artefacts have been widely reported in the general vicinity of Beaufort West. This is a result of the erosional nature of the environment, which tends to leave artefacts exposed on the surface rather than buried beneath layers of sediment. To date, heritage studies in the area have shown that these artefacts have occurred in secondary contexts, often associated with gravel deposits, having been subjected to erosion of the soils in which they were once deposited (Dreyer 2005; Halkett 2009; Kaplan 2006, 2007; Orton 2010; Webley & Hart 2010a, 2010b; Webley & Lanham 2011). Although context is generally poor, the Karoo is still regarded as a region that is very rich in archaeological and historical heritage.

Historical resources, such as farmsteads, kraals and graves, are also observed within the Beaufort West region (Halkett 2009; Webley & Hart 2010b). To the northeast of Beaufort West, rock engravings have been identified on dolerite boulders that are characteristic of parts of the Karoo (Orton, 2010; Parkington *et al*., 2008). The lack of caves and rock shelters in the Karoo region, results in the majority of archaeological sites in the area being classified as open-air sites. As such, the artefacts are generally not *in-situ* and organic remains are rarely preserved.

A review of SAHRIS has revealed that a number of other archaeological studies have been performed within the wider vicinity of the study area. The following studies were conducted around the study area of this report:

- ***Cape Archaeological Survey (CAS) cc and Associates. 2016. Heritage Impact Assessment: Proposed Construction of Two Power Lines & Three Substations for the Mainstream Wind Energy Facility. Land Parcel Beaufort West, Remainder of Farm Trakaskuilen No 15, Portion 1 Trakaskuilen No 15, Portion 1 of Witpoortje No 16.*** *CAS was appointed by SiVest Environmental Division on behalf of their client Mainstream Renewable Power South Africa (Pty) Ltd to conduct an AIA report. The study area was situated on the N12 between Beaufort West and Klaarstroom. Several MSA open sites, positioned on the summit areas of low rides and koppies, were identified. There was also a general background presence of MSA with occasional flakes or cores observed in the open. There was little evidence of LSA activity in the area. Most of the raw material used was a fine-grained chert with a reddish outer patina (grey when flaked). In terms of colonial period archaeology, there were several farm complexes with buildings, historic dumps and derelict structures. The area*

hadn't been systematically studied or researched, so the archaeological sensitivity of the proposed wind farm on archaeological features was seen as high.

- ***Dreyer, C. 2005. Archaeological and historical investigation of the proposed residential developments at the farms Grootfontein 180 & Bushmanskop 302, Beaufort West, south-western Cape.*** *The study area is located approximately 20km west of Beaufort West. Scattered and isolated lithics were found in the area. A trihedra, Acheulian or Victoria West I handaxe, a bifacial worked Oldowan chopper with minimal retouch, a number of isolated flakes and core flakes and several small assemblages of LSA scrapers were identified. On the flood plain near the Sand River, fragments of ostrich eggshell and one single ostrich eggshell bead were also identified.*
- ***Fourie, W. 2018. AIA: Proposed Construction of a Linking Station, two (2) Power Lines and two (2) On-site Substations for the Beaufort West and Trakas Wind Farms, near Beaufort West in the Western Cape Province.*** *PGS Heritage (Pty) Ltd (PGS) was appointed by SiVEST to undertake an Archaeological Impact Assessment (AIA). The study area was located approximately 50km south of Beaufort West. Two archaeological sites and seven findspots were identified. The archaeological resources identified during the fieldwork comprised a large number of Stone Age surface artefact scatters. These were primarily from the MSA, although both LSA and earlier ESA material was identified. All of these artefact assemblages occurred in heavily deflated and eroded areas, so their scientific potential and heritage significance is somewhat lowered.*
- ***Halkett, D. 2009. An archaeological assessment of uranium prospecting on portions 1, 3 and 4 of the farm Eerste Water 349, and remainder of the farm Ryst Kuil 351, Beaufort West.*** *ACO Associates was appointed by Ferret Mining and Environmental Services (Pty) Ltd to undertake a scoping survey. Heritage sites were quite sparse in the area. Pre-colonial stone age sites (ESA, MSA and LSA) and colonial sites related to farming and settlement (incl. cemeteries, small ruined dwellings, stone kraal, fragments of annular ware and transfer printed refined earthenware ceramics) were identified. There were patinated and polished ESA/MSA artefacts made of hornfels and siltstone. LSA material is rarer but one scatter of LSA material was identified in close proximity to a dry river course.*
- ***Kinahan, J. 2008. Archaeological Baseline Survey of the Proposed Ryst Kuil Uranium Project.*** *Kinahan was appointed by Turgis Consulting (Pty) Ltd on behalf of UraMin-Mago-Lukisa JV Company (Pty) Ltd to cnduct an archaeological baseline survey. The study area was located approximately 45km southeast of Beaufort West. In general, the study area was characterised by a low density of surface material, with much displacement by sheet erosion. None of the ESA material (isolated quartzite artefacts) were in-situ as all showed evidence of fluvial transport. Isolated MSA finds were observed. These finds probably formed part of a continuous surface scatter but lateral disturbance may have greatly exaggerated the distribution and number of these sites. The lack of focal points in the landscape means that there were no major MSA site concentrations. MSA artefacts were dominated by quartzite and*

hornfels. There was also some evidence of Levallois core production and a few Howieson's Poort segments found at a number of sites. Isolated and local scatters of LSA materials were also apparent. A number of these sites were associated with lithic raw material sources (chert and hornfels outcrops). Late pre-colonial sites included a number of suspected hut circles and short lengths of stone walling, as well as possible burial cairns. Historic stone structures (dry-stone construction and mud-brick construction) along with imported items (crockery and rifle cartridges) were also noted.

- ***Nilssen, P. 2011. Archaeological Impact Assessment. Proposed Beaufort West Photovoltaic (Solar) Park: southern portion of properties; 2/158 Lemoenkloof, RE 9/161 Kuilspoort, RE 162 Suid-lemoensfontein and RE 1/163 Bulskop, Beaufort West, Western Province.*** *The study area was approximately 8km south east of Beaufort West. The finds included numerous isolated and very low-density scatters of Stone Age artefacts ranging in age from the ESA to the LSA. Due to their temporally mixed nature and the absence of other faunal/cultural remains, these finds were considered to be of low heritage significance. There were also several archaeological occurrences that represented isolated events that were recorded as medium to high heritage significance.*
- ***Orton, J. 2011. Heritage Impact Assessment for a proposed Photo-Voltaic Facility on Steenrots Fontein 168/1, Beaufort West Magisterial District, Western Cape. University of Cape Town: Archaeology Contracts Office.*** *The UCT Archaeological Contracts Office was appointed by the Council for Scientific and Industrial Research (CSIR) to conduct a HIA. Most of the archaeological material was likely MSA (background scatters) and the artefacts were generally weathered. Historical material included fragments of a bottle and fragments of an annular ware bowl. All of the finds were recorded as low significance.*
- ***Webley, L. & Halkett, D. 2015. Archaeological Impact Assessment: Proposed Uranium Mining and Associated Infrastructure on Portions of the Farms Quaggasfontein and Rystkuil* near Beaufort West in the Western Cape and De Pannen near Aberdeen in the Eastern Cape.*** *Webley and Halkett were appointed by Ferret Mining & Environmental Services (Pty) Ltd, on behalf of a client, to conduct an AIA report. Archaeological material comprised small numbers of ESA artefacts, scatters of MSA and occasional LSA. The majority were manufactured on indurated shales (hornfels) and some artefacts were manufactured from a chert band. Artefact numbers were very low and of low significance. One LSA site, Site D009, was located on the banks of a little stream. Amongst the identified lithics, was a characteristic LSA drill and thumbnail scraper.*
- ***Webley, L. & Lanham, J. 2011. Heritage Assessment of the Proposed upgrade to the stormwater retention facilities at Beaufort West, Western Cape.*** *Archaeology Contracts Office (ACO) were appointed by Kayad Knight Piesold (Pty) Ltd to conduct a heritage impact assessment. No heritage resources were identified.*
- ***Vidamemoria Heritage Consultants. 2015. Heritage Impact Assessment: DR 2403 Central Karoo, Beaufort West – Central Karoo District Municipality, Western Cape.*** *Vidamemoria*

was appointed by Aurecon South Africa (Pty) Ltd to conduct a HIA for a proposed borrow pit. The study area was located approximately 44.5km southeast of Murraysburg. No heritage resources were identified.

- ***Vidamemoria Heritage Consultants. 2012. Heritage Impact Assessment: DR 2308 Central Karoo, Beaufort West – Central Karoo District Municipality, Western Cape.*** *Vidamemoria was appointed by Aurecon South Africa (Pty) Ltd to conduct a HIA for a proposed borrow pit. The study area was located approximately 40km southwest of Beaufort West. Low density scatters of mixed MSA and LSA artefacts were observed in a secondary context and were of low archaeological heritage significance.*

7.2.2 Archaeological Background

Table 4: Summary of archival data found on the general area.

DATE	DESCRIPTION
Early Stone Age (2.5 million to 250 000 years ago)	The Earlier Stone Age (ESA) is the first phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates to approximately 1.5 million years ago. Isolated ESA lithics, including occasional hand axes have been reported from the area surrounding Beaufort West, but they are generally quite ephemeral. Kinahan (2008) identified 7 ESA sites during an assessment of Ryst Kuil. He recorded isolated quartzite artefacts and commented that "none of the ESA material was considered to be in primary context and therefore of little research value". No Early Stone Age sites are known within the immediate vicinity of the study area. However, this is probably due more to a lack of research on the surroundings of the study area rather than a lack of sites.
Middle Stone Age (250 000 to 40 000 years ago)	The Middle Stone Age (MSA) is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique. Within the region around Beaufort West, heritage reports have shown that MSA artefacts are widespread and occur in isolated as well as relatively dense concentrations over large areas. According to Kinahan (2008), the MSA sites in his assessment (Ryst Kuil) "probably formed part of a continuous surface scatter almost without focal points". He noted that the MSA artefacts were mainly made from quartzite and hornfels. No Middle Stone Age sites are known within the immediate vicinity of the study area. However, this is probably due more to a lack of research on the surroundings of the study area rather than a lack of sites.
Later Stone Age (40 000 years ago	The Later Stone Age (LSA) is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths.

DATE	DESCRIPTION
to the historic past)	According to heritage reports conducted in the region, LSA artefacts are not as common as ESA and MSA stone artefacts in the area. Artefacts are generally made from hornfels and in some cases chert which was most likely sourced from a chert horizon that caps some of the low hills in the area. LSA artefacts are generally located close to dry river courses (Kinahan, 2008; Halkett, 2009). There have also been hut circles and stone kraals identified which have been interpreted as representing pre-colonial pastoralist groups. No Later Stone Age sites are known in the vicinity of the study area. However, this is likely rather due to a lack of research focus on the surroundings of the study area than a lack of sites.
17th – 19th Century	Beaufort West historically was an important centre for sheep farming, trade and transport. This was also an area of interaction between various cultural groups. During the eighteenth and early nineteenth century the Koup was one of the last refuges of the San. A shortage of surface water meant that populations of San hunter-gatherers, and later Khoekhoe pastoralists were confined to areas with springs. During the second half of the 18th century, farmers started moving northward into the Karoo, settling in areas known as the Nuweveld and the Koup (**Figure 19**, **Figure 20**). The movement of small groups of Xhosa into the Karoo during the 18th century resulted from a century of frontier wars in the Eastern Cape. The movement of Xhosa into the Karoo accelerated after the great cattle killing of 1856 and 1857. Many Xhosa migrated into the Karoo in search of work to survive. Many of these migrants fleeing starvation in the devasted lands east of the Kei River helped build some of the beautiful stone kraals that have become a feature of the Karoo.

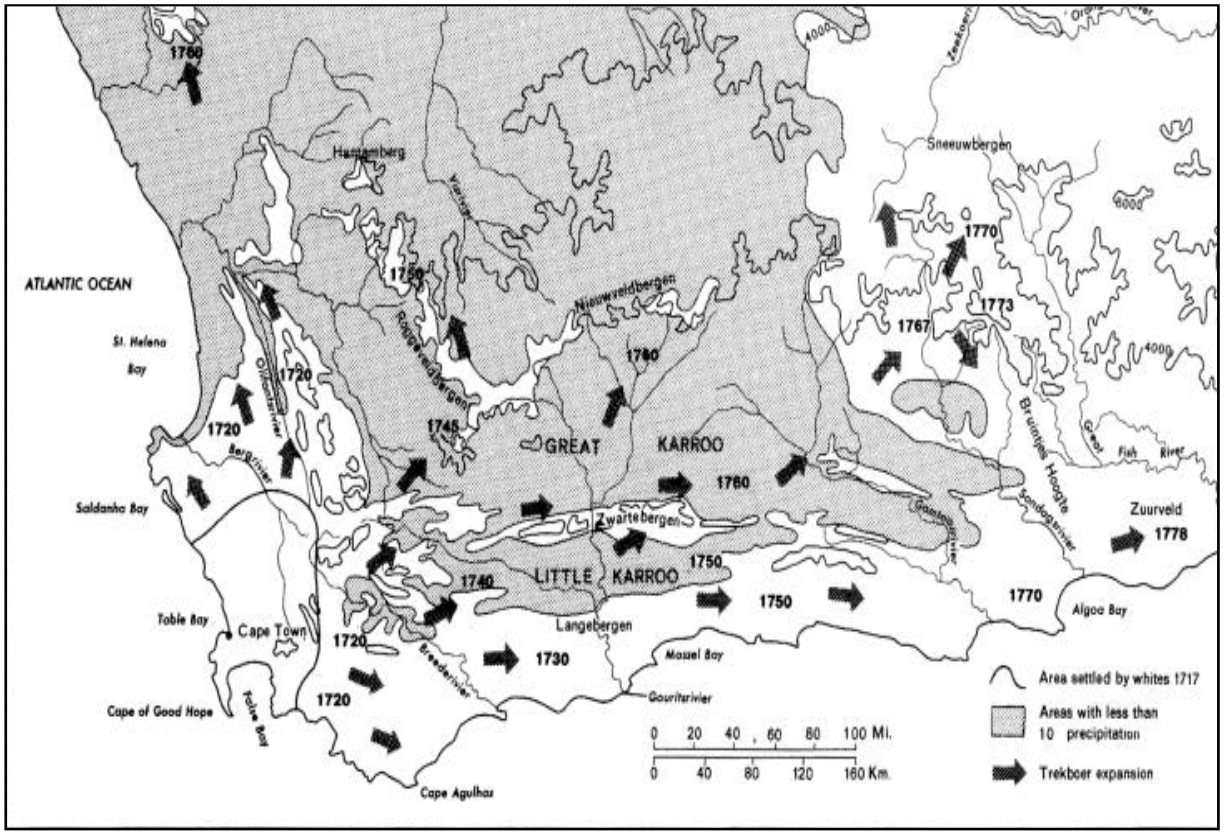
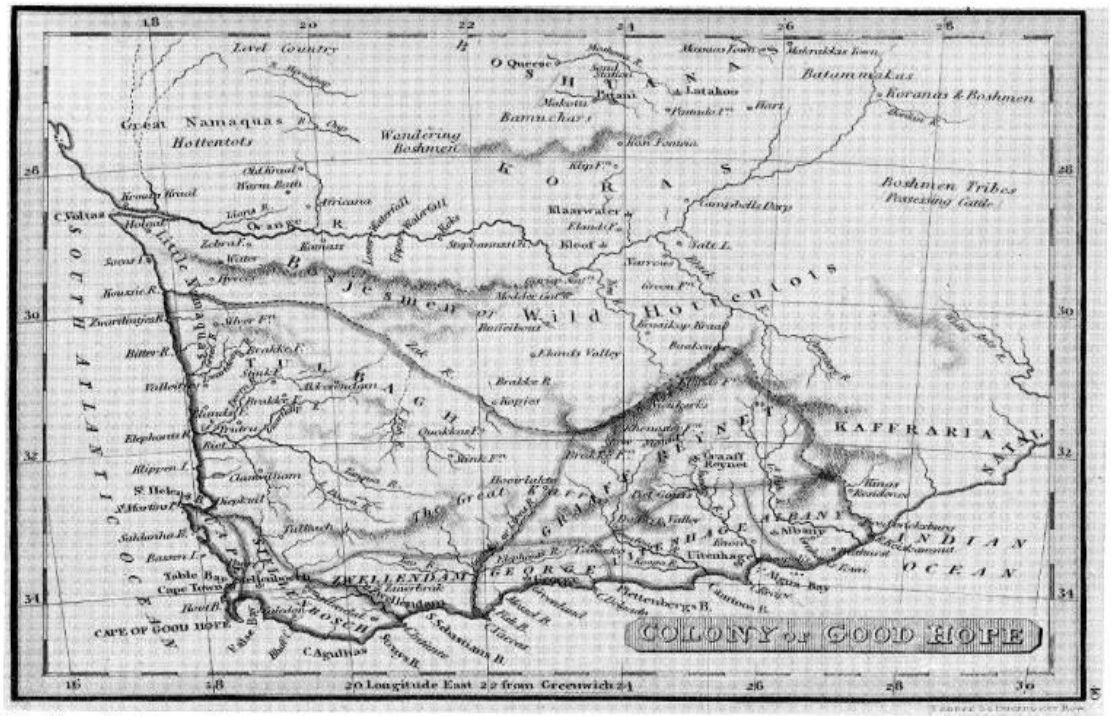


Figure 19: Trekboer and colonial expansion by 1717-1788 in the study region (Reference: Guelke & Shell 1992: 818).



The Cape Colony, 1820

Figure 20: Early map of the Cape illustrates the expansion of farmers towards the east and northeast Karoo (Reference: Watson, R.L. 1990).

7.3 Palaeontological context

The PIA (2023) completed for this project indicates that the geology of the Heuweltjies WEF project area is covered by 1: 250 000 geology sheets 3222 Beaufort West and 3322 Oudtshoorn (Council for Geoscience, Pretoria; Johnson & Keyser 1979, Toerien 1979) (**Figure 21**). The WEF project area is underlain at depth by Middle Permian continental (fluvial / lacustrine) sediments of the **Abrahamskraal Formation** (Lower Beaufort Group / Adelaide Subgroup, Karoo Supergroup) (Pa, pale green in **Figure 21**) (Johnson & Keyser 1979, Johnson *et al.* 2006). It is likely that the majority of the bedrocks here can be largely or entirely assigned to the sandstone package of the **Moordenaars Member** and the following mudrock-dominated **Karelskraal Member** towards the top of the very thick Abrahamskraal Formation succession (see stratigraphic column in **Figure 22**). Stratigraphically lower members of the Abrahamskraal succession, but not the underlying Ecca Group, may well be represented in the far south, however (*cf* Day & Rubidge 2014). Given the complexity of folding and thrust faulting in the study region, no attempt has been made here to identify the member-level stratigraphy in the project area, very broadly younging from south to north, for which detailed mapping beyond the scope of the present study would be required. According to the published geological map, the **Poortjie Member**, which spans the Middle to Late Permian boundary (*cf* Day *et al.* 2015b) and defines the base of the **Teekloof Formation** (Lower Beaufort Group / Adelaide Subgroup) (Pt, dark green in **Figure 21**), is *not* represented within the project area. However, this sandstone-dominated, tuffite-containing unit *might* underlie the WSW-ESE ridges traversing the northern margins of the area (this is unconfirmed). The sedimentology of the Abrahamskraal Formation has been reviewed recently by Wilson *et al.* (2014) while the Abrahamskraal – Teekloof transition has been addressed by Paiva (2015).

Early Jurassic intrusions of the Karoo Dolerite Suite are not mapped within the project area but do occur closer to Beaufort West. The project area lies within the northern margins of the Cape Fold Belt where levels of tectonic deformation vary from low to moderately high. As is clearly apparent from the striking colour-striped patterns seen on satellite images as well as in the field, the Palaeozoic bedrocks here have been deformed by moderately intense, north-directed crustal compression during the Permo-Triassic Orogeny, resulting in a series of tight, large-scale folds with broadly W-E axes as well as several low-angle thrust faults with a similar strike orientation in the region, the latter often associated with quartz veining. (Bedding dips are up to 40º and both mudrock as well as sandstone facies may be affected by a pervasive tectonic cleavage or closely-spaced fracture sets with a west-east orientation.

The Palaeozoic bedrocks in the study area are, for the most part, poorly exposed away from the more important drainage lines and occasional steeper hillslopes. Topographic relief is generally low so that on gentler hillslopes, beneath the extensive gravelly to sandy *vlaktes,* as well as along many water courses the bedrocks are mantled by a spectrum of **Late Caenozoic superficial sediments**. For the most part these comprise downwasted (eluvial) surface gravels (notably of wacke / vein quartz and tuffite), rubbly colluvium, silty, sandy and gravelly alluvium and skeletal soils with local development of spring deposits such as calcrete.

Most of the superficial deposits are unconsolidated and probably of Late Pleistocene to Holocene age (*i.e., deposited* within the last 2.5 million years) but some alluvium is well-calcretised and might be somewhat older. High Level gravel terraces are not well-developed in the region, implying low levels of stream incision, and there are no extensive areas of alluvium within the WEF and associated Infrastructure project areas on the geological map (these are better represented on the 1: 50 000 topographic sheets).

An interesting surface feature of the region are well-developed *heuweltjies* or mima mounds – slightly raised areas up to 10 or so meters in diameter that are characterised by pale, calcretised sandy soils, tall woody shrubs or small trees, and intensive vertebrate burrowing as well as frequently by Later Stone Age artefacts. These relictual to currently active features show up as well-dispersed, pale, round spots on aerial photos and satellite images and have been variously attributed to a combination of termite activity, mammalian burrowing and bush clumps.

The main geological features of this region of the Great Karoo margins have already been covered in some detail in the previous accounts of the adjoining Trakas and Beaufort West WEFs by Almond (2018, 2022d) and will therefore not be repeated at length here.

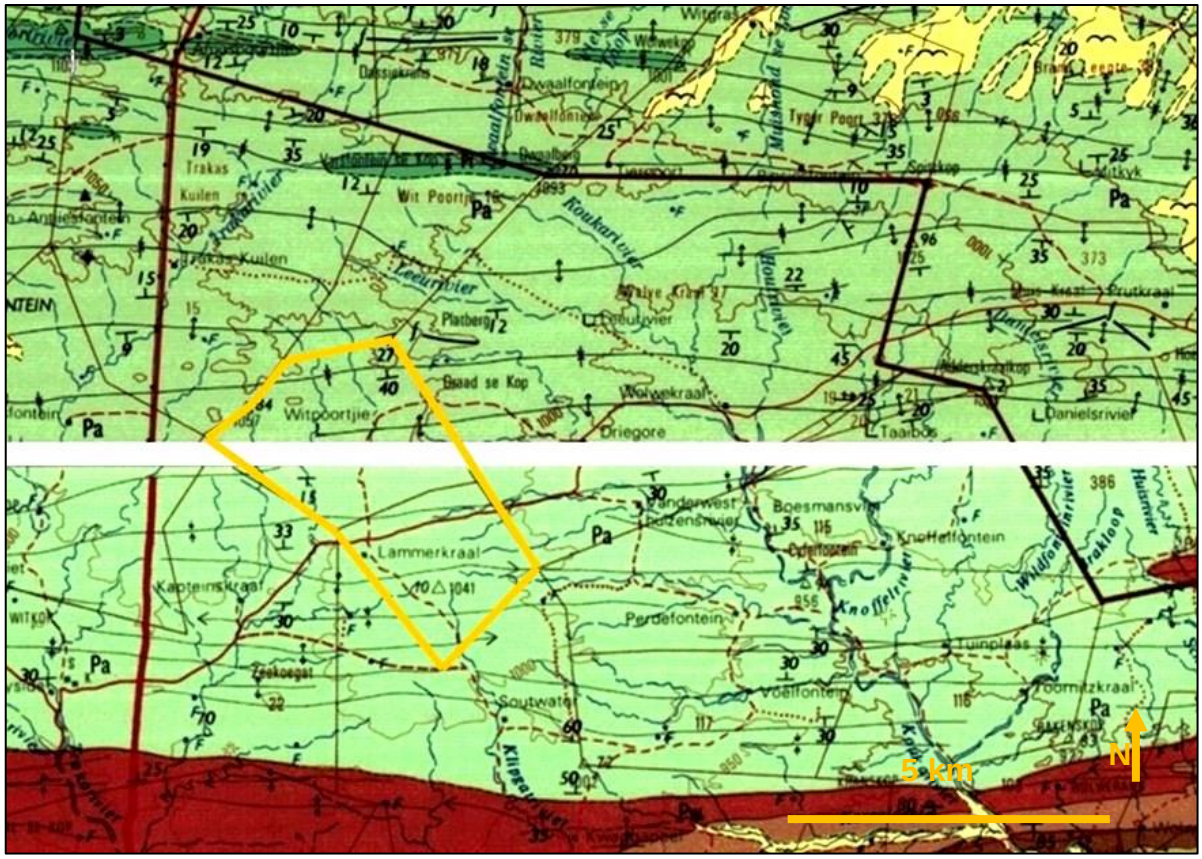


Figure 21: Extract from adjoining 1: 250 000 geology sheets 3222 Beaufort West (above) and 3322 Oudtshoorn (below) showing the boundaries of the Heuweltjies WEF project area to the south of Beaufort West (yellow polygon). Note numerous W-E trending fold axes occur in the region which falls within the northern margins of the Cape Fold Belt. Pa (pale green) =

Abrahamskraal Formation (Adelaide Subgroup, Lower Beaufort Group). Pt (dark green) = Poortjie Member of the Teekloof Formation (Adelaide Subgroup, Lower Beaufort Group). Yellow = Late Caenozoic / Quaternary superficial sediments, including alluvium, sheet wash, colluvium, soils, locally cemented by pedocretes such as calcrete. To the west of the N12 and outside the WEF / Grid Connection Infrastructure project area diamond symbols indicate fossil localities within the Tapinocephalus Assemblage Zone. Triangles indicate fossils within the Pristerognathus Assemblage Zone (N.B. This fossil biozone data is now outdated and the fossils concerned have probably been collected).

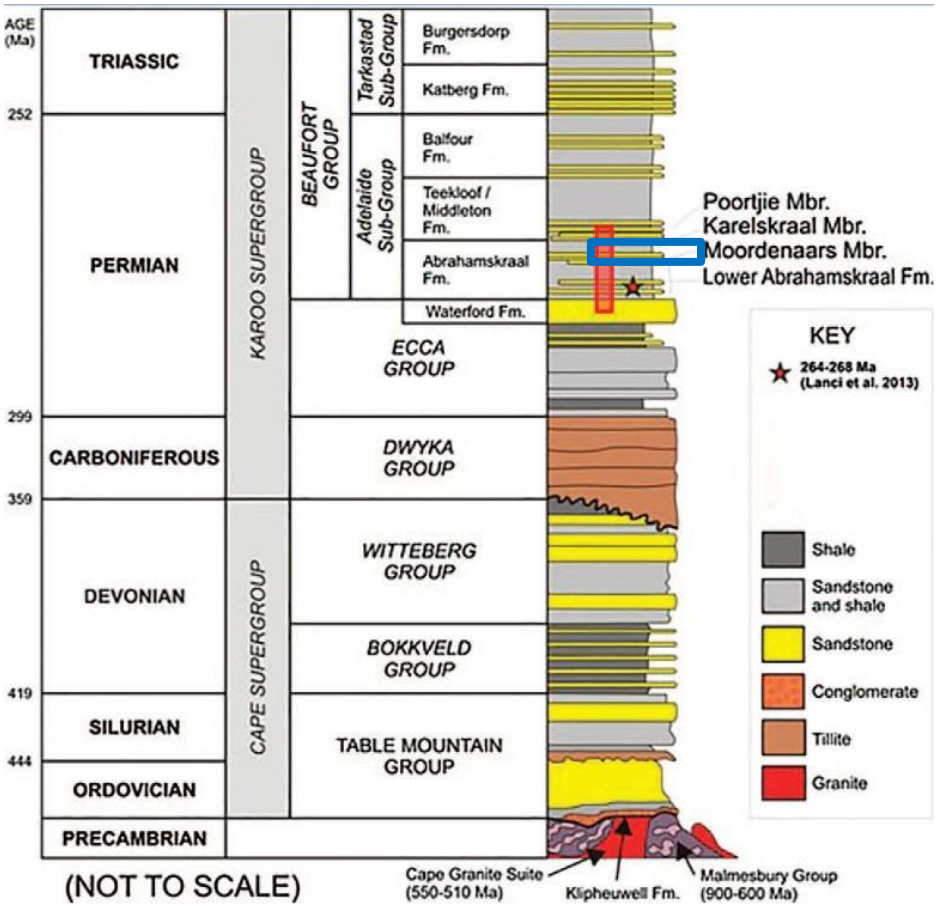


Figure 22: Palaeozoic stratigraphic column for the Western Cape showing the position of the Abrahamskraal Formation of the Lower Beaufort Group within the Karoo Supergroup which isrepresented within the WEF project area (blue rectangle). A Middle Permian (Wordian) zircon age has been obtained for the lower part of the Abrahamskraal Formation (red star) (Figure modified from Wilson et al. 2014). The base of the Poortjie Member has recently been dated to 260 Ma (end-Capitanian = end Middle Permian) on the basis of a white tuff unit 3.5 m above the basal sandstone (Day et al. 2015b). As currently mapped, only the upper part of the Abrahamskraal Formation is represented within the Heuweltjies WEF and associated Infrastructure project area but this may be revised with further detailed mapping

7.4 Findings of the historical desktop study

The findings can be compiled as follows and have been combined to produce a heritage sensitivity map for the project based on the desktop assessment (**Figure 23).**

7.4.1 Heritage Screening

A Heritage Screening Report was compiled using the Department of Forestry, Fisheries and Environment National Web-based Environmental Screening Tool as required by Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended. According to the Heritage screening report, the directly affected area has a low sensitivity rating (**Figure 10**).

The study area's field work demonstrates that historical heritage structures warrant conservation. The low rating as provided by the Environmental Screening Tool possibly reflects scarcity of heritage reports conducted in the region.

7.4.2 Heritage Sensitivity

The sensitivity maps were produced by overlying:

- Satellite Imagery;
- Current Topographical Maps;
- First edition Topographical Maps dating from the 1960's

This enabled the identification of possible heritage sensitive areas around the proposed development area that included:

- Structures/Buildings
- Archaeological Heritage sites

By superimposition and analysis, it was possible to rate these structure/areas according to age and thus their level of protection under the NHRA. Note that these structures refer to possible tangible heritage sites as listed in **Table *5.***

Table 5: Tangible heritage sites in the study area

Name	Description	Legislative protection
Architectural Structures/Dwellings	Possibly older than 60 years	NHRA Sect 3 and 34
Archaeological sites	Artefacts and/or structures/sites	NHRA Sect 3 and 35 and Sect 27

Observation of the previous heritage reports has shown that archaeological sites are in abundance in the surrounding areas and especially near certain landscape features. This factor needs to be held in consideration.

7.4.3 Possible Heritage Finds

The evaluation of satellite imagery and the analysis of the studies previously undertaken in the area has indicated that certain areas may be sensitive from a heritage perspective. Archaeological surveys and studies in the area have shown rocky outcrops, dry river beds, riverbanks and confluence to be prime localities for archaeological finds and specifically Stone Age sites (Kinahan, 2008; Halkett, 2009; Webley & Halkett, 2015).

The analysis of the studies conducted in the area assisted in the development of the following landform to heritage find matrix in **Table 6**. Dry river courses have been referenced as having possible heritage sensitivity within the study area (**Figure 23**). It must be noted that the proposed development layout for the most part has excluded river courses from the footprint.

Table 6: Landform type to heritage find matrix

LAND FORM TYPE	HERITAGE TYPE
Crest and foot hill	MSA scatters
Pans/ dry river courses	LSA/MSA scatters
Outcrops	Occupation sites dating to LSA
Farmsteads	Historical archaeological material

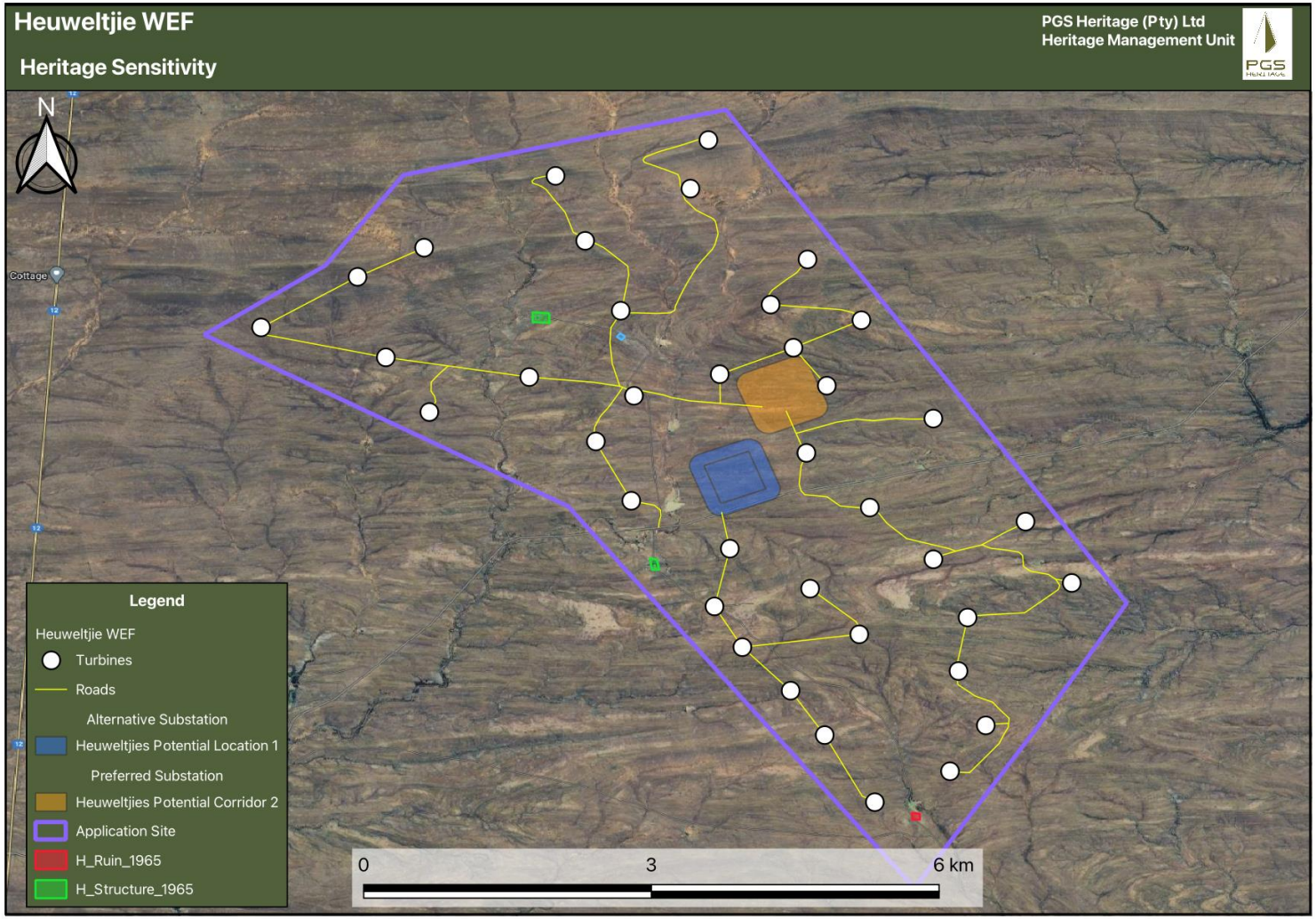


Figure 23: Possible heritage sensitivity areas: Structure (blue polygon), farmsteads (green polygons) and ruin (red polygon) within the Heuweltjies WEF study area.

8. HERITAGE RESOURCE – STATUS QUO

A selective survey of the study area was conducted between November 2020 and July 2021. Focus was placed on the areas identified for the placement of the proposed turbines and associated internal roads, laydown areas and substation sites within the larger assessment area. Farmsteads and structures were documented from their property boundaries when access was restricted.

8.1 Archaeology and Built Environment

A selective survey of the study area was conducted in February 2021. Due to the nature of cultural remains, with most artefacts occurring below surface, two archaeologists from PGS conducted a vehicle and foot-survey of the proposed development area. The fieldwork was logged with GPS devices to provide a tracklog of the area covered.

The fieldwork identified 27 heritage finds that were then classified as either find spots, structures (incl. historical farmsteads), burial grounds and graves. The fieldwork completed for the AIA component has confirmed the presence of 3 Stone Age sites (**H013, H013/1, H013/3**) (**Figure 24**), 14 findspots (**H003-5, H009-12, H018-24**), 8 structures (**H001, H002, H007, H008, H014, H014/1, H015, H017**) (**Figure 25** and **Figure 26**) and 2 burial ground sites (**H006, H016**) (that may be affected by the proposed development.

Figure 24: Large assemblage of MSA Lithic artefacts observed at H013, H013/1 and H013/3.

Figure 25: Stone packed farm house *(H002)* with associated ox wagon. In the distance the dam, tall tree and wind pump are evidence of water management in the landscape *(Hearth Heritage, 2023)*

Figure 26: Views of the ruins of the Klipgat farmstead at H014.

Figure 27: Farmstead complex at Witpoortjie showing midC20th graves in the foreground (CLA, Hearth Heritage, 2023)

Figure 28: Views of the small historical cemetery at H016.

8.2 Palaeontological heritage

The PIA reported fossil assemblages that were already known from the main sedimentary rock units represented within the WEF project area are outlined, while the very limited corpus of new fossil

material recorded during the present field assessment is listed and illustrated. GPS locality details and brief descriptions of fossil material for numbered palaeontological sites are provided in **Figure 46**.

8.2.1 Abrahamskraal Formation palaeontology

Continental (terrestrial / fluvial /lacustrine) fossil biotas within the Abrahamskraal Formation bedrocks of the WEF project area are assigned to the ***Tapinocephalus* Assemblage Zone** of late Middle Permian (Capitanian) age (*c*. 265 – 260 Ma) according to the latest biozonation map of Day and Rubidge (2020) (**Figure 29**). The preceding *Eodicynodon* AZ is also mapped along southern Karoo margins to the south of Beaufort West where its type of area on the farm Modderdrift 106 in the Prince Albert District lies only some 10 km SW of the present WEF project area (Rubidge & Day 2020). The Ecca – Beaufort Group boundary has been mis-mapped in this sector of the Karoo margins while *Eodicynodon* AZ biotas have not, as yet, been demonstrated as far north as the WEF project area, however. The *Tapinocephalus* Assemblage Zone has recently been revised by Day and Rubidge (2020) and subdivided into two subzones. The younger and more fossil-rich of these, the *Diictodon* – *Styracocephalus* Subzone which is of Middle Permian / Late Capitanian age (*c*. 262-260 Ma), is mapped within the present WEF project area. This situation may change, however, as new fossil material is recorded and analysed in this comparatively understudied sector of the Main Karoo Basin.

The fossil biota of the the *Tapinocephalus* Assemblage Zone is characterised by a range of vertebrate fossil groups, notably large dinocephalian therapsids, primitive pareiasaur parareptiles and small-bodied dicynodonts *plus* a variety of carnivorous therocephalians (**Figure 30** to **Figure 32**). The main categories of fossils expected within the *Tapinocephalus* fossil biozone (Keyser & Smith 1977-78, Anderson & Anderson 1985, Smith & Keyser 1995a, MacRae 1999, Rubidge 2005, Smith *et al.* 2012, Cole *et al.* 2016, Day & Rubidge 2020) include:

- isolated petrified bones as well as rare articulated skeletons of tetrapods (*i.e.,* air-breathing terrestrial vertebrates) such as true **reptiles** (notably large herbivorous pareiasaurs like *Bradysaurus*, small insectivorous millerettids, the small, turtle-like *Eunotosaurus*), rare pelycosaurs, and diverse **therapsids** or “mammal-like reptiles”. This last group includes numerous genera of large-bodied, herbivorous and carnivorous dinocephalians, herbivorous dicynodonts (with several new genera recently described), flesh-eating biarmosuchians, rare, generally small-bodied gorgonopsians and a variety of therocephalians, including some sizeable apex predators.
- aquatic vertebrates such as large **temnospondyl amphibians** (*Rhinesuchus*, usually disarticulated), and **palaeoniscoid bony fish** (*Atherstonia*, *Namaichthys*, often represented by scattered scales rather than intact fish).
- freshwater **bivalves** (*Palaeomutela*), **insects.**

- **trace fossils** such as worm, arthropod and tetrapod burrows and trackways, lungfish burrows, fish swimming trails, arthropod tracks, coprolites (fossil droppings) and plant root or stem casts (*e.g.,* reedy sphenophytes).
- **vascular plant remains** (usually sparse and fragmentary), including leaves, twigs, roots and petrified woods ("*Dadoxylon*") of the *Glossopteris* Flora, especially glossopterid trees and arthrophytes (horsetails) as well as rare lycophytes (club mosses).

In general, tetrapod fossil assemblages in this zone are dominated by a wide range of dinocephalian genera and small therocephalians *plus* pareiasaurs while the dicynodonts are mostly small-bodied forms. Vertebrate fossils in this zone are on the whole much rarer than seen in younger assemblage zones of the Lower Beaufort Group, with almost no fossils to be found in the lowermost beds. Jirah & Rubidge (2014, their Fig. 5) record a higher density of vertebrate fossils within the sandstone-rich uppermost Abrahamskraal Formation succession below the Poortjie Member in the Merweville – Prince Albert Road sector of the southern Karoo (*cf* Loock *et al.* 1994 who do not record fossils in this uppermost part of their Abrahamskraal Formation section near Laingsburg, their Fig. 3).

Vertebrate fossils in the *Tapinocephalus* Assemblage Zone occur in association with *both* mudrocks and channel sandstones, including rolled bones and teeth within thin intraformational conglomerates (*beenbreksie*) at the base of channel sandstones (Rossouw & De Villiers 1952, Turner 1981, Smith & Keyser 1995a, Day & Rubidge 2020). Many of the vertebrate remains are associated with calcretised palaeosol (ancient soil) horizons, including postcranial bones and intact skulls that are largely or entirely enclosed within hard pedocrete nodules. Skeletal remains eroding out of mudrocks are often scattered and highly weathered; they may also show evidence of pre-burial suncracking as a result of protracted exposure on the ancient Karoo floodplain.

The fossil record of the upper Abrahamskraal – basal Teekloof contact zone, extensively represented just to the north of the present WEF project area, is of special scientific interest because of its record of environmental and palaeobiological events related to the major **Middle Permian Mass Extinction Event** of 262-260 million years ago (= Capitanian or Guadalupian Mass Extinction Event) (Day *et al.* 2015b). Since vertebrate fossils are generally rare within this stratigraphic interval, any new records of well-preserved, identifiable material here are of considerable scientific value (*cf* ongoing research project on this extinction event conducted by Professor Bruce Rubidge of Wits University and colleagues).

Fossil locality distribution maps for the Lower Beaufort Group in the southern sector of the Main Karoo Basin in the region to the south of Beaufort West show very few records of vertebrate fossils in this area (**Figure 33**). This is apparent on early palaeontological maps of Kitching (1977) and Keyser & Smith (1977-1978) as well as from the published 1: 250 000 geological sheets 3222 Beaufort West and 3322 Oudtshoorn (Johnson & Keyser 1979, Toerien 1979). The Beaufort West geological sheet shows just a few fossil sites of the *Tapinocephalus* and *Pristerognathus* Assemblage Zones, as previously

defined, to the west of the N12 and *outside* the present WEF project area (Figure 6). The more recent fossil site map of Nicolas (2007) features a few sites just to the west of the N12 and one site further east (*possibly* located within or close to the Kwagga 3 WEF project area).

Several additional vertebrate fossil sites – mostly small-bodied dicynodonts *plus* poorly-cranial and postcranial remains of large herbivorous tetrapods (pareiasaurs and / or dinocephalians) with much rarer carnivorous therapsids – have been recorded recently recorded within the adjoining project areas for the Trakas, Beaufort West, Kraaltjies and Kwagga 1-3 WEFs in the immediate vicinity of the present WEF project area as well as for the Koup 1 and Koup 2 WEF project areas further to the ENE (See references under Almond). The sites recorded within the adjoining Trakas and Beaufort West WEF project areas are mapped in Appendix 1, Figure A1.1. GPS data and brief descriptions for these sites are provided by Almond (2018, 2022d). This material may ultimately assist with the detailed fossil biozonation of the tectonically complex southern Karoo margins.

Fossil finds are very sparse within the Abrahamskraal Formation bedrocks within the Heuweltjies WEF project area, with only 5 recorded fossil sites from *c*. 50 exposures examined (See tabulated fossil data and satellite site map in Appendix 1). In part, this is due to (1) the low levels of bedrock exposure in the region as well as, perhaps, (2) the moderately high levels of tectonic deformation locally and (3) weathering of bedrocks related to the ancient African palaeosurface. Due to the high levels of deformation (folding, faulting), the precise stratigraphic position of new fossil finds is hard to determine while vertebrate fossils (*e.g.* many skulls within nodules) often cannot be identified until they are prepared in the lab. For this reason, it is not feasible at present to assign the fossil material to specific stratigraphic members within the Abrahamskraal Formation (As noted below, the pareiasaur skeleton recorded within the WEF project area supports an upper Abrahamskraal Formation succession here).

The only new vertebrate fossil records documented here include (1) occasional weathered “rolled bone” fragments reworked into surface gravels (**Figure 38**) and (2) the postcranial remains of a large-bodied pareiasaur reptile (**Figure 31**, **Figure 32**, **Figure 34** to **Figure 37**). The left limbs and vertebrae of this last specimen – preserved within grey-green mudrocks on Portion 8 of The Farm Klipgat No 114 - are exposed in a stream bank while much of the rest of the skeleton (quite likely including the skull) are probably still buried within the matrix. Based on detailed features of the limb bones, and possibly also on bony scutes adhering to the vertebrae, the specimen has been provisionally assigned to the genus *Nochelesaurus* by Dr Marc van den Brandt (pers. comm., March 2021). This genus is restricted to the *upper* part of the Abrahamskraal Formation, largely within the *Diictodon* – *Styracocephalus* Subzone (*cf* Van den Brandt *et al.* 2021a, 2021b).

The only trace fossils identified within the WEF project area include narrow, small-scale invertebrate burrows associated with wrinkled sandstone palaeosurfaces which may have been generated by small microbal mat miners such as insects or worms (**Figure 41**). No convincing tetrapod burrows were seen,

although possible but *equivocal* candidates are occasionally seen (*cf* **Figure 40**), while no petrified wood or other plant fossil were recorded within the WEF project area.

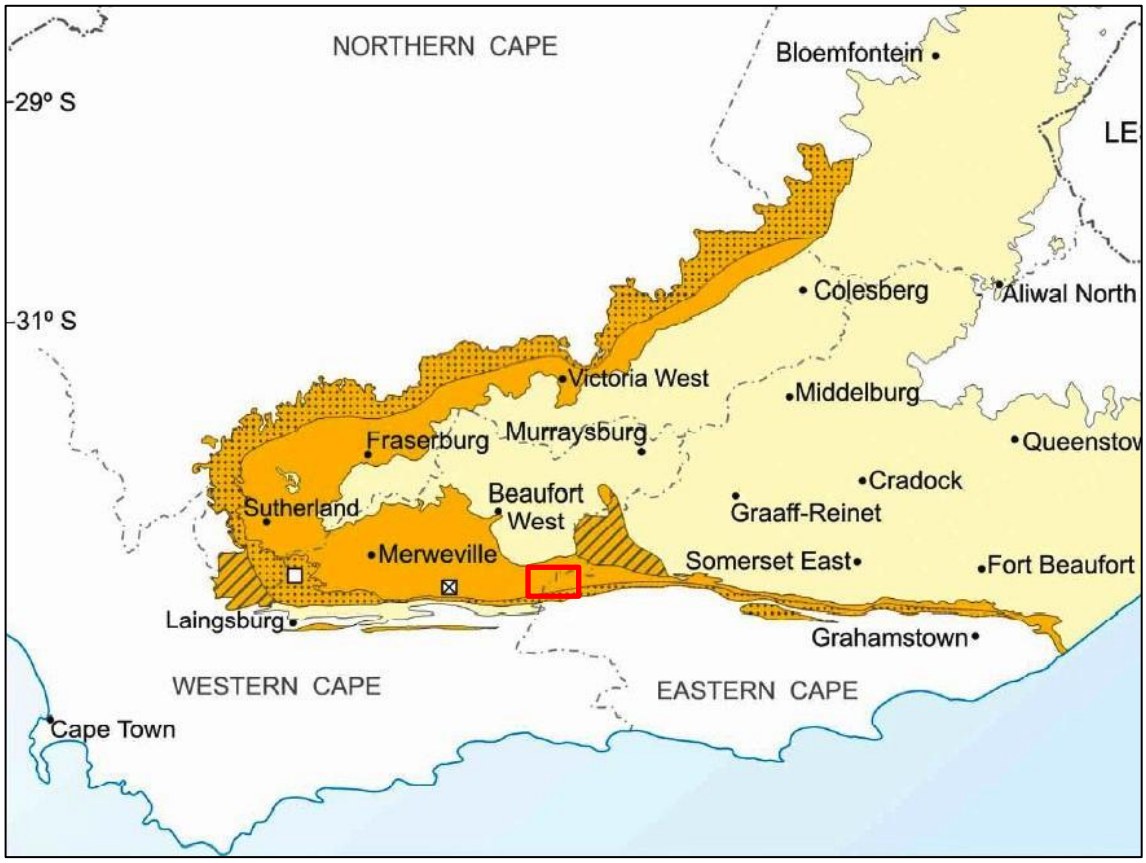


Figure 29: Map showing the known or inferred distribution of late Middle Permian (Capitanian) continental fossil assemblages of the revised Tapinocephalus Assemblage Zone around the margins of Main Karoo Basin (From Day & Rubidge 2020). The Heuweltjies WEF and associated Infrastructure project area along the southern Karoo margins to the south of Beaufort West lies within the outcrop area of the recently recognised Diictodon – Styracocephalus Subzone (plain dark yellow area on map) but this is currently supported by very limited palaeontological data in this historically under-recorded sector of the Karoo. New, potentially identifiable fossil vertebrate material from the WEF project area is therefore of considerable biostratigraphic interest.

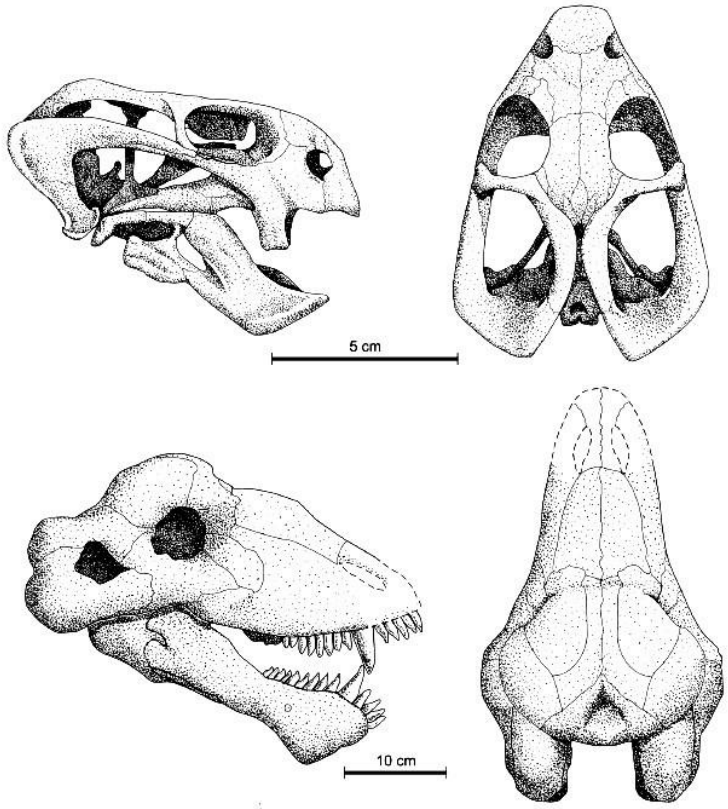


Figure 30: Skulls of two key vertebrate herbivores of the recently recognised Diictodon – Stracocephalus Subzone (upper portion of the Tapinocephalus Assemblage Zone) which extends across the end – Middle Permian (Capitanian) Extinction Event of 260 Ma (million years ago). Diictodon (above) was a small-bodied, burrowing dicynodont therapsid ("mammal-like reptile") while Styracocephalus (below) was one of the longest-surviving members of the dinocephalians, a major group of large-bodied herbivorous therapsids (From Day & Rubidge 2020).

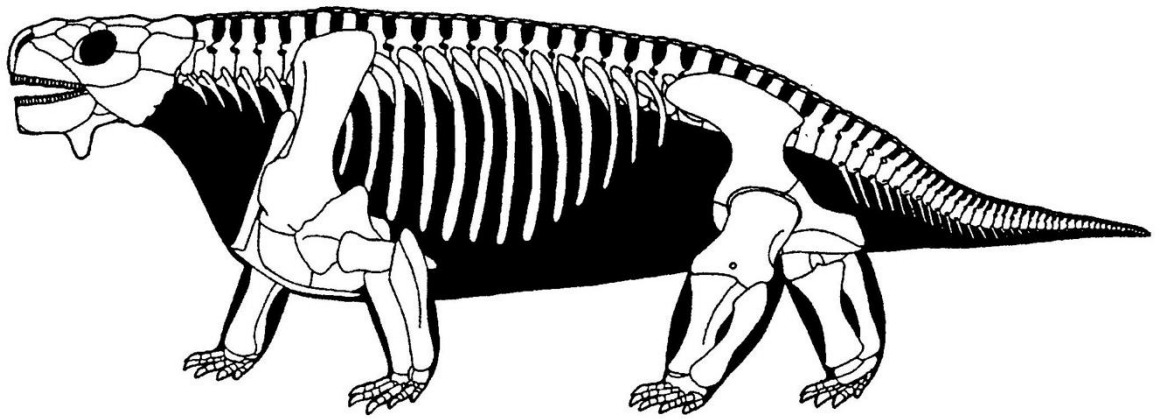


Figure 31: Skeleton of a large-bodied (rhino-sized), herbivorous pareiasaur reptile (Bradysaurus) from the Middle Permian Karoo Basin of the RSA.

Figure 32: Graphic reconstruction of a typical large-bodied, herbivorous pareiasaur reptile from the Middle Permian Period.

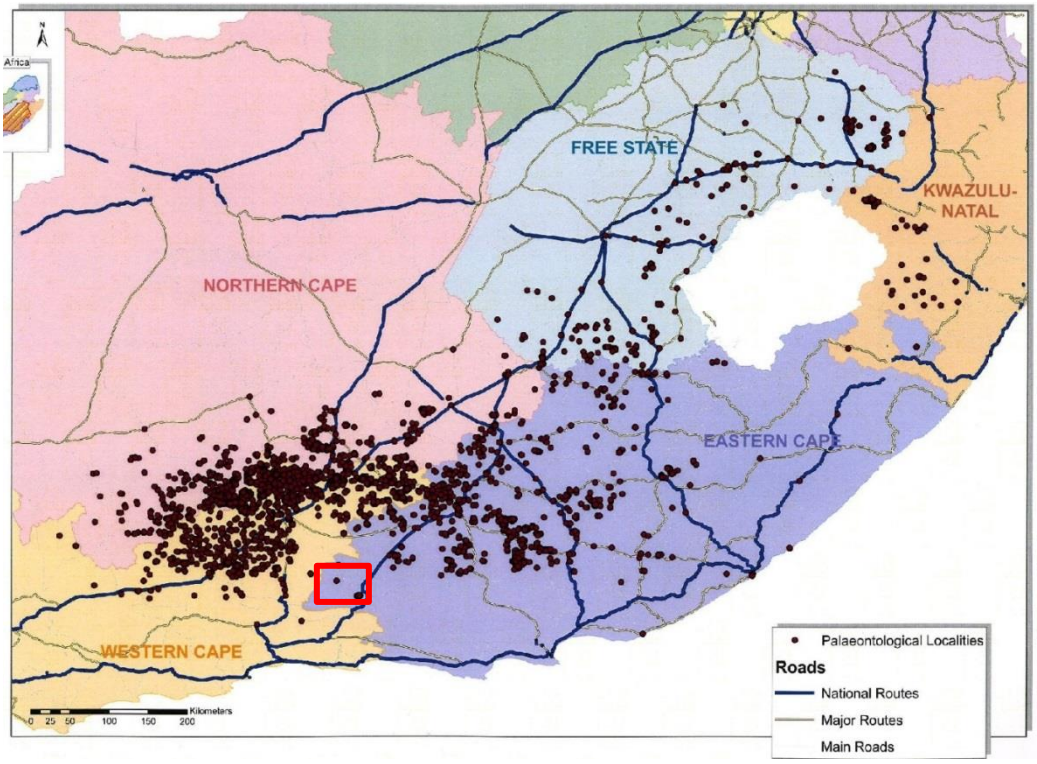


Figure 33: Distribution of recorded vertebrate fossil sites within the within the Lower Beaufort Group of the Main Karoo Basin (modified from Nicolas 2007). The WEF project area to the south of Beaufort West is located within the small red rectangle. The very low density of

recorded fossil sites here, to the east of the N12 and on the SW periphery of the Aberdeen Vlaktes, is notable.

Figure 34: Sedimentological setting of the large-bodied pareiasaur reptile skeleton illustrated in the following three images (Loc. 048). The postcranial remains are associated with a rusty-brown ferruginous calcrete palaeosol horizon (arrowed) within grey-green silty overbank mudrocks. Below this are seen a small lenticular channel sandstone and a package of riverbank / levée sediments (See also Figure 14).

Figure 35: Postcranial skeletal remains, including left forelimb and vertebrate column, of a large-bodied pareiasaur reptile weathering out of grey-green overbank siltstones beneath the brownish concretionary lens in a riverbank at Loc. 048 (See following two figures for scale).

Figure 36: Close-up of a string of articulated sacral vertebrate and ribs of the specimen shown above (Scale is c. 15 cm long). The bones are encrusted by a film of pedogenic carbonate. Further articulated vertebrate and possible portions of a limb girdle were found in float nearby.

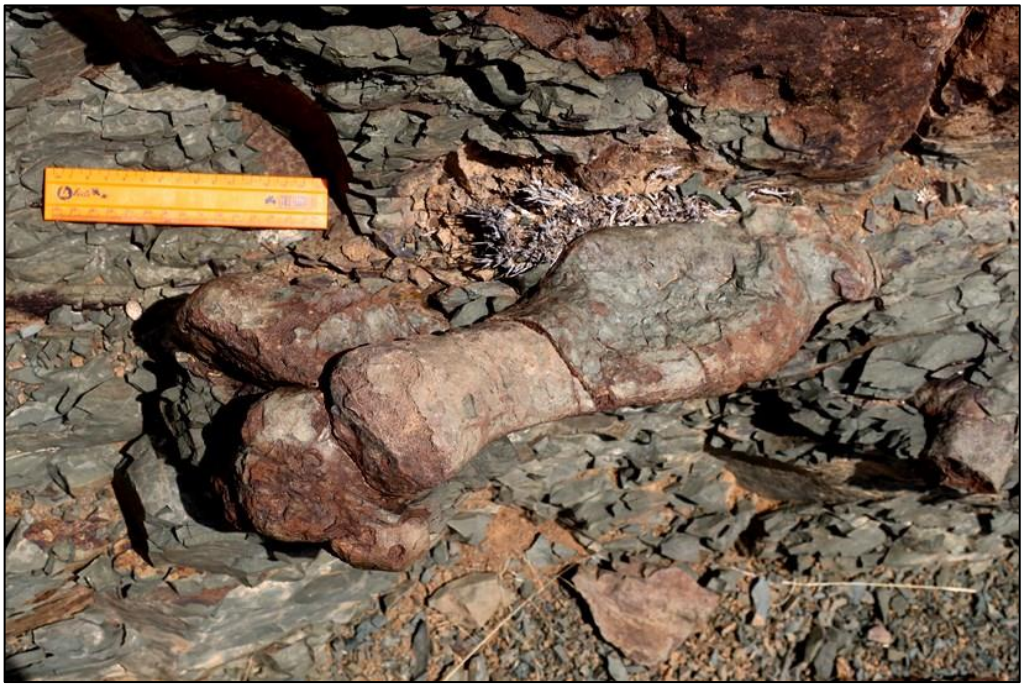


Figure 37: Articulated left forelimb bones of the pareiasaur skeleton shown in Figure 43 (scale is 15 cm long).

Figure 38: Typical example of a rounded block of weathered and rounded "rolled bone" of a sizeable tetrapod showing spongy texture (Scale in cm and mm). The specimen has probably weathered-out of a channel sandstone body and was found among sheetwashed surface gravels (Loc. 001). Such reworked material is unidentifiable.

Figure 39: Subcylindrical fossil structure (c. 1.5 cm wide) preserved within a medium-grained sandstone – possibly a plant root / stem cast or invertebrate burrow (Loc. 053). See Figure 11 for context.

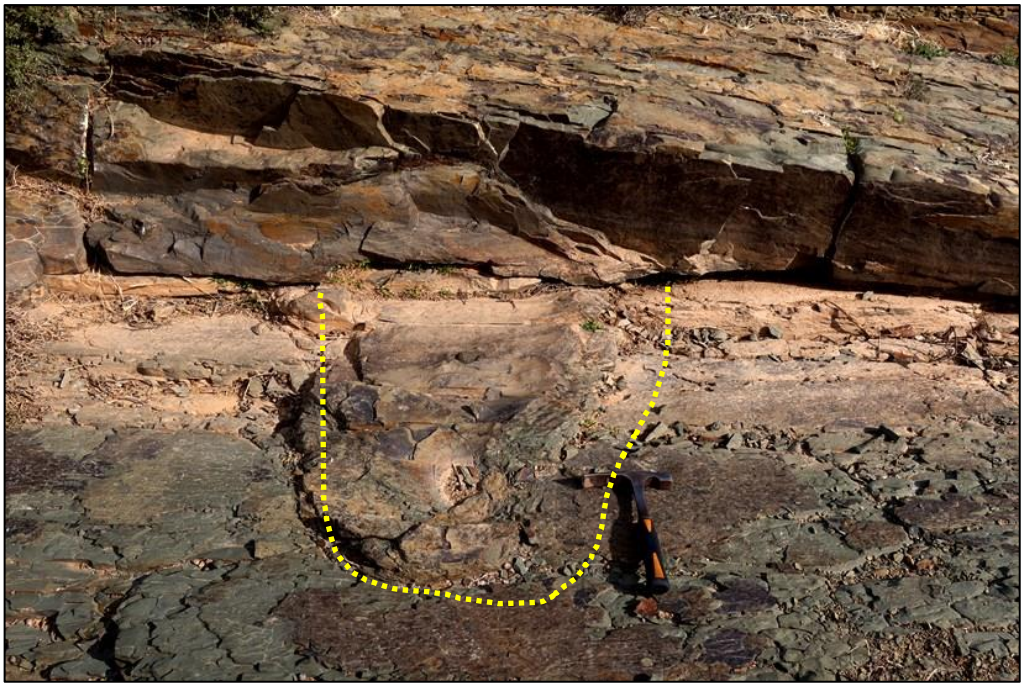


Figure 40: Sizeable gutter-shaped sedimentary structure with convex-downward internal lamination within interbedded sandstones and siltstones exposed in a dam overflow (Loc. 024) (Hammer = 30 cm). This feature broadly resembles a tetrapod burrow but is probably sedimentary in origin (e.g. load or basal scour structure).

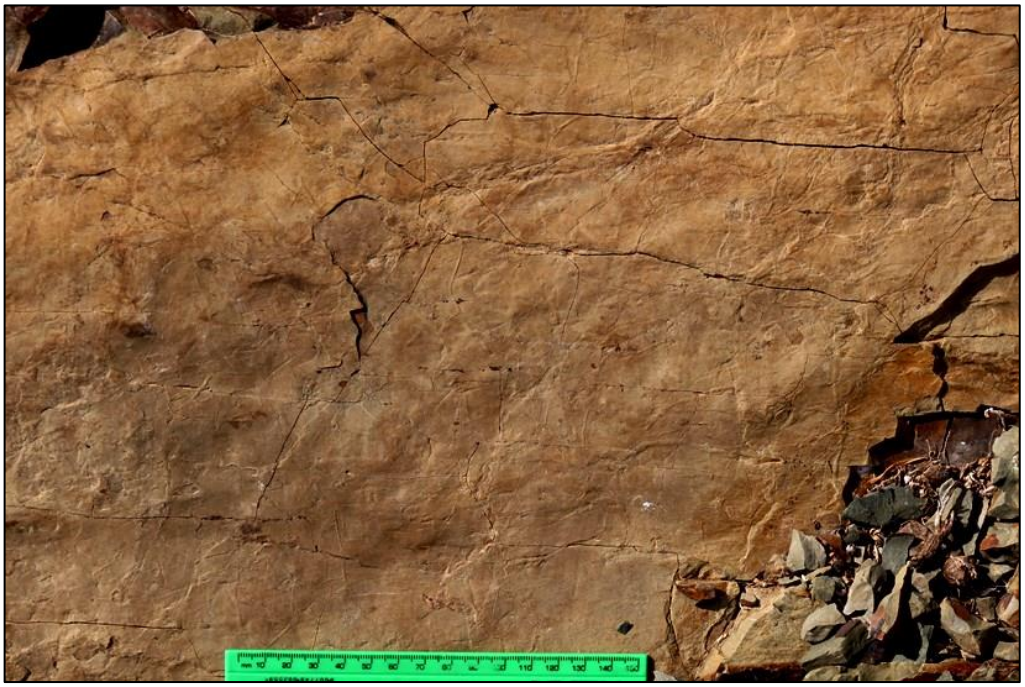


Figure 41: Wrinkled sandstone palaeosurface with sparse, barely visible, narrow horizontal burrows, probably of small-bodied microbial mat miners – perhaps worms or small insects (Scale in cm and mm) (Loc. 024).

8.3 Cultural landscape

The CLA found that Heuweltjies site can be divided into landscape character areas with cultural heritage resource types. These units were determined by considering the larger landscape context to understand the character and cultural heritage values that underpin the proposed development site. These areas are shown in Figure 47 of this report.

8.3.1 Poorts and koppies

The vast terrain of the Koup lends significance to the low ridges and associated visually prominent koppies that create intermittent relief from the monotonous largely flat topography of the region. The small local poorts and koppies create a sense of place and orientation in this landscape and are associated to points of continuous access and thoroughfare by humans and animals over time. The poort that exits into the Koup landscape from Meiringspoort Pass is 11kms away from the Heuweltjies WEF. At this distance the WEF will be clearly visible from this viewpoint and will have a medium negative impact on the heritage resource.

8.3.2 Riverine corridors – Bio-cultural heritage resources

The dry riverine corridors that spread over the Koup landscape create points of contact and cultivation in an otherwise dry and barren environment. Largely non-perrenial, these watercourses are also known for flooding after heavy rains, spreading much needed water over the surrounding land and, in so doing, supporting ecological and agricultural systems. Historic farmsteads and their associated structures and areas of crop cultivation are found in this landscape unit.

8.3.3 Historic farmsteads and associated crop gardens – Grade IIIA – IIIC cultural heritage resources

The farmsteads in this study are all located adjacent or near to riverine corridors. Areas of crop cultivation are found adjacent to the farmsteads, often along the dry riverbeds. The continued existence of these farmsteads in this historically and environmentally hostile environment lends significance to their place on the landscape and the determination of the people they represent.

8.3.4 Conservation areas –Bio-cultural heritage resources

Critical Biodiversity Areas and Ecological Support Areas, largely associated with the riverine environment of the study area supports biodiversity conservation. These areas recognise the ongoing relationship between man and the environment in the way they are managed to maintain a natural state, which in turn, has a benefit for human habitation.

8.3.5 Historic routes and gateways – Grade IIIB – II cultural heritage resources

The site is accessed via the national N12 road, a historic route linking Beaufort West with the towns of De Rust and Outdshoorn via scenic Meiringspoort Pass, and the coastal town of George further south. The north-south orientated N12 intersects the characteristic east west ridges with shallow poorts, often the location of historic farmsteads, such as Amospoortjie, Trakaskuilen and Amandelhoogte, culminating in the Meiringspoort Pass that winds through the Groot Swartberg mountain range located within the Swartberg Nature Reserve. This road has carried inhabitants and travellers between historic towns, farmsteads and further regional destinations since at least the late C18th. The N12 has been recognised as a scenic route in the district and municipal SDFs for the area.

8.3.6 Viewsheds of significant mountain ranges

Views and vistas of the distant mountains and destinations give significance to the experience of the vast open landscape. The flat open expanses of the Koup Karoo are a central element to the experience and sense of place of the landscape; the mountain ranges of the Nuiweveld to the north and Swartberg to the south give scale and containment to this vastness. Buffers for development mitigate the impact of the development on places from which significant viewsheds are experienced.

8.3.7 Slopes and ridges

The vast terrain of the Koup lends significance to the low undulating ridges and associated visually prominent koppies that create intermittent relief from the monotonous largely flat topography of the region. Within this relatively flat expanse the steep slopes and ridges contained in the Heuweltjies landscape are significant in their visual and environmental capacities.

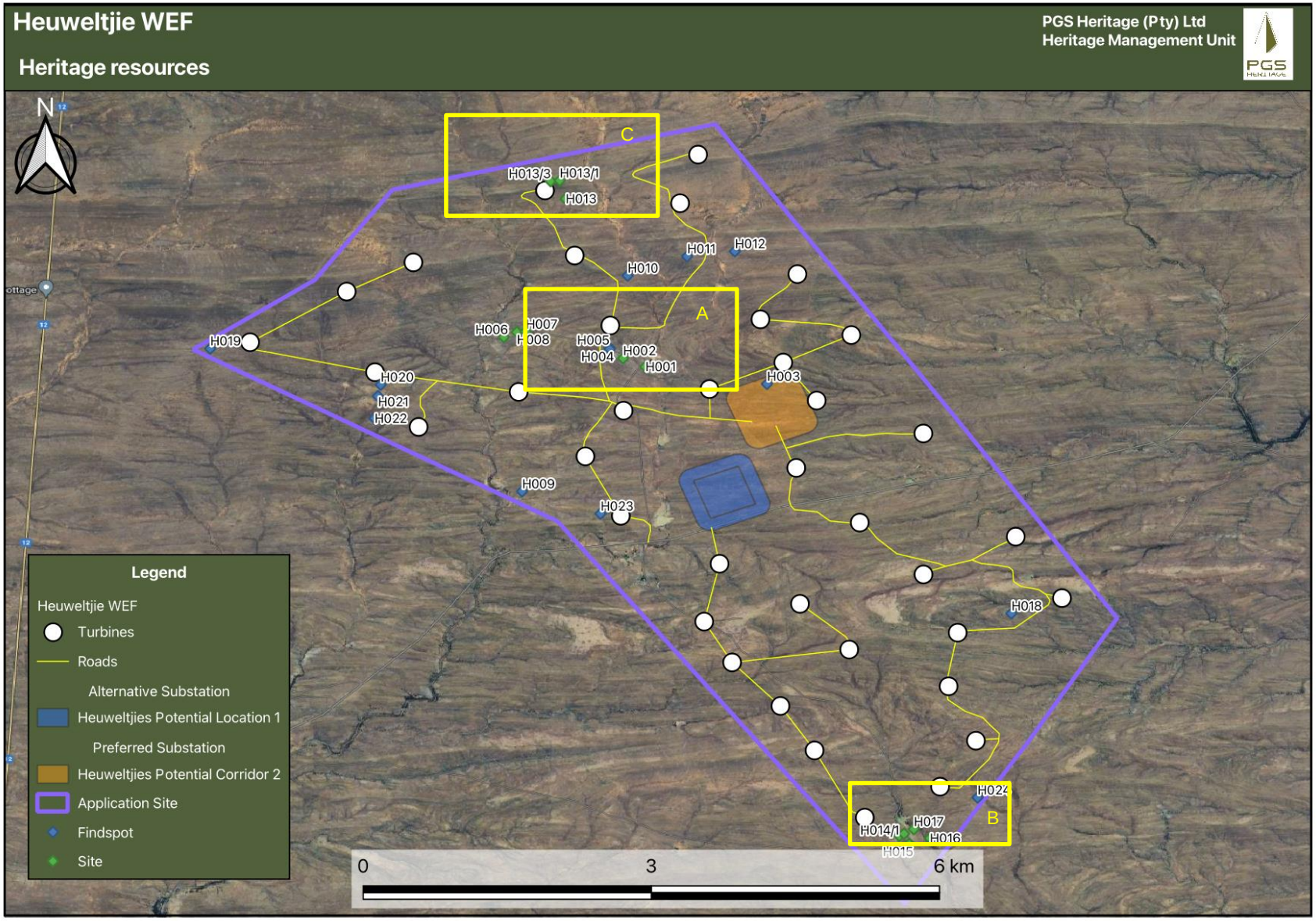


Figure 42: Locality of the heritage resources identified within the WEF study area. See insets A and B below.

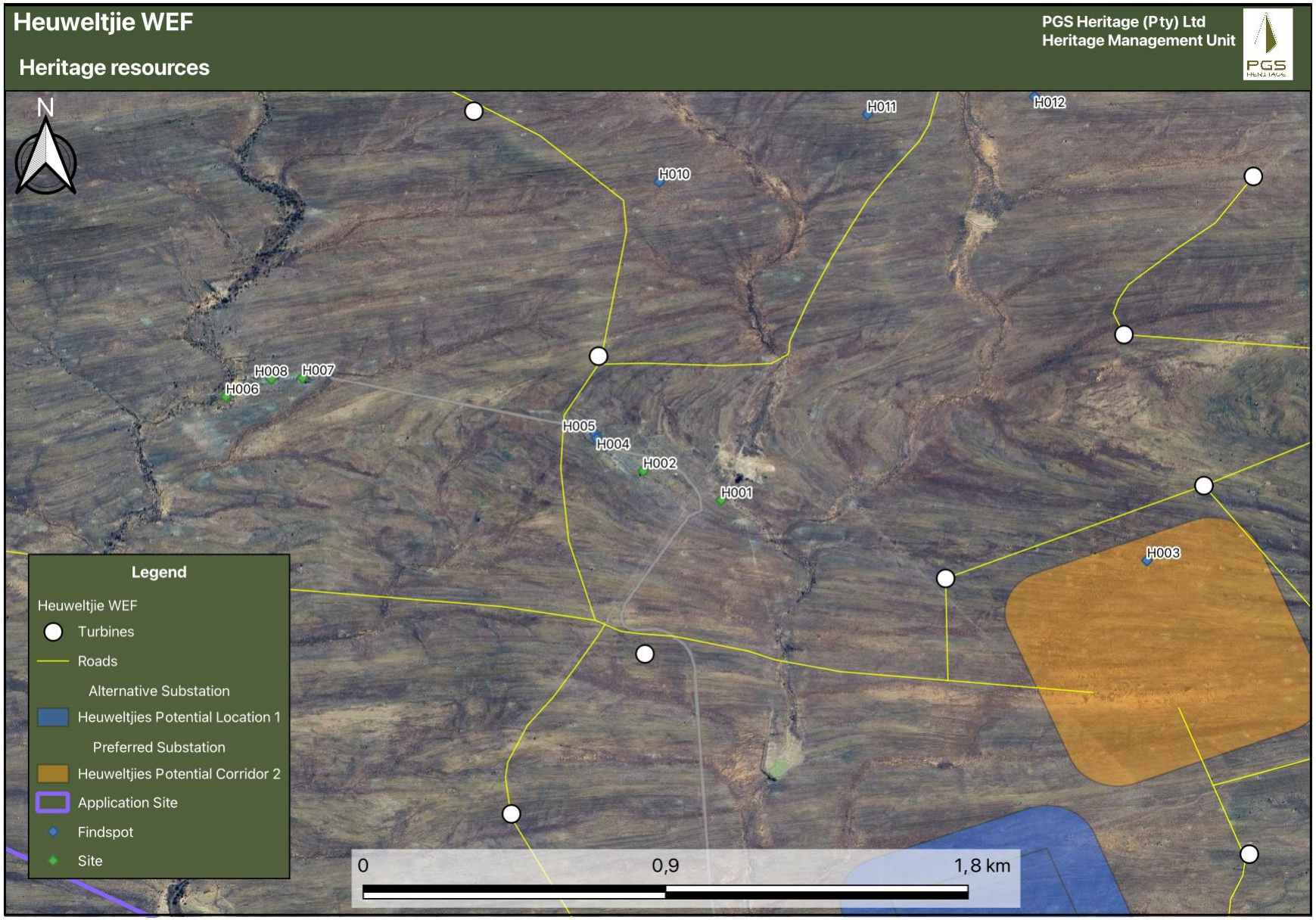


Figure 43: Heuweltjies WEF. Inset A.

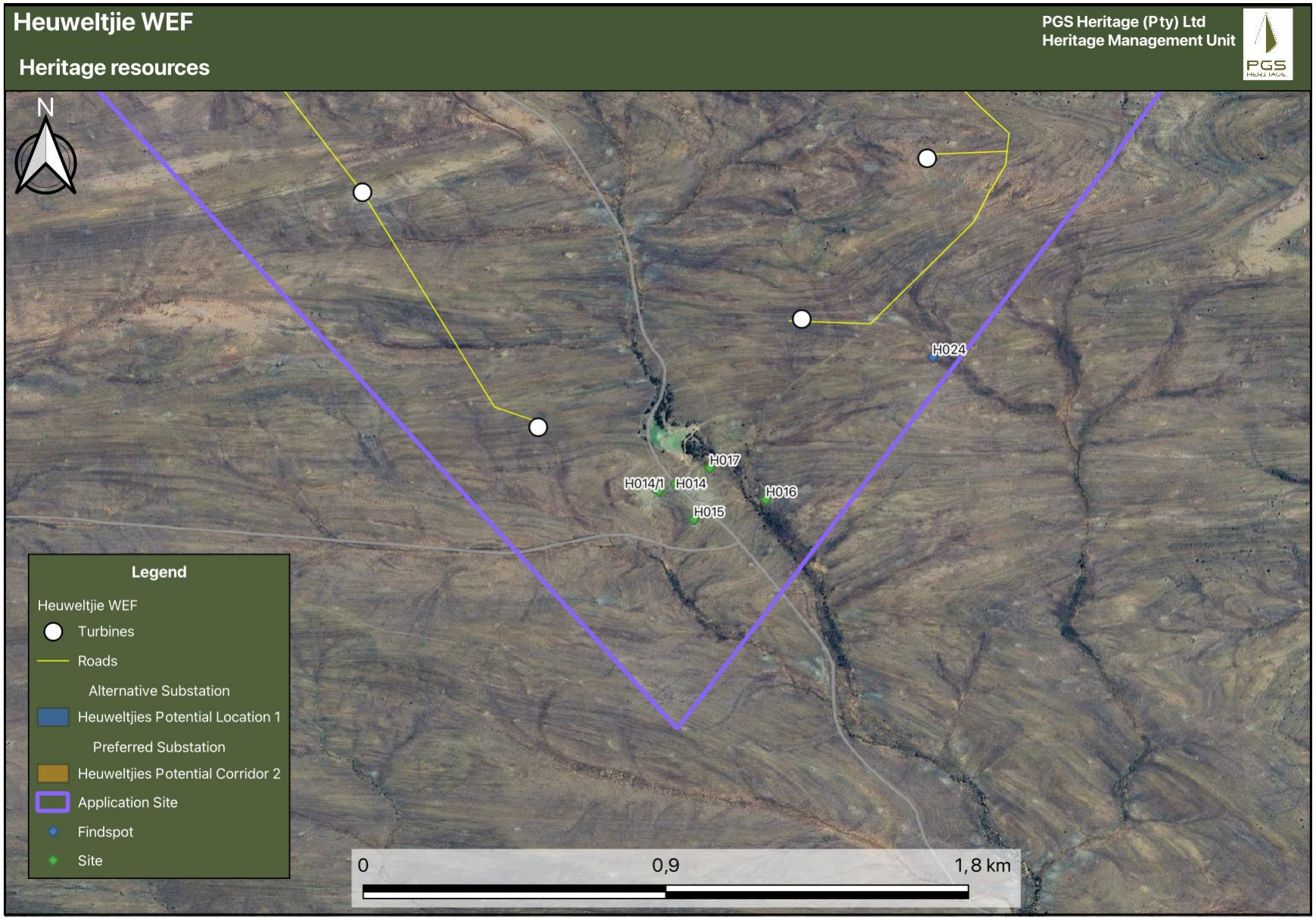


Figure 44: Heuweltjies WEF. Inset B.

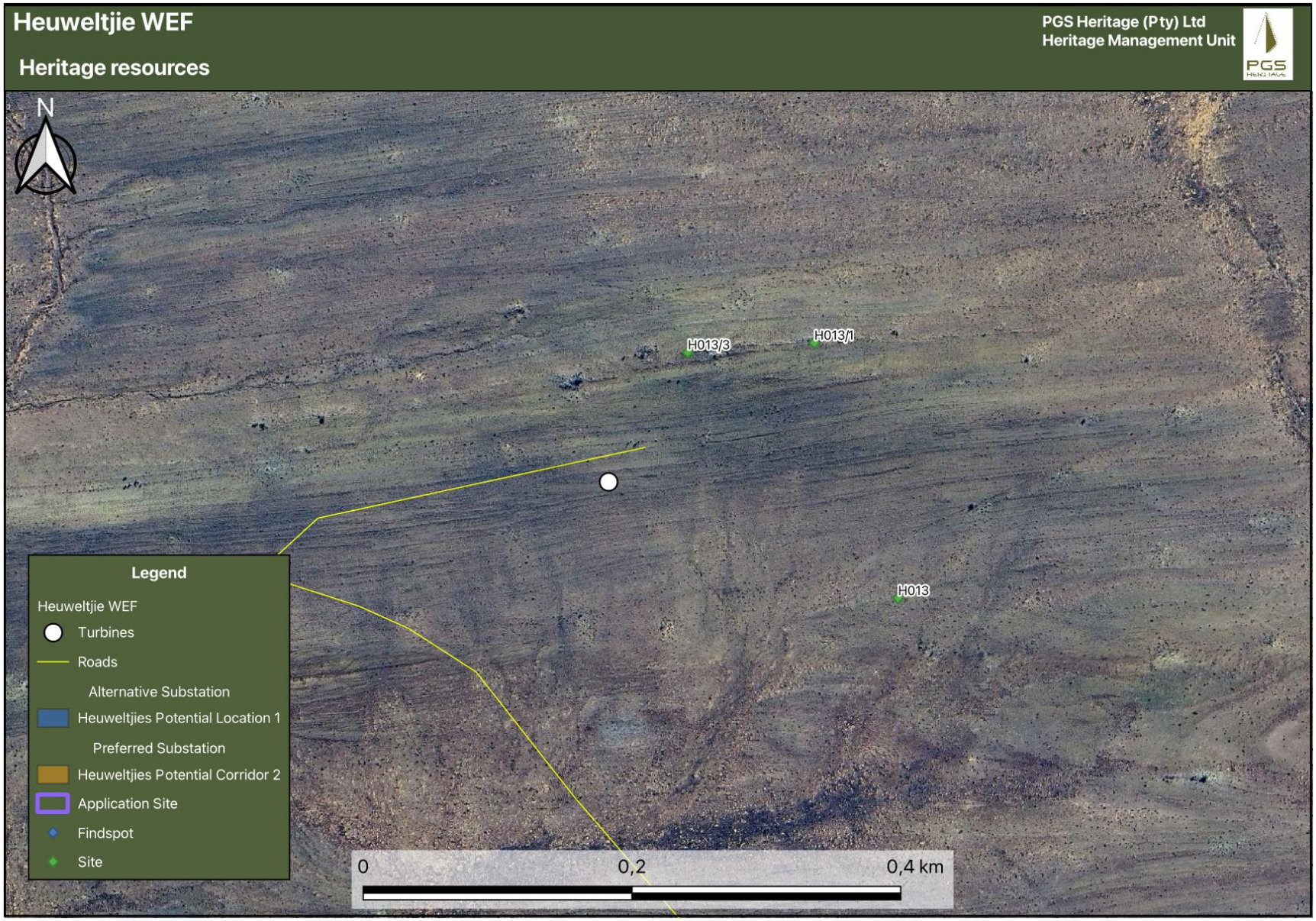


Figure 45: Heuweltjies WEF. Inset C

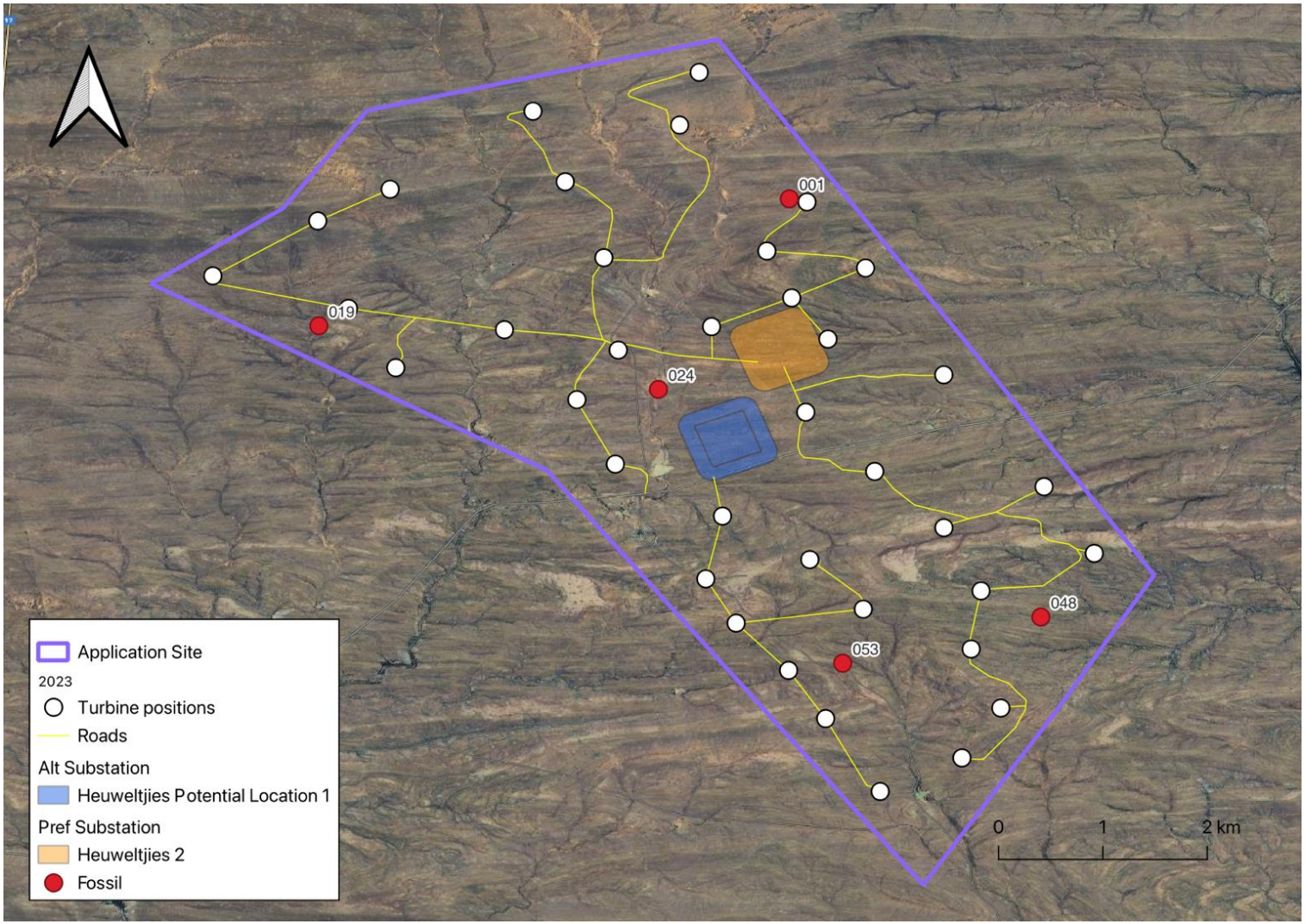


Figure 46: Google Earth© satellite image of the Heuweltjies WEF showing numbered fossil sites recorded here (numbered red dots). See table above for GPS data and brief description for the new Heuweltjies WEF fossil sites. Many of the recorded fossil sites are protected within standard environmental buffer zones along drainage lines and none of them lie within the proposed WEF layout. No palaeontological heritage High Sensitivity or No-Go areas have been defined within the WEF project area since well-preserved, scientifically important fossils are very sparse here and, in all cases, known or chance fossil finds can normally be effectively mitigated through professional recording and collection during the pre-construction phase, if necessary.

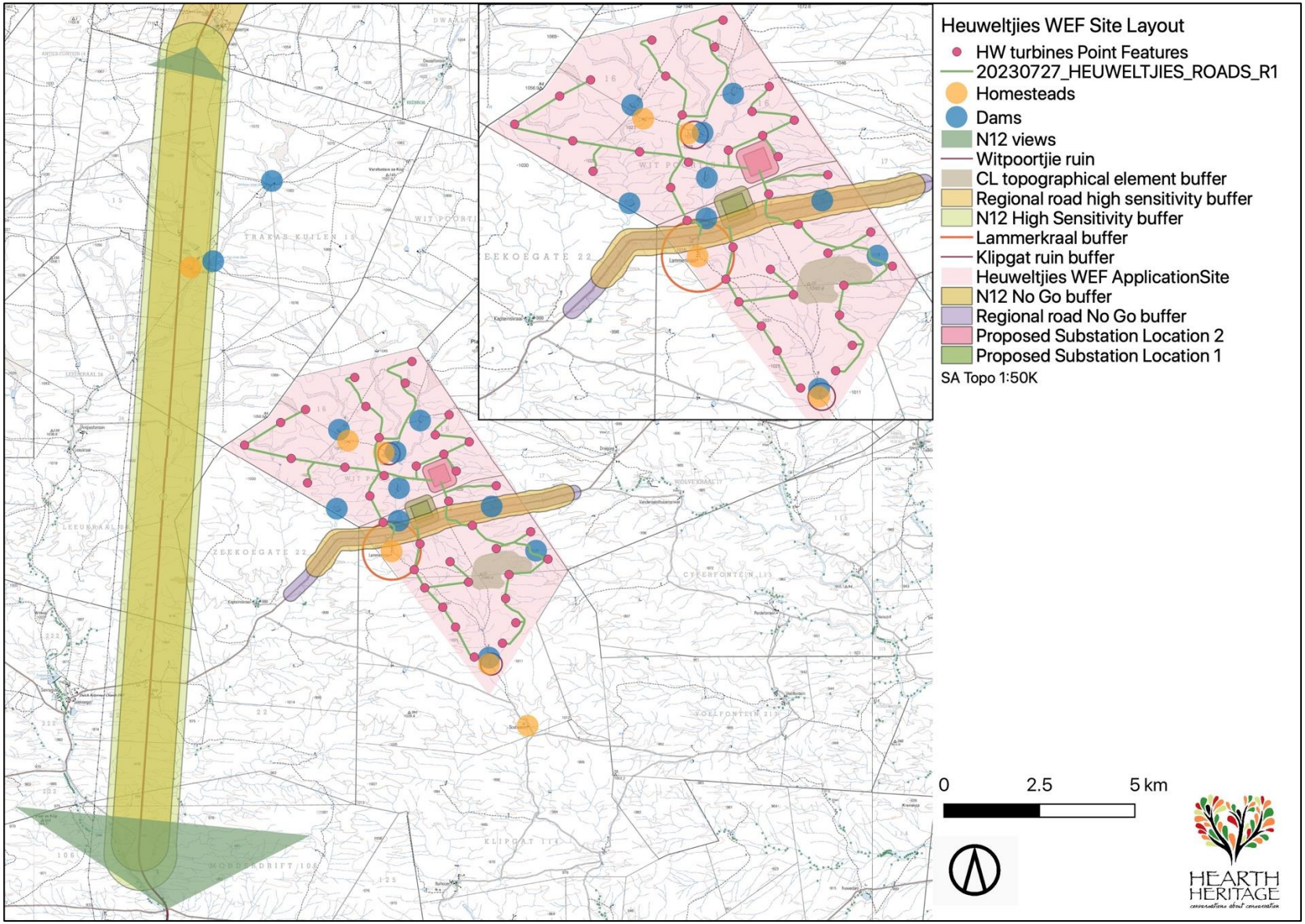


Figure 47: Heuweltjies Cultural landscape features map with proposed WEF infrastructure overlay. (slope classes and riverine corridors/ ESAs have not been included here but have been mitigated for in the recommendations)

9. IDENTIFICATION AND ASSESSMENT OF IMPACTS

The various heritage specialists that worked on the identification of heritage resources and assessed their significance based their findings on a set of guidelines developed by the HWC (2021) in line with the NHRA and international best practice. The CLA further expanded its assessment through the core values as developed by Roos (2007), which include ecologic, aesthetic, historic, social and economic.

Tangible heritage resources are often preserved due to unusual circumstances and are non-renewable resources. When a development is proposed, and specialist studies are undertaken as part of the wider evaluation of heritage resources, it provides an opportunity into a depository that would not otherwise exist. In this sense the impact is POSITIVE for some heritage resources provided that efforts are made to preserve or mitigate heritage resources in the study footprint, prior to and during the construction phase of the development. For this reason, four development scenarios, informed by EIA constraints are considered in this study, including the no-development / no-go option.

The general nature of impacts from the proposed development will be visual with regard to spatial and built heritage, and physical with regard to archaeological heritage resources. Mitigation measures for heritage resources will be recommended to mitigate impacts.

9.1 General Observations

In this section, an assessment will be made of the impact of the proposed development on the identified heritage sites. An overlay of all the heritage sites identified during the fieldwork over the proposed development footprint areas was made to assess the impact of the proposed development on these identified heritage sites. This overlay resulted in the following observations:

The following general observations will apply for the impact assessment undertaken in this report:

- The impact assessment rating is based on the rating scale as contained in **Appendix B**.
- Heritage sites assessed to have a low heritage significance are not included in these impact risk assessment calculations. The reason for this is that sites of low significance will not require mitigation. The documentation of these sites in this HIA report is sufficient and the sites can be destroyed without a permit, but only with the approval of this report as provided here. These sites are 14 findspots (**H003-5, H009-12, H018-24**) and 3 structures (**H007**, **H015, H017**).
- Three Stone Age sites (**H013**, **H013/1 H013/3**) are located about 85m from the closest infrastructure, and it is therefore avoided.
- Two burial grounds (**H006 and H016**) of high heritage significance were located more than 600m away from **layout of the WEF, as included in this report.**

- Five structures (**H001, H002, H008, H014, H014/1**) of medium heritage significance were located less than 100m from existing farm tracks. **The final WEF layout avoids these sites.**

It is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources in the area. Various factors account for this, including the size of the study area and the subterranean nature of some heritage sites. The impact assessment conducted for heritage sites assumes the possibility of finding heritage resources during the project life and has been conducted as such. Although the sites mentioned and described above are listed as points on a map, these resources are part of a larger cultural landscape (farmstead, vistas etc) and as such the impact on the cultural landscape extends outside of the boundaries of these specific heritage resource. These impacts are multi-faceted and cannot always be seen as only a direct impact on tangible heritage resources.

Three project phases have been identified by SiVEST namely the Pre-Construction Phase, Construction Phase and Operational Phase. As site clearing activities of all the development footprint areas are grouped under the Pre-Construction Phase, the highest level of impact on the identified heritage sites is expected during this phase. No impacts are expected during the Operational Phase. All the identified heritage sites are expected to be destroyed in terms of the pre-mitigation impact assessments undertaken below, whereas only those sites not mitigated by amendments to the proposed development footprints will also be destroyed in terms of the post-mitigation impact assessment calculations undertaken below.

The following impact rating table is based on the proposed WEF development layout within the region.

9.2 Pre construction

Table 7: Rating of impacts for Planning/ Pre-construction Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Planning Phase																				
Ecological	Inappropriate infrastructure layout planning degrades ecological elements of the cultural landscape.	2	4	3	3	3	4	60	-	H	Please see **Table 18**	2	2	2	1	3	2	20	-	L
Aesthetic	Inappropriate infrastructure layout planning negates aesthetic and sense of place requirements of the cultural landscape.	2	4	4	4	3	4	68	-	VH	Please see **Table 18**	2	3	2	3	3	3	39	-	M
Historic	Inappropriate infrastructure layout planning degrades historic elements of the cultural landscape.	2	4	3	4	4	4	68	-	VH	Please see **Table 18**	2	2	2	1	3	2	20	-	L
Socio-economic	Non-landowner residents' lack of representation in planning and public participation process leads to loss of local knowledge, socio-economic empowerment and character of the cultural landscape.	2	4	4	3	4	4	68	-	VH	Please see **Table 18**	2	2	1	2	4	2	22	+	L

Table 8: Rating of impacts for Construction/Decommissioning Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction Phase																				
Damage to heritage resources (**H001, H002, H008, H013/1 & H013/3 & H013 H014, H014/1**)	Eight heritage resources are located less than 100m away from existing farm roads within the proposed development area. The expansion of existing farm roads may impact the sites.	2	2	4	4	4	2	32	-	M	- A **no-go-buffer-zone** of at least **30m** should be kept to the closest WEF infrastructure (incl. roads). - If development occurs within 30m of the site, the structure will need to be satisfactorily studied and recorded before impact occurs. - Recording of the structure i.e. (a) map indicating the position and footprint of the structure (b) photographic recording of the structure (c) measured drawings of the floor plans of the structure. - A baseline report must be compiled for the site within which the recorded drawings from the	2	1	4	4	4	1	15	-	L

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											previous item as well as all existing information on the structure can be included. This baseline report will then be utilised as a part of the HMP to determine any future unforeseen impacts on the heritage resources. - The baseline report must be submitted to the relevant heritage authorities with a permit application in the event that the site will be impacted.									
Unidentified heritage resources	Due to the size of the area assessed, there's a possibility of encountering heritage features in un-surveyed areas does exist.	1	3	4	2	4	2	28	-	M	- An induction and training program on managing archaeological resources must be included in the induction programs for the Environmental Control/Site Officer working on the project.	1	3	4	2	4	1	14	-	L

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
											- An assessment of the footprint areas must be done if the project is to commence immediately pre-construction and any findings must be handled through the Chance finds protocol. - Implementation and training of the Chance finds program must be included.									
Fossil heritage resources	Disturbance, damage or destruction of fossils at or beneath the ground surface due to surface clearance and bedrock excavations	1	3	4	2	4	2	28	-	M	- Immediate assessment of footprint areas before construction by palaeontologist - Implementation of Chance finds protocol	1	2	4	2	4	1	13	-	L
Ecological	Fragmentation and destruction of the landscape degrading the environment and thus continuous	2	4	3	3	4	3	48	-	H	Please see **Table 18**	2	2	2	1	4	2	22	-	L

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
	relationship between man and environment																			
Aesthetic	WEF infrastructure construction and decommissioning activity degrades the character of the cultural landscape and the sense of place	2	4	3	3	3	4	60	-	H	Please see **Table 18**	2	4	2	2	2	2	24	-	M
Historic	Integrity of farmsteads and farm roads degraded by insensitive construction or decommissioning activities.	2	4	4	3	4	4	68	-	VH	Please see **Table 18**	2	2	3	2	2	2	22	+	L
Socio-economic	Integrity of local residents to continue their patterns of land use is disregarded by the construction and decommissioning activities.	2	3	4	4	4	4	68	-	VH	Please see **Table 18**	1	3	3	1	3	2	22	+	L

Table 9: Rating of impacts for Construction/ Decommissioning Phase

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
Construction/ Decommissioning Phase																				
Ecological	Fragmentation and destruction of the landscape degrading the environment and thus continuous relationship between man and environment	2	4	3	3	4	3	48	-	H	Please see **Table 18**	2	2	2	1	4	2	22	-	L
Aesthetic	WEF infrastructure construction and decommissioning activity degrades the character of the cultural landscape and the sense of place	2	4	3	3	3	4	60	-	H	Please see **Table 18**	2	4	2	2	2	2	24		M
Historic	Integrity of farmsteads and farm roads degraded by insensitive construction or	2	4	4	3	4	4	68		VH	Please see **Table 18**	2	2	3	2	2	2	22		L

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+ OR -)	S
	decommissioning activities.																			
Socio-economic	Integrity of local residents to continue their patterns of land use is disregarded by the construction and decommissioning activities.	2	3	4	4	4	4	68		VH	Please see **Table 18**	1	3	3	1	3	2	22		L

9.3 Cumulative Impacts

This section evaluates the possible cumulative impacts (CI) on heritage resources with the addition of the Heuweltjies WEF. The CI on heritage resources evaluated a 35-kilometer radius (**Figure 48**). It must further be noted that the evaluation is based on available heritage studies. Although there are 12 WEF applications in process currently, none have yet been built and as a result the full impact of the development cannot be fully assessed.

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

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

With regards to the historical resources, in most cases given a low-medium heritage significance on a local scale and in the majority of the cases were recommended as being easily mitigated or avoidable.

While the graves sites in all cases given a high heritage significance on a local scale and in the majority of the cases were recommended as being no-go areas or extensive mitigation required.

The CLA further notes that the focus of heritage studies in the area has been on the material and tangible aspects of the landscape as identified in the NHRA. Cultural landscape assessments ideally include consideration of intangible heritage associated to the tangible resources identified and a public participation process dealing with issues regarding inter alia intangible heritage, indigenous knowledge systems, oral histories, language and lifeways of the people who inhabit and use the landscape.

The Heuweltjies WEF site is not located within a SEA identified REDZ zone or in one of the SEA strategic transmission corridors. Currently, there are no operational renewable energy projects in the Koup region, however there are applications for both wind and solar energy developments within a 35km radius of the Heuweltjies WEF application site. Various electric grid connections and transmission lines operate along the N1 and the N12. Although their height surpasses any natural or cultural elements, the linear orientation of these lines, mostly adjacent to the road, do not cross the viewshed

as one travels along the N12. Together with their light form and static nature, this reduces their visual impact. The associated infrastructure, such as substations, is more intrusive as the height, scale and angular form is more in conflict with the natural undulating horizontal lines of the surrounding landscape. These elements are currently relatively low scale and do not overwhelm the sense of place, but should be considered as part of the cumulative impact of the new renewable energy developments in the region.

Table 11 provides an analysis of the projected cumulative impact this project will add to impact on heritage resources.

Table 10: Renewable energy developments proposed within a 35km radius of the Heuweltjies WEF application site.

Project	DEA Reference No	Technology	Capacity	Status of Application / Development
Proposed Beaufort West Wind Farm	12/12/20/1784/1	Wind	140MW	Approved
Proposed Trakas Wind Farm	12/12/20/1784/2	Wind	140MW	Approved
Proposed Wind and Solar Facility on the Farm Lombardskraal 330	14/12/16/3/3/2/406	Solar	20MW	EIA in Process
Proposed Kraaltjies WEF	TBA	Wind	140MW	EIA in Process
Kwagga WEF 1	Pending	Wind	279 MW	EIA in Process
Kwagga WEF 2	Pending	Wind	341 MW	EIA in Process
Kwagga WEF 3	Pending	Wind	204.6 MW	EIA in Process
Koup 1 WEF	TBA	Wind	140 MW	EIA in Process
Koup 2 WEF	TBA	Wind	140 MW	EIA in Process

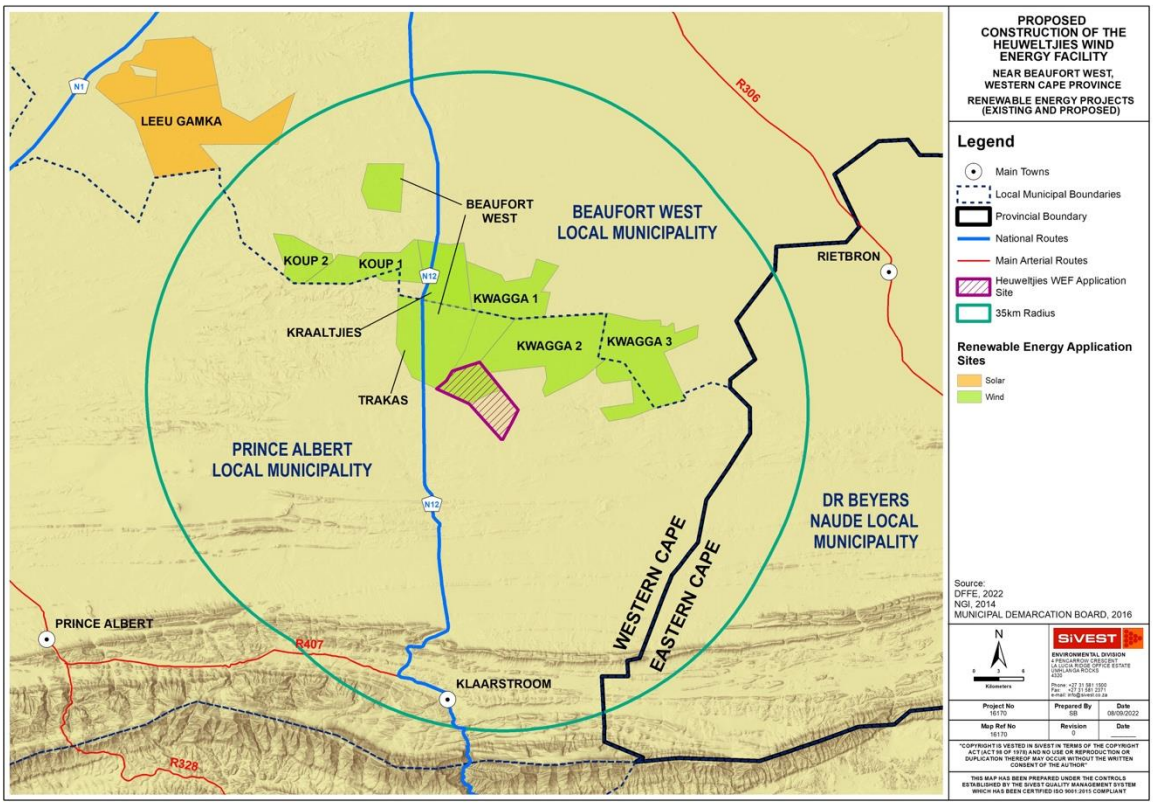


Figure 48: Renewable energy facilities proposed within a 35km radius of the proposed development (provided by SiVEST).

THE CLA summarises as follows:

"The numerous applications and proposed establishment of several wind energy facilities between Beaufort West and the Swartberg mountain range, as well as the adjacent regions in the Karoo have sparked a concern with regards to the cumulative impacts that these projects may have on the heritage resources and the cultural landscape. The approval of an increased number of RE projects in the region may lead to the mass industrialisation of the landscape that changes the character of the landscape and hence impacts on the sense of place and aesthetic value negatively. The Koup region has been considered as a wilderness landscape with a significant footprint of human habitation, cultural contact and conflict, whereby the cumulative impact of increased WEF's will involve significant sterilisation of the aesthetic qualities of the landscape.

The cumulative impacts on tangible heritage resources can be considered low in general due to the thin density in the area, except when considering the cultural landscape which is negatively impacted by the construction of renewable energy, wind turbines and associated electrical infrastructure on the 'sense of place', land use patterns and its scenic beauty. The cumulative impact on the cultural landscape is thus unavoidably high without mitigation, with losses to perceptual qualities and historic land use. Similarly, cumulative impacts to living heritage sites will be unavoidably high without mitigation, with losses including the physical expressions of cultural heritage as well as to sense of place and cultural landscapes. While mitigation in the form of avoidance and protection of these sites can go some way to reducing cumulative impacts, these are likely to remain moderate.

By placing turbines away from the high and prominent ridgelines as well as further below rather than on top of steep and high slopes, the height of the turbines should be reduced so that they can be more gently incorporated visually into the skyline of the landscape. The infrastructure associated with the WEF, such as laydown areas, substations and gridlines, should be less conspicuous located between the ridgelines, at low-lying elevations.

The main negative impacts by WEF development and associated infrastructure to the cultural landscape are on the aesthetic and historic value of the area, including the local residents' opportunity to continue their historic patterns of land use and relationship to the landscape. The historic inhabitants of the area are an essential element to the historic and cultural significance of the cultural landscape and their continued existence in this place with the opportunity to practice traditional land use patterns and knowledge systems are critical in the conservation of the Koup region's intangible heritage.

The cumulative visual impact of the Heuweltjies WEF on the region has been considered by Schwartz (VIA, 2022) and is supported by the findings of this cultural landscapes impact assessment in terms of aesthetic heritage significance. The recommendations for cumulative visual impact according to the VIA impact rating table is supported by this cultural landscape impact assessment.

"Although it is important to assess the visual impacts of the proposed Heuweltjies WEF and associated infrastructure specifically, it is equally important to assess the cumulative visual impact that could materialise if other renewable energy facilities (both wind and solar facilities) and associated infrastructure projects are developed in the broader area. Cumulative impacts occur where existing or planned developments, in conjunction with the proposed development, result in significant incremental changes in the broader study area. In this instance, such developments would include renewable energy facilities and associated infrastructure development.

Renewable energy facilities have the potential to cause large scale visual impacts and the location of several such developments in close proximity to each other could significantly alter the sense of place and visual character in the broader region. Although power lines and substations are relatively small developments when compared to renewable energy facilities, they will introduce a more industrial character into the landscape, thus altering the sense of place.

9 renewable energy project applications were identified as 'approved' or 'in process' within just over a 35 km radius of the proposed Heuweltjies WEF and associated infrastructure. It is assumed that all of these renewable energy developments include grid connection infrastructure. The eleven (11) WEF's, namely Beaufort West WEF, Trakas WEF, Kwagga WEF's 1, 2 and 3 and Koup 1 & 2 WEF's and Kraaltjies WEF are all located in relatively close proximity to Heuweltjies WEF. These proposed WEF's, in conjunction with the associated grid connection infrastructure, will inevitably introduce an increasingly industrial character into a largely natural, pastoral landscape, thus giving rise to significant cumulative impacts. The number of renewable energy facilities within the surrounding area and their potential for large scale visual impacts will significantly alter the sense of place and visual character in the broader region, as well as exacerbate the visual impacts on surrounding visual receptors, once constructed.

From a visual perspective, the further concentration of renewable energy facilities as proposed will inevitably change the visual character of the area and alter the inherent sense of place, introducing an increasingly industrial character into the broader area, and resulting in significant cumulative impacts."

Significant negative cumulative impacts will occur due to the night lighting associated with WEF's. As identified and supported by the VIA (Schwartz, 2022) the negative impact of this WEF element on the cultural landscape will alter the sense of place for the duration of the operation of the facility.

"Much of the study area is characterised by natural areas with pastoral elements and low densities of human settlement. As a result, relatively few light sources are present in the broader area surrounding the proposed development site. The closest built-up area is the town of Beaufort West which is situated approximately 55km north of the application site and is thus too far away to have significant impacts on the night scene. At night, the general study area is therefore characterised by a picturesque dark starry sky and the visual character of the night environment across the broader area is largely 'unpolluted' and pristine. Sources of light in the area are limited to isolated lighting from surrounding farmsteads and transient light from the passing cars travelling along the N12 national route. Given the scale of the proposed WEF, the operational and security lighting required for the proposed project is likely to intrude on the nightscape and create glare, which will contrast with the extremely dark backdrop of the surrounding area. In addition, red hazard lights placed on top of the turbines may be particularly noticeable as their colour will differ from the few lights typically found within the environment and the flashing will draw attention to them."

However, with the proposed recommendations of this CLA the cumulative negative impact of the proposed WEF's on the cultural landscape can be reduced."

Table 11: Impact rating - Cumulative

ENVIRONMENTAL PARAMETER	ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION									RECOMMENDED MITIGATION MEASURES	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S		E	P	R	L	D	I / M	TOTAL	STATUS (+/-)	S
Cumulative Phase																				
Heritage Resources	The extent that the addition of this project will have on the overall impact of developments in the region on heritage resources.	4	2	4	4	4	2	36	-	M	It can clearly be noted that the area in general is abundant with Stone Age and historical remains. However, until a regional detailed study is commissioned by HWC or SAHRA, no further mitigations measures can be proposed other than those already recommended for the site-specific mitigation of sites in this report.	4	1	4	4	4	1	17	-	L
Fossil heritage resources	Disturbance, damage or destruction of fossils at or beneath the ground surface due to surface clearance and bedrock excavations	1	4	4	3	4	2	32	-	M	Immediate assessment of footprint areas before construction by palaeontologist Implementation of Chance finds protocol	1	2	4	2	4	1	13	-	L
Ecological	Inappropriate cumulative development degrade the significant ecological elements of the cultural landscape	3	4	4	3	4	4	72		VH	Please see **Table 18** for mitigation recommendations for specifically cumulative impacts. NOTE: If the recommendations in	3	2	4	2	3	2	28	-	M

Aesthetic	Inappropriate cumulative development degrades the significant aesthetic elements of the cultural landscape altering the character and sense of place	3	4	3	3	3	4	64	-	VH	this CLA are applied to the majority of the surrounding RE developments, impacts can be reduced to ratings given in this table. With no specialist CLA reports done on the surrounding applications, cumulative impact on the cultural landscape of the region has not been considered and cannot be included in this rating.	3	4	2	2	3	2	28	-	M
Historic	Inappropriate cumulative development degrades the significant historic elements of the cultural landscape altering the character and sense of place	3	4	4	4	4	4	76	-	VH		3	2	3	2	3	2	26	-	M
Socio-economic	Inappropriate cumulative development degrade the significant socio-economic opportunities of the cultural landscape	3	4	3	4	4	4	72	-	VH		3	3	1	1	4	2	24	+	M

9.4 No-Go Alternative

It is mandatory to consider the “no-go” option in the EIA process. The no development alternative option assumes the site remains in its current state, i.e. there is no construction of a WEF facility and associated infrastructure in the proposed project area and the status quo would remain. This option would result in no development impact on the Heuweltjies CL or tangible heritage and it would continue to operate in the current way maintaining the current significance.

If the Heuweltjies site is not developed, the WEF and associated infrastructure will not be built to the west of the N12 and the aesthetic and visual impact of new RE developments will be contained to the eastern viewshed.

The potential for socio-economic opportunities related to the construction and operation of the RE facility for local residents in the area would be lost. The potential for increased RE energy capacity nationally would be lost in this instance but certainly gained elsewhere.

10. COMPARATIVE ASSESSMENT OF ALTERNATIVES

Two alternatives were provided for the substation sites.

An assessment of the options for the substation shows that there will be an impact on heritage resources if the Option 1 substation is chosen. Therefore, there is a preference for substation Option 2.

Key

PREFERRED	The alternative will result in a low impact/reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact/increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 12: Comparative assessment of archaeological resources

Alternative	Preference	Reasons
SUBSTATION		
Substation site Option 1	**PREFERRED**	No heritage resources have been identified in the general area of the substation footprint.
Substation site Option 2	**PREFERRED**	No heritage resources have been identified in the general area of the substation footprint.

Table 13: Comparative assessment of palaeontological resources

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION SITE ALTERNATIVES		
Substation Option 1	**PREFERRED**	Comparable geology and palaeontology to alternative.
Substation Option 2	**PREFERRED**	Comparable geology and palaeontology to alternative.

Table 14: Comparative assessment of cultural landscape

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION SITE ALTERNATIVES		
Substation Option 1	**LEAST PREFERRED**	This location will result in increased impact due to proximity to regional road. but is acceptable if all infrastructure, other than roads, is kept out of the 300m high sensitivity buffer on final construction.
Substation Option 2	**FAVOURABLE**	This location results in less impact as it is located further from the regional road.

11. GENERAL RECOMMENDATIONS AND MITIGATION MEASURES

11.1 Construction phase

The project will encompass a range of activities during the construction phase, including vegetation clearance, excavations and infrastructure development associated with the project.

It is possible that cultural material will be exposed during construction and may be recoverable, keeping in mind delays can be costly during construction and as such must be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, however foundation holes do offer a window into the past, and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project, and these must be catered for. Temporary infrastructure developments are often changed or added to the project as required. In general, these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognize any significant material being unearthed, making the correct judgment on which actions should be taken. It is recommended that the following chance find procedure should be implemented as part of the Environmental Management Programme (EMPr).

11.2 Chance finds procedure

- A heritage practitioner / archaeologist should be appointed to develop a heritage induction program and conduct training for the ECO as well as team leaders in the identification of heritage resources and artefacts. The ECO (following this training) can be permitted to provide similar induction and awareness training to contractors that will undertake construction of the project.
- An appropriately qualified heritage practitioner / archaeologist must be identified to be called upon if any possible heritage resources or artefacts are identified.
- Should an archaeological site or cultural material be discovered during construction (or operation), the area should be demarcated, and construction activities halted using the appropriate protocol.
- The qualified heritage practitioner / archaeologist will then need to come out to the site and evaluate the extent and importance of the heritage resources and make the necessary recommendations for mitigating the find and the impact on the heritage resource.
- The contractor therefore should have a contingency plan so that operations could move elsewhere temporarily while the materials and data are recovered.
- Construction can commence as soon as the site has been cleared and signed off by the heritage practitioner / archaeologist.

11.3 Possible finds during construction

The study area occurs within a greater historical and archaeological site as identified during the desktop and fieldwork phase. Soil clearance for infrastructure as well as the proposed development activities, could uncover the following:

- High density concentrations of stone artefact; and
- Unmarked graves.
- Fossil deposits

11.4 Timeframes

It must be kept in mind that mitigation and monitoring of heritage resources discovered during construction activity will require permitting for collection or excavation of heritage resources and lead times must be worked into the construction time frames. **Table 15** gives guidelines for lead times on permitting.

Table 15: Lead times for permitting and mobilisation

Action	Responsibility	Timeframe
Preparation for field monitoring and finalisation of contracts	The contractor and service provider	Approximately 1 month
Application for permits to do necessary mitigation work	Service provider – Archaeologist and HWC	Approximately 3 months
Documentation, excavation and archaeological report on the relevant site	Service provider – Archaeologist	Approximately 3 months
Handling of chance finds – Graves/Human Remains	Service provider – Archaeologist and HWC	Approximately 2 weeks
Relocation of burial grounds or graves in the way of construction	Service provider – Archaeologist, HWC, local government and provincial government	Approximately 6 months

11.5 Heritage Management Plan for EMPr implementation

Table 16: Heritage Management Plan for EMPr implementation – Archaeological and built environment.

Area and site no.	Mitigation measures	Phase	Target
General project area	▪ An induction and training program on managing archaeological resources must be included in the induction programs for the Environmental Control/Site Officer working on the project. ▪ An assessment of the footprint areas must be done if the project is to commence immediately pre-construction and any findings must be handled through the Chance finds protocol. ▪ Implement chance find procedures in case where possible heritage finds are uncovered.	Construction and operation	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 34-36 and 38 of NHRA
Graves and Burial grounds (H006, H016)	▪ The sites should be demarcated with a **50-meter** no-go-buffer-zone and the graves should be avoided and left in situ. ▪ A Grave Management Plan should be developed for the graves, to be implemented during the construction and operation phases (which needs approval by HWC prior to construction). ▪ If the site is going to be impacted directly and the graves need to be removed a grave relocation process for these sites is recommended as a mitigation and management measure. This will involve the necessary social consultation and public participation process before grave relocation permits can be applied for with the HWC under the NHRA and National Health Act regulations.	Construction	Ensure compliance with relevant legislation and recommendations from HWC under Section 36 and 38 of NHRA
Historical Structures that were rated as low heritage significance (**H007**, **H015, H017**) and don't fall within an area demarcated for development.	▪ No mitigation is required. ▪ The documentation of the site in this HIA report is sufficient and the site can be destroyed without a permit, only with the approval of this report as provided here.	Pre-construction	Ensure compliance with relevant legislation and recommendations from HW under Section 36 and 38 of NHRA

Area and site no.	Mitigation measures	Phase	Target
Historical Structures that were rated as medium heritage significance (**H001, H002, H008, H014, H014/1**).	▪ As the sites are located less than 100m adjacent to an existing farm road, it is possible that the sites will be impacted upon if the road is expanded. ▪ If there are plans to expand the current farm road, it is recommended that a no-go-buffer-zone of at least **30m** is kept to the closest WEF infrastructure. ▪ If development occurs within 30m of the site, the structure will need to be satisfactorily studied and recorded before impact occurs. ▪ Recording of the structure i.e. (a) map indicating the position and footprint of the structure (b) photographic recording of the structure (c) measured drawings of the floor plans of the structure. ▪ A baseline report must be compiled for the site within which the recorded drawings from the previous item as well as all existing information on the structure can be included. This baseline report will then be utilised as a part of the HMP to determine any future unforeseen impacts on the heritage resources. ▪ The baseline report must be submitted to the relevant heritage authorities with a permit application in the event that the site will be impacted.	Pre-construction	Ensure compliance with relevant legislation and recommendations from HW under Section 36 and 38 of NHRA
Stone Age sites that were rated as medium heritage significance (**H013, H013/1, H013/3**) but don't fall within an area demarcated for development.	▪ No mitigation required. ▪ A **30m** buffer is recommended to retain the sites integrity. ▪ If the site can't be avoided, then it must be sampled by a qualified specialist under a permit issued by SAHRA ▪ A management plan, for the heritage resources needs then to be compiled and approved for implementation during construction and operations.	Pre-construction	Ensure compliance with relevant legislation and recommendations from HWC under Section 36 and 38 of NHRA

Table 17: Recommended monitoring and mitigation for the Heuweltjies WEF project

Impact/Aspect	Mitigation/Management Actions	Responsibility	Methodology	Mitigation/Management Objectives and Outcomes	Frequency
Disturbance, damage or destruction of fossil remains preserved at or below the ground surface through site clearance of bedrock excavations.	Assessment of footprint areas immediately before construction commence. Monitoring of substantial, deeper excavations (> 1m)	Specialist palaeontologist appointed by developer ECO / ESO	Assessment of footprint areas immediately before construction commences in sensitive sectors with recording and judicious collection of fossil material where discovered. Curation of fossils and site data within an approved repository (museum / university palaeontological collection) Visual inspection of excavations Application of Chance Fossil Finds Protocol Safeguarding newly exposed fossils - *in situ*, if feasible – pending mitigation.	Reporting and safeguarding of significant new fossil finds (*e.g.* vertebrate bones, teeth, petrified wood, shells) to Heritage Western Cape for potential mitigation.	Before and going throughout Construction Phase
	Submission of Work Plan to / application for Fossil Collection permit from responsible Heritage Resources Agency (PRHA) Recording and sampling / collection of significant new fossil finds that have been reported by ECO / ESO	Specialist palaeontologist appointed by developer	Recording of fossil material as well as associated geological data. Professional sampling / collection of fossils. Curation of fossils and site data within an approved repository (museum / university palaeontological collection)	Conservation and recording of new fossil material of scientific / conservation value within project area	Triggered by alert from ECO / ESO / PHRA
	Palaeontological mitigation reporting to responsible Heritage Resources Agency (PRHA)	Specialist palaeontologist	Submission of Fossil Collection Report to responsible Heritage Resources Agency (PRHA)	Conservation and recording of new fossil material of scientific / conservation value within project area	Following specialist palaeontological mitigation

Table 18: Heritage Management Plan for EMPr implementation – Cultural landscape

Aspect	Mitigation measures	Phase	Target
Ecological	• Critical Biodiversity Areas, and Ecological Support Areas (along drainage lines), should be protected from development of the wind turbines or any associated development during all phases as far possible. • No wind turbines should be placed within the 1:100-year flood line or the no-go areas specified by the wetland specialist (where advised) of the watercourses. In the context of the sensitivity to soil erosion in the area, as well as potential archaeological resources, it would be a risk to include any structures close to these drainage lines and specialist recommendations must be taken into account in this regard, as advised. • Identified medicinal plants used for healing or ritual purposes should be conserved during all phases if threatened for use and continued access to these resources must be maintained. • Careful planning should incorporate areas for stormwater runoff where the base of the structure disturbed the natural soil. Local rocks found on the site could be used to slow stormwater (instead of concrete, or standard edge treatments), and prevent erosion that would be an unfortunate consequence that would alter the character of the site. By using rocks from site it helps to sensitively keep to the character.	Planning/ pre-construction	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA
	• Critical Biodiversity Areas, and Ecological Support Areas (along drainage lines), including manmade wetlands and dams, should be protected from development of the wind turbines or any associated development during all phases. • No wind turbines should be placed within the 1:100-year flood line of the watercourses, unless otherwise advised by the aquatic specialist. In the context of the sensitivity to soil erosion in the area, as well as potential archaeological resources, it would be a risk to include any structures close to these drainage lines. This recommendation can be waived if the archaeological or hydrological / aquatic specialist reports recommend different buffers. • Remaining areas of endemic and endangered natural vegetation should be conserved in line with relevant specialist buffers. • Critical Biodiversity Areas, and Ecological Support Areas (along drainage lines), should be protected from development of the wind turbines or any associated development during all phases in line with relevant ecological and aquatic specialist recommended buffers. • Areas of critical biodiversity should be protected from any damage during all phases; where indigenous and endemic vegetation should be preserved at all cost. • Areas of habitat are found among the rocky outcrops and contribute to the character, as well as biodiversity of the area. Care should be taken that habitats are not needlessly destroyed. • Identified medicinal plants used for healing or ritual purposes should be conserved during all phases if threatened for use. • Careful planning should incorporate areas for stormwater runoff where the base of the structure disturbed the natural soil. Local rocks found on the site could be used to slow stormwater (instead of concrete, or standard	Construction/ decommissioning	

Aspect	Mitigation measures	Phase	Target
	edge treatments), and prevent erosion that would be an unfortunate consequence that would alter the character of the site. By using rocks from site it helps to sensitively keep to the character.		
	• Areas of endemic and endangered natural vegetation should be conserved. • Critical Biodiversity Areas, and Ecological Support Areas (along drainage lines), including manmade wetlands and dams, should be protected as far possible. • Areas of habitat are found among the rocky outcrops and contribute to the character, as well as biodiversity of the area. Care should be taken that habitats are not needlessly destroyed. • Identified medicinal plants used for healing or ritual purposes should be conserved during all phases if threatened for use. Access to these resources should be made available to those who have had historic access to them.	Operational	
Aesthetic	• Where additional infrastructure (i.e. roads) is needed, the upgrade of existing roads to accommodate the development should be the first consideration. • Avoid development of infrastructure (such as buildings, wind turbines and power lines), on crests or ridgelines due to the impact on the visual sensitivity of skylines. The visual impact of turbines can be reduced by distancing them from viewpoints such as roads and farmsteads, and placing them in lower lying plains to reduce their impact on the surrounding sensitive cultural landscape. • Significant and place-making viewsheds of surrounding ridgelines and distant mountain should be maintained by limiting the placement of turbines or associated infrastructure on opposing sides of any of the regional roads, so that at any time a turbine-free view can be found when travelling through the landscape or at the historic farmsteads. • Retain view-lines and vistas focused on prominent natural features such as mountain peaks or hills, as these are important place making and orientating elements for experiencing the cultural landscape. • Prevent the construction of new buildings/structures/ new roads on visually sensitive, steep, elevated or exposed slopes, ridgelines and hillcrests. • Turbine and new road placement to avoid slopes steeper than 10% with existing farm roads to be used for access to turbines as far possible. The low gradient is relative to the context of the landscape, which is flat and expansive. • Two relevant poorts on the N12 offer views of the vast flat Koup landscape and the Heuweltjies WEF site. 1) A smaller poort alongside the Amospoortjie farmstead as one travels south on the N12 (recommended grading IIIC) which runs through one of the east west ridges of the Koup landscape. 2) On travelling north through the Meiringspoort Pass (Grade II), this portion of the N12 that travels through the Swartberg range, culminates in a poort through the last ridge of the mountain range, which opens up with dramatic views of the vast flat landscape of the Koup Karoo. This poort is located 11kms from the nearest proposed Heuweltjies turbine and is of medium sensitivity at this distance. • To support the continued occupation of the homesteads on the landscape, the turbines should be placed at a suitable distance from any occupied homestead. Trakaskuilen and Lammerkraal both dated to pre-1965 can be	Planning/ pre-construction	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA

Aspect	Mitigation measures	Phase	Target
	graded IIIB and an 800m buffer would be minimum. Trakaskuilen and Lammerkraal are currently not negatively impacted by the proposed development. Any associated gravesites are graded IIIA. • Due to the historic and local experience of the landscape from the regional farm road running across the north of Klipgat portion, which links the historically significant farmsteads across the region, a buffer of 300m (200m no-go buffer for all turbine infrastructure other than sensitive road upgrade, and 100m high sensitivity buffer where infrastructure placement is subject to specialist approval); from the regional road still in use should be maintained and any road upgrades must not impact on the views from the road. • The preferred substation in terms of cultural landscapes assessment is location 2 as it is located further away from the regional road. • Substation Option 1 is acceptable if all permanent infrastructure, other than roads, underground cabling and guard house, can be kept out of the regional road 200m no-go buffer on final construction. • The impact of WEF turbine night lighting on the wilderness landscape is intrusive and overwhelms the rural character of the landscape, giving it an industrial sense of place after dark. Reduce the impact of turbine night lighting by minimizing the number of turbines with lighting to only those necessary for aviation safety such as a few identified turbines on the outer periphery, or use aircraft triggered night lighting. Due to the reduced receptors on the roads at night, the impact of the lighting at night is reserved mainly for farmsteads and other places of overnight habitation such as the surrounding tourist facilities, which would be heavily impacted by the light pollution on a long term and ongoing basis.		
Aesthetic	• Encourage mitigation measures (for instance use of vegetation) to 'embed' or disguise the proposed structures within the surrounding tourism and agricultural landscape at ground level, road edges etc; • The continuation of the traditional use of material could be enhanced with the use of the rocks on the site as building material. This would also help to embed structures into the landscape and should not consist of shipping containers or highly reflective untreated corrugated sheeting that clutters the landscape and is exacerbates the foreign intrusion on the natural matte landscape. • Using material found on the site adds to the sense of place and reduces transportation costs of bringing materials to site. • The local material such as the rocks found within the area could be applied to address storm water runoff from the road to prevent erosion. • Duration and magnitude of construction/ decommissioning activity must be minimized as far possible to reduce the impact of heavy vehicles on the roads as well as the associated dust from the activity. Lightest vehicles possible should be used to reduce degradation to the farm roads and the need to upgrade roads to scale and extent that negatively impacts on the integrity of the historic farm roads. Construction/ decommissioning traffic must operate at speeds that reduce dust and noise as far possible.	Construction/ decommissioning	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA
Aesthetic	• Infrastructure improvement or maintenance work, including new roads and upgrades to the road network, should be appropriate to the rural context (scale, material etc.) and avoid steep slopes over 10% as well as ridges.	Operational	Ensure compliance with relevant

Aspect	Mitigation measures	Phase	Target
	• Prevent the construction of new buildings/structures on visually sensitive, steep (over 10%), elevated or exposed slopes, ridgelines and hillcrests or within farmstead and N12 buffers and 300m of the regional farm roads. • Avoid visual clutter in the landscape by intrusive signage, and the intrusion of commercial, corporate development along roads. • Duration and magnitude of operational activity must be minimized as far possible to reduce the impact of heavy vehicles on the roads as well as the associated dust from the activity. Lightest vehicles possible should be used to reduce degradation to the farm roads and the need to upgrade roads to scale and extent that negatively impacts on the integrity of the historic farm roads. Operational traffic must operate at speeds that reduce dust and noise as far possible. • The impact of WEF turbine night lighting on the wilderness landscape is intrusive and overwhelms the rural character of the landscape, giving it an industrial sense of place after dark. Reduce the impact of turbine night lighting by minimizing the number of turbines with lighting to only those necessary for aviation safety, such as a few identified turbines on the outer periphery, or use aircraft triggered night lighting. Due to the reduced receptors on the roads at night, the impact of the lighting at night is reserved mainly for farmsteads and other places of overnight habitation such as the surrounding tourist facilities, which would be heavily impacted by the light pollution on a long term and ongoing basis.		legislation and recommendations from SAHRA under Section 38 of NHRA
Historic	• Due to the scenic and historic significance of the regional road, a buffer of 1000m (800m no-go turbine buffer and 200m high sensitivity buffer where infrastructure placement is subject to specialist approval, if required) to either side of the N12 should be maintained for no development associated with the WEF other than sensitive road upgrades, which must not impact on the views from the road. The visual impact of the turbines will be 50% less at 1000m distance and therefore this distance will greatly reduce the negative visual impact of the turbines on the experience of the historic road and the values that give it significance. – layout proposed in this report has been assessed and approved with recommendations and any further changes will require review and approval by the specialist; • The integrity of the historic farmsteads and their associated cultivated areas and relationship to the riverine corridors and other natural elements should be maintained and protected. Due to the nature of the landscape being largely devoid of high vertical elements such as the proposed turbines, the introduction of turbines will fundamentally alter the sense of place and character of the landscape for those living there. Location of proposed turbines should be limited to the identified buffers around the farmsteads as far possible to limit impact to the farmsteads. • Any development that impacts the inherent character of the werf component should be discouraged and a development buffer of 50m around any graded heritage structure, must be maintained, including the associated cultivated areas, cemeteries and unmarked graves, for all new infrastructure. Klipgat and Witpoortjie ruin complexes, provisionally graded IIIB, should be regarded as distinct cultural landscape features and buffers of 250m around each complex, including homesteads, graves, dams, stone kraals and other water management features are recommended. No-go buffers have been provided for Klipgat and Witpoortjie CL complexes and have been adhered to by the proposed site layout presented in this report.	Planning/ pre-construction	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA

Aspect	Mitigation measures	Phase	Target
	• Due to the historic and local experience of the landscape from the regional farm road running across the north of Klipgat portion, which links the historically significant farmsteads across the region, a buffer of 300m (200m no-go buffer for all turbine infrastructure other than sensitive road upgrade, and 100m high sensitivity buffer where infrastructure placement is subject to specialist approval); from the regional road still in use should be maintained and any road upgrades must not impact on the views from the road. • The existing names of places, routes, watercourses and natural features in the landscape that are related to its use, history and natural character should be retained and used as heritage resources related to intangible heritage. • Burial grounds and places of worship are automatically regarded as Grade IIIa or higher. Any development that threatens the inherent character of family burial grounds must be assessed and should be discouraged and a buffer of 50m around any burial ground or unmarked graves should be in place. No turbines have been proposed for placement near known unmarked burials or family cemeteries. These recommendations should be considered together with the AIA report and the AIA recommendations should take preference for stand-alone burial grounds or graves where they are not associated with other heritage features or cultural landscape elements. • Respect existing patterns, typologies and traditions of settlement-making by promoting the continuity of heritage features. These include: (a) indigenous; (b) colonial; and (c) current living heritage in the form of tangible and intangible associations to place. • Alterations and additions to conservation-worthy structures should be sympathetic to their architectural character and period detailing.		
Historic	• Historic farmsteads must be protected from the impacts of heavy construction vehicles and increased numbers of people. No construction traffic should pass through or closer than 50m to any outlying graded heritage structure, which includes the associated historically cultivated lands, cemeteries, unmarked burials. The most appropriate use of existing farm roads must be found to avoid farm werfs as far as possible and reduce construction impact on these heritage features. The AIA buffer recommendations should take preference for identified archaeological heritage resources. • Duration and magnitude of construction/ decommissioning activity must be minimized as far possible to reduce the impact of heavy vehicles on the roads as well as the associated dust from the activity. Lightest vehicles possible should be used to reduce degradation to the farm roads and the need to upgrade roads to scale and extent that negatively impacts on the integrity of the historic farm roads. Construction decommissioning traffic must operate at speeds that reduce dust and noise as far possible. • Accommodation of construction staff must not negatively impact on existing farm residents or degrade the integrity of the farmstead complexes and should, without negative impact to ecological or aesthetic resources, be located outside of the farmstead complexes or site. Farm residents should be consulted on the preferable location for construction staff accommodation. • Traditional planting patterns should be protected by ensuring that existing trees are not destroyed as these signify traces of cultural intervention in a harsh environment. These planting patterns include the trees planted around the werfs and along travel routes. Interpretation of these landscape features as historic remnants should occur.	Construction/ decommissioning	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA

Aspect	Mitigation measures	Phase	Target
	A buffer of 50m around such planting patterns, associated with cultural landscapes elements and farmsteads as identified in this report, should be maintained. • Burial grounds and places of worship are automatically regarded as Grade IIIa or higher. Any development that threatens the inherent character of family burial grounds must be assessed and a buffer of 50m around all burial ground or unmarked graves should be in place. No turbines have been proposed for placement near known unmarked burials or family cemeteries. These recommendations should be considered together with the AIA report and the AIA recommendations should take preference for stand-alone burial grounds or graves where they are not associated with other heritage features or cultural landscape elements. • Mountain slopes have been used for traditional practices for many years, and care should be taken that any significant cultural sites, such as burials and veldkos/medicinal plant resources, are not disturbed. • Farms in the area followed a system of stone markers to demarcate the farm boundaries in the area. Where these structures are found on the site, care should be taken that they are not needlessly destroyed, as they add to the layering of the area. • Roads running through the area have historic stone way markers. Where these are found, care should be taken that they are left intact and in place. Road upgrades and or new roads must not move or threaten their position and they should be visible from the road they are related to by passing travellers. Final buffers for stone markers will be for identification and mitigation in collaboration with the ECO prior to construction and approval by heritage specialist. • Where the historic function of a building/site is still intact, the function has heritage value and should be protected. • Surviving examples (wagon routes, outspans, and commonage), where they are owned in some public or communal way (or by a body responsible for acting in the public interest) and where they are found to be actively operating in a communal way, will have cultural and heritage value and should be enhanced and retained. The historic route running through Heuweltjies should be maintained and integrity as a communal road for farm residents must be retained.		
Historic	• Historic farmsteads must be protected from the impacts of operational facility vehicles and increased numbers of people. No WEF operations traffic should pass within 50m from graded structures, which includes the associated historically cultivated lands, cemeteries, unmarked burials. The most appropriate use of existing farm roads must be found to avoid farm werfs as far as possible and reduce construction impact on these heritage features. The AIA buffer recommendations should take preference for identified archaeological heritage resources. • Traditional planting patterns should be protected by ensuring that existing trees are not destroyed as these signify traces of cultural intervention in a harsh environment. These planting patterns include the trees planted around the werfs and along travel routes. Interpretation of these landscape features as historic remnants should occur. A buffer of 50m around such planting patterns, associated with cultural landscapes elements and farmsteads as identified in this report, should be maintained. • Burial grounds and places of worship are automatically regarded as Grade IIIa or higher. Any development that threatens the inherent character of family burial grounds must be assessed and should be discouraged and a buffer of 50m around any burial ground or unmarked graves should be in place. No turbines have been proposed	Operational	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA

Aspect	Mitigation measures	Phase	Target
	for placement near known unmarked burials or family cemeteries. These recommendations should be considered together with the AIA report and the AIA recommendations should take preference for stand-alone burial grounds or graves where they are not associated with other heritage features or cultural landscape elements. • Mountain slopes have been used for traditional practices for many years, and care should be taken that any significant cultural sites, such as burials and veldkos/medicinal plant resources, are not disturbed. • Farms in the area followed a system of stone markers to demarcate the farm boundaries in the area. Where these structures are found on the site, care should be taken that they are not needlessly destroyed, as they add to the layering of the area. • Roads running through the area may have historic stone way markers. Where these are found care should be taken that they are left intact and in place. Road upgrades must not move or threaten their position and they should be visible from the road they are related to by passing travellers. • Where the historic function of a building/site is still intact, the function has heritage value and should be protected. • Surviving examples (wagon routes, outspans, and commonage), where they are owned in some public or communal way (or by a body responsible for acting in the public interest) and where they are found to be actively operating in a communal way, will have cultural and heritage value and should be enhanced and retained. The historic route running through Heuweltjies should be maintained and integrity as a communal road for farm residents must be retained. • Accommodation of WEF staff must not negatively impact on existing farm residents or degrade the integrity of the farmstead complexes and should, without negative impact to ecological or aesthetic resources, be located outside of the farmstead complexes or site. Farm residents should be consulted on the preferable location for construction staff accommodation. • Lightest vehicles possible should be used to reduce degradation to the farm roads and the need to upgrade roads to scale and extent that negatively impacts on the integrity of the historic farm roads. Operational traffic must operate at speeds that reduce dust and noise as far possible.		
Socio-economic	• The findings of this report must be shared with identified interested and affected parties, including non-landowner residents on the development properties, in the EIA public participation process in order to further ascertain any intangible cultural resources that may exist on the landscape that have not been identified. A specialist qualified in recognising and discussing significance of intangible heritage resources should be present during the public meetings. The findings should inform the recommendations for appropriate mitigation for impacts to the cultural landscape. • The continued use of the landscape for human habitation and cultivation by historic residents of the area, should be retained and encouraged as far possible to sustain the continual use pattern and human-environment relationship which is the ultimate significance of this cultural landscape element. The WEF development must allow and support this, including financially, and not degrade this continued relationship. • The local community on and around the development should benefit from job opportunities created by the proposed development and the development should not cause reduction in economic viability of surrounding	Planning/ pre-construction	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA

Aspect	Mitigation measures	Phase	Target
	properties in excess of those offered by the development. Short-term job opportunities at the expense of long term economic benefit and local employment opportunities must be prevented. • Local residents must be offered the opportunity for employment on the construction/ decommissioning and operational phases before 'importing' staff from elsewhere. • Local residents must be offered employment training opportunities associated with WEF developments at all phases.		
Socio-economic	• An updated cultural landscapes impact assessment report must be completed should the WEF continue to be used after the term granted in this application. This report should include a detailed assessment of the socio-economic impacts to the cultural landscape and its outcomes and recommendations need to be considered in the decision for recommissioning and be implemented if recommissioning is approved. • The continued use of the landscape for human habitation and cultivation by historic residents of the area, should be retained and encouraged as far possible to sustain the continual use pattern and human-environment relationship which is the ultimate significance of this cultural landscape element. The WEF development must allow and support this, including financially, and not degrade this continued relationship. • The local community on and around the development should benefit from job opportunities created by the proposed development and the development should not cause reduction in economic viability of surrounding properties in excess of those offered by the development. Short-term job opportunities at the expense of long term economic benefit and local employment opportunities must be prevented. • Local residents must be offered the opportunity for employment on the construction/ decommissioning and operational phases before 'importing' staff from elsewhere. • Local residents must be offered employment training opportunities associated with WEF developments at all phases. • Sheep, cattle or game farming should be allowed to continue below the wind turbines, or be rehabilitated to increase biodiversity in the area.	Construction/ decommissioning	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA
Socio-economic	• The local community on and around the development should benefit from job opportunities created by the proposed development, and the development should not cause reduction in economic viability of surrounding properties in excess of those offered by the development. Short-term job opportunities at the expense of long term economic benefit and local employment opportunities must be prevented. • The continued use of the landscape for human habitation and cultivation by historic residents of the area, should be retained and encouraged as far possible to sustain the continual use pattern and human-environment relationship which is the ultimate significance of this cultural landscape element. The WEF development must allow and support this, including financially, and not degrade this continued relationship. • Local residents must be offered the opportunity for employment on the construction/ decommissioning and operational phases before 'importing' staff from elsewhere.	Operational	Ensure compliance with relevant legislation and recommendations from SAHRA under Section 38 of NHRA

Aspect	Mitigation measures	Phase	Target
	• Local residents must be offered employment training opportunities associated with WEF developments at all phases. • Crop cultivation, sheep, cattle or game farming should be allowed to continue below the wind turbines,		

12. CONCLUSIONS AND RECOMMENDATIONS

PGS has been appointed by SiVEST on behalf of Mainstream, to undertake the assessment of the proposed construction of the Heuweltjies WEF, near Beaufort West in the Western Cape Province of South Africa.

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant.

The fieldwork conducted for the evaluation of the possible impact of the new Heuweltjies WEF has revealed the presence of twenty-seven (27) tangible heritage resources.

12.1 Burial Grounds and graves

Two (2) sites with burial grounds (**H006, H016**) were rated as having high heritage significance.

12.2 Historical structures

Five (5) structures (**H001, H002, H008, H014, H014/1**) were rated as having medium heritage significance and three (3) structures (**H007, H015, H017**) were rated as having low heritage significance.

12.3 Archaeological features

Three (3) Stone Age sites (**H013, H013/1, H013/3**) were rated as having medium heritage significance.

Fourteen (14) find spots (**H003-5, H009-12, H018-24**) comprise a number of low-density Stone Age surface artefact scatters and were rated as having low heritage significance. These are primarily from the Middle Stone Age (MSA), although both Later Stone Age (LSA) and earlier Early Stone Age (ESA) material was identified. All of these artefact assemblages occur in heavily deflated and eroded areas, so their scientific potential and heritage significance is somewhat lowered. Based on findings from a range of other heritage reports in the area, these types of sites are to be expected in this region.

The pre-construction and construction phase of the proposed WEF will entail extensive surface clearance as well as excavations into the superficial sediment cover and underlying bedrock (e.g. for widened or new access roads, wind turbine foundations, hardstanding areas, on-site substation, underground cables, construction laydown area, O&M building and BESS). The possible pre-construction impacts calculated on the tangible cultural heritage resources is overall MODERATE

NEGATIVE rating but with the implementation of the recommended buffers and management guidelines will be reduced to a LOW NEGATIVE impact.

12.4 Palaeontological resources

The Heuweltjies WEF and associated Infrastructure project area is underlain by continental (fluvial / lacustrine) sediments of the Abrahamskraal Formation (Lower Beaufort Group, Karoo Supergroup) which are of Middle Permian age. These bedrocks contain sparse, unpredictable to locally concentrated vertebrate fossils as well as rare trace fossils (*e.g.,* tetrapod trackways and burrows) and plant material of scientific and conservation value. Very few new fossil vertebrate sites - most notably a partial, articulated pareiasaur reptile skeleton - have been recorded during within the WEF project area during the short site visit, while several more sites have previously been mapped in the vicinity during recent palaeontological surveys of adjoining WEF project areas. These palaeontological sites, together with their sedimentological context, provide important data for on-going research into the pattern and causes of the Middle Permian Mass Extinction Event on land around 260 million years ago. All of the recorded fossil sites lie *outside* the WEF and associated Infrastructure project footprints.

No vulnerable Very High Sensitivity or No-Go palaeontological sites or areas have been identified within the WEF and associated Infrastructure project areas. The single known pareiasaur reptile skeleton site lies along a stream bank and is therefore already protected within the standard ecological buffer zone. Since all known fossil sites can be readily mitigated – if necessary - through professional recording and collection of fossil material in the pre-construction phase, no recommendations for micro-siting of infrastructure such as wind turbine, pylon positions or access roads are therefore made here. There are no preferences on palaeontological heritage grounds for specific site options for the WEF on-site substation and construction laydown area, given their similar geological and palaeontological context.

In terms of palaeontological heritage resources, the proposed Heuweltjies WEF and associated Infrastructure development is assigned an overall impact significance rating (Construction Phase) of NEGATIVE MEDIUM without mitigation and NEGATIVE LOW following mitigation. Residual negative impacts may be partially offset by improvements to the local palaeontological database as a result of professional mitigation of chance fossil finds. No significant further impacts on fossil heritage resources are anticipated in the planning, operational and decommissioning phases. The No-Go Option is likely to have a neutral impact significance. Anticipated cumulative impacts in the context of several planned or authorized renewable energy projects in the region are assessed as NEGATIVE MEDIUM without mitigation and NEGATIVE LOW after mitigation. These cumulative impacts fall within acceptable limits.

12.5 Cultural Landscape

The Koup region is a significant cultural landscape that reflects the relationship between man and nature over a period of time. This relationship has generally been sustainable, where biodiversity and ecological systems have been maintained in the utilisation of the landscape expressed in specific land use patterns. The surrounding land use indicates a social appreciation of the natural environment with low impact stock farming with limited farmstead crop cultivation. The vastness and relative homogenous nature of the cultural landscape is, however, often undervalued. If careful contextual planning is not followed, it will rapidly result in a cluttered wasteland. This does not mean that development is discouraged, but rather that the implementation of wind and solar energy farms should be planned holistically. It is the duty of the planning department to consider this application in terms of other renewable energy developments that are planned/proposed for the Koup area, notably the proposed RE developments included in the cumulative impact section of this report.

Conservation: to protect the natural resources (water, air, land, sand, fishes, etc.), ecosystems (reefs, fynbos), biological abundance (flora and fauna), landscapes and the local culture.

Development: to protect social and economic progress, without damaging or depleting the natural resources (sustainable development).

The findings of the CLA report, coupled with the proposed layout for development of the project area, which considers appropriate placement in terms of wind energy capacity, concludes that the development can be permitted within the site if the report's recommendations are followed. The mitigating recommendations in this report consider the ecological, aesthetic, historic and socio-economic value lines that underpin the layers of significance that combine to create the character of the place and the cultural landscape of the Koup.

These recommendations include road and farmstead complex buffers which incorporate cultivated areas and graves, steep slope and ridgeline no-go areas as well as consideration of the unique land form of the site, CBA and ESA no-go areas, as well as mechanisms to support the non-landowner residents that live on the site in being able to continue their indigenous land use patterns, knowledge and social systems. These mitigations will reduce the impact on the surrounding landscape and heritage resources but due to the high visual impact of the turbines, largely a result of their height, the negative impact to the cultural landscape cannot be removed, only reduced from very high to moderate.

12.6 Recommendations

The calculated impact, as summarised in **Section 9** of this report, confirms the impact of the new Heuweltjies WEF will be reduced with the implementation of the mitigation measures. This finding in addition to the implementation of a chance finds procedure, as part of the EMPr, will mitigate possible impacts on unidentified heritage resources.

Tangible heritage recommendations are to be implemented in conjunction with the **Table 16** and

Table 17**.**

The following mitigation measures will be required:

- 50m buffer zones around grave sites (**H006, H016**)
- 30m buffer zone around farmsteads (**H001, H002, H008, H014 (H014/1)**)
- 30m buffer zone around historical structures (**H007, H015, H017**)
- 30m buffer zones around Stone Age sites with a medium heritage significance (**H013, H013/1, H013/3**)
- An induction and training program on managing archaeological resources must be included in the induction programs for the Environmental Control/Site Officer working on the project.
- An assessment of the footprint areas must be done if the project is to commence immediately pre-construction and any findings must be handled through the Chance finds protocol.
- A chance finds protocol must be developed that includes the process of work stoppage, site protection, evaluation and informing HWC of such finds and a final process of mitigation implementation.
- If (*and only if*) the WEF receives Environmental Authorization, the approved layout of the WEF and associated Infrastructure must be, immediately pre-construction, cross-checked by a qualified palaeontological specialist to determine what level of additional palaeontological surveying, monitoring or mitigation is necessary for these projects, if any.
- Should a palaeontological heritage study of selected, potentially sensitive and previously unsurveyed sectors of the authorised footprint be recommended at this stage, this should involve the recording and judicious collection by a professional palaeontologist of valuable fossil material as well as relevant geological data (e.g., on stratigraphic context, preservation style / taphonomy) within or close to (within ~10 m) the project footprint in the Pre-Construction Phase. Since mitigation through professional recording and collection is almost invariably feasible for fossil sites.
- During the construction phase, the Chance Fossil Finds Protocol summarised in Appendix 2 of the PIA should be fully implemented.
- The qualified palaeontologist responsible for the mitigation work during the construction phase will need to submit beforehand a Work Plan for approval by Heritage Western Cape (HWC) and, following completion of mitigation, a Mitigation Report must be submitted to HWC for consideration.

12.7 Cultural Landscape Heritage Indicators

The conclusion of this CLA study has culminated in the map (Figure 49) showing the proposed WEF development layout with the following heritage indicators and development buffers:

- A 1000m buffer to either side of the N12 for turbine and infrastructure placement (800m no-go turbine buffer and 200m high sensitivity buffer where turbine placement is subject to specialist approval if required) – layout proposed in this report has been assessed and the approved and any further changes will require review and approval by the specialist;
- 300m buffer to either side of identified significant historic regional road for turbine placement, substation and laydown area (200m no-go turbine buffer and 100m high sensitivity buffer where turbine placement is subject to specialist approval if required)

- 800m buffer around Trakaskuilen and Lammerkraal farmsteads and 300m buffer around Klipgat and Witpoortjie ruin cultural landscape features for turbine placements (single turbines at the edges of some of these buffers are acceptable); and
- existing roads to be used with minimal upgrades as far as possible;
- no-go areas on koppie and steep slopes (over 10%) for all infrastructure
- riverine corridors 100m buffer.

Further, the following changes to the current proposed layout is recommended:
- Substation option 2 is preferable as it is located further from the regional road.
- Substation Option 1 is acceptable if all infrastructure, other than roads, underground cabling and guard house, are kept out of the historic 200m no-go buffer on final construction.

Further socio-economic impact assessment is recommended to consider heritage:
- Potential impact of WEF development on any non-landowner residents of the site needs to be assessed within the EIA Public Participation Process, to the approval of the heritage consultant, to determine the impact of the development on the historical residents of the area as an integral part of the cultural landscape.

Further heritage indicators and recommendations for construction/ decommissioning and operational phases unsuitable for mapping have been made in the CLA (**Please see Table 18**) and are necessary for the identified adverse impacts to be reduced from very high to medium negative impact of the proposed Heuweltjies WEF and associated infrastructure on the cultural landscape.

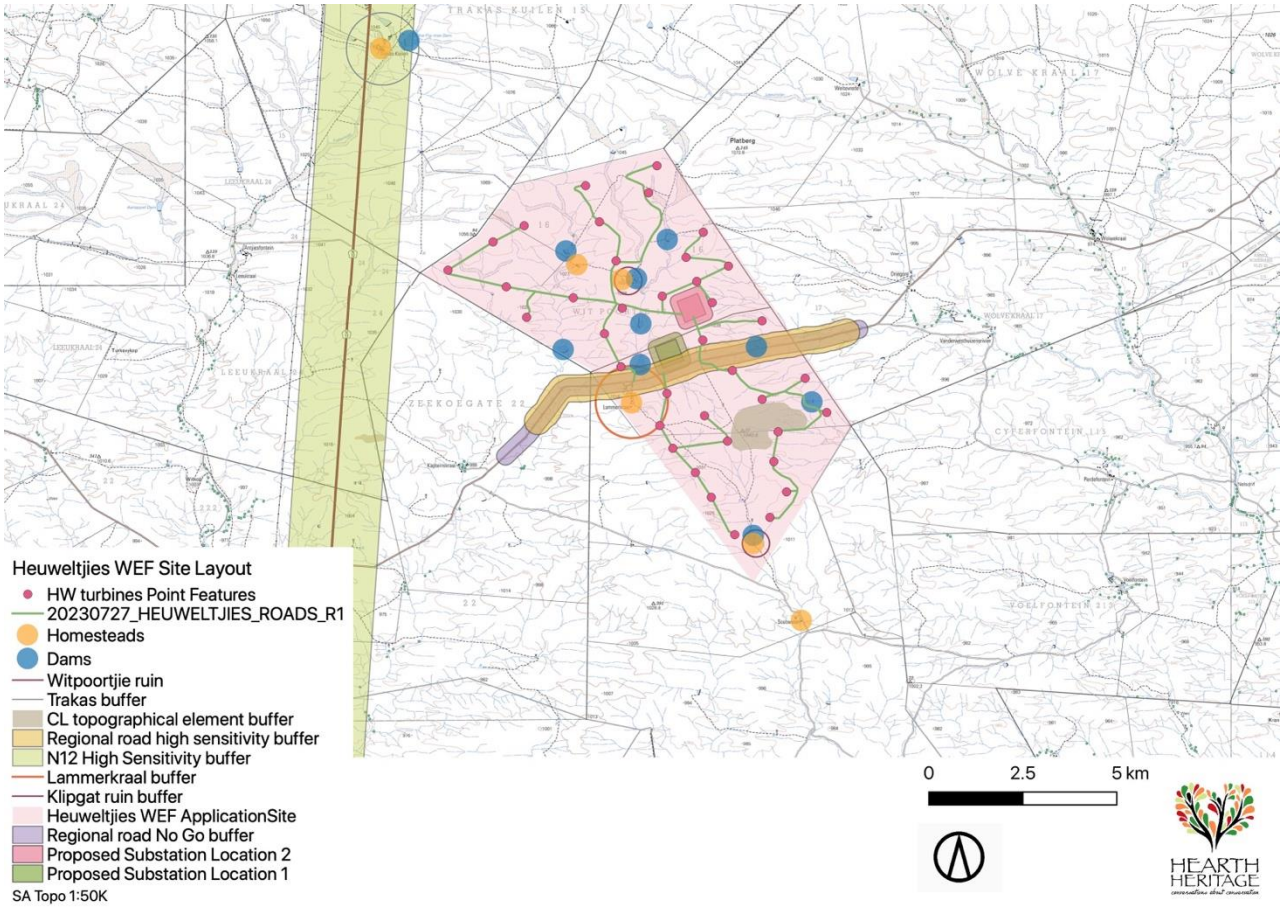


Figure 49: Cultural Landscapes Assessment heritage indicators and buffers map for proposed Heuweltjies WEF project (Note: 100m/ flood line riverine corridor buffers not indicated). Internal roads marked in red are not acceptable and have not considered recommendations in BA CLA.

12.8 General

If heritage resources are discovered during site clearance, construction activities must stop in the vicinity, and a qualified archaeologist must be appointed to evaluate and recommend mitigation measures.

With the recommended CLA buffers in place and all other recommendations followed, the overall impact to the cultural landscape for the proposed Heuweltjies WEF and associated infrastructure can be reduced from very high to moderate and the proposed project layout can be accepted in terms of cultural landscape assessment.

The overall impact of the Heuweltjies WEF on the heritage resources is seen as acceptable after the recommendations have been implemented, and therefore, impacts can be mitigated to acceptable levels allowing for the development to be granted environmental authorisation.

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APPENDIX A – CV

WOUTER FOURIE

Professional Heritage Practitioner

PROFILE

Project Manager and Principal Heritage Specialist holds a post-graduate degree in Archaeology and is registered with the Association of Southern African Professional Archaeologists as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners in South Africa.

My work focuses on heritage management through Heritage Impact Assessments, implementation of recommendations and large-scale heritage mitigation projects. I have worked, completed and implemented heritage projects in South Africa, Botswana, Mozambique, Mauritius, Zambia, Lesotho, and the Democratic Republic of the Congo.

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PGS HERITAGE

EDUCATION

University of Pretoria
1993-1996
BA Degree - Majors in Archaeology, Anthropology and Geography

University of Pretoria
1997
BA Hon Archaeology, with further specialisation in environmental management.

University of Cape Town
2016 – present
MPhil Conservation of the Built Environment

WORK EXPERIENCE

PGS Heritage Group of Companies
(***South Africa, Lesotho, Mozambique, and Portugal***)
Director – Heritage Specialist
2003- present
I am actively involved in the management of the business and focus on marketing and new business for PGS, specifically the broader SADC region. Acting as heritage specialist in multidisciplinary teams

The University of the Witwatersrand - Project Manager – Archaeological Contracts Unit
2007-2008
Responsible for conducting heritage and archaeological impact studies, archaeological excavations and general management of the unit

Matakoma Consultants – Director – Heritage Specialist
2000 – 2008
Heritage specialist and Director responsible for heritage and archaeological impact studies

Randfontein Estate Gold Mine – Environmental Coordinator
Oct 1998- Feb 2000
Coordinating all environmental Rehabilitation work

Department of Minerals and Energy Environmental Officer
Oct 1997– Sept 1998

PROFESSIONAL AFFILIATION

Accredited Professional Heritage Practitioner
Association of Professional Heritage Practitioners
Since 2014

Accredited Professional Archaeologist
Association of Southern African Professional Archaeologists –
Since 2001

APPENDIX B – IMPACT ASSESSMENT METHODOLOGY

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) METHODOLOGY

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

1.1 Determination of Significance of Impacts

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

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

1.2 Impact Rating System

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

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

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

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

1.2.1 Rating System Used to Classify Impacts

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

Table 1: Rating of impacts criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity (e.g. oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		

1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.
SIGNIFICANCE (S)		
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.**		

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderate positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.