BIOTHERM ENERGY (PTY) LTD

Aletta Wind Energy Facility (WEF)

Heritage Impact Report

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Executive Summary

PGS Heritage was appointed by SiVEST Environmental Division to undertake a Heritage Impact Report that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Wind Energy Facility for Biotherm Energy (Pty) Ltd, near Copperton in the Northern Cape Province.

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

The Heritage Scoping Report completed in February 2016 has shown that the proposed Aletta site to be developed as a Wind Energy Facility (WEF) may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.

The subsequent field work completed for the HIA component in August 2016, has confirmed the presence of 3 archaeological find spots, 5 historical sites, 21 archaeological sites or resources and 3 grave sites. The archaeological sites are associated with the Early Stone Age (ESA), Middle (MSA) and Later Stone Age (LSA) and are representative of archaeological sites with a medium to high significance.

The design process and methodology followed by the developer for this project enabled the heritage assessment to provide input into the proposed layouts before the impact assessment. This resulted in cognisance being taken of the positions of the heritage sites and thus the reduction of impacts at an early design phase. Analysis of the impact matrix tables will reflect this.

The mitigation measures proposed is a follows:

1.1 Pre-Construction

1. A detailed walk down of the final approved layout will be required before construction commence;
2. Any heritage features of significance identified during this walk down will require formal mitigation or where possible a slight change in design could accommodate such resources.
3. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

1.2 Palaeontology

1. The EAP as well as the ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Palaeontologist be appointed at the start of

the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the EAP, ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Palaeontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged.

2. The two historic spring sites indicated on the Palaeontological sensitivity map and database is of extreme importance as Geological Heritage appoints and these points must for at least 500m around them be declared “No-Go” zones.
3. The recommendations must be included in the EMPr of the project.

1.3 Archaeological Sites

1. A walk down of the final layout to determine if any significant sites will be affected. Relocate turbines if need be.
2. Sites Ale 4 and ALE 36 must be monitored during construction, as they are close to turbine construction activities.
3. Demarcate and fence during construction if construction activities are within 100 meters from a site.
4. Monitor find spot areas if construction is going to take place through them.
5. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by heritage practitioner during the construction phase.

1.4 Historical sites

1. Demarcate sites as no-go areas
2. Demarcate and fence during construction if construction activities area to happened within 100 meters from a site.
3. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

1.5 Grave sites and cemeteries

1. Adjust the development layout (where possible) and demarcate the grave sites with at least a 5-10-meter buffer.
2. In the event that the sites cannot be excluded from the development footprint a grave relocation process as described in Appendix A of this reports needs to be implemented

1.6 Comparative Assessment of Alternatives

The comparative assessment of the alternatives has shown that an overall low impact on heritage is foreseen, as all of the heritage sites identified fall outside the proposed alternative foot prints. The application site however holds a Negative Medium Impact.

1.6.1 Wind Turbine Layouts

Allowing for a 60m diameter construction foot print for on all turbine positions has shown that all the find spots and sites fall outside and in most case more than 100 meters away from any construction activities.

1.6.2 Associated Infrastructure

One archaeological resource occurs at the option 2 substation (Rated as having low heritage significance)

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

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION and O & M Building ALTERNATIVES		
Option 1	Preferred	No heritage resources has been identified in the general area of the substation footprint
Option 2	Favourable	A site occurs at this location however is of a low significance

1.7 Cumulative Impact

It is my considered opinion that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate.

It can clearly be noted that the area in general is abundant with Stone Age remains. I concur with Kaplan and Wiltshire 2011, "*SAHRA must assess this application in the broader context of other present and future applications in the area in order to guide the Client and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area*."

It is recommended that SAHRA commissions a regional study that focus on the identification of heritage resources and all documentation and mitigation of heritage resources as part of developments in the region must be aimed at a combined research output for developments in the Copperton area.

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HERITAGE IMPACT REPORT

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1 INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) was appointed by SiVEST Environmental Division (SiVEST) to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Wind Energy Facility for Biotherm Energy (Pty) Ltd, near Copperton in the Northern Cape Province.

1.1 Scope of the Study

The aim of the study is to identify possible heritage resources, finds and sensitive areas that may occur in the study area for the EIA study. The Heritage Impact Assessment (HIA) aims to inform the Environmental Impact Assessment in the development of a comprehensive Environmental Management Plan to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 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 development 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.

1.3 Specialist Qualifications

PGS Heritage (PGS) compiled this Heritage Impact Report.

The staff at PGS has a combined experience of nearly 80 years in the heritage consulting industry. PGS and its staff have extensive experience in managing the HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Wouter Fourie, Project manager for this project, is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA) and has CRM accreditation within the said organisation, as well as being accredited as a Professional Heritage Practitioner with the Association of Professional Heritage Practitioners – Western Cape (APHP)

Jessica Angel holds a Masters degree in Archaeology and is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA).

Marko Hutten, heritage specialist and project archaeologist, has 18 years of experience in the industry and is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as a Field Director.

1.4 Legislative Context

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

- National Environmental Management Act (NEMA), Act 107 of 1998
- National Heritage Resources Act (NHRA), Act 25 of 1999
- Mineral and Petroleum Resources Development Act (MPRDA), Act 28 of 2002

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

- National Environmental Management Act (NEMA) Act 107 of 1998
    a. Basic Environmental Assessment (BEA) – Section (23)(2)(d)
    b. Environmental Scoping Report (ESR) – Section (29)(1)(d)
    c. Environmental Impact Assessment (EIA) – Section (32)(2)(d)
    d. Environmental Management Plan (EMP) – Section (34)(b)
- National Heritage Resources Act (NHRA) Act 25 of 1999
    a. Protection of Heritage Resources – Sections 34 to 36; and
    b. Heritage Resources Management – Section 38
- Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
- Section 39(3)

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that, “no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…” The NHRA is utilized as the basis for the identification, evaluation and management of heritage resources and in the case of CRM those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through NEMA and MPRDA legislation. In the latter cases, the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorizations are granted for development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impacts Processes required by NEMA and MPRDA. This change requires us to evaluate the Sections of these Acts relevant to heritage.

The NEMA 23(2)(b) states that an integrated environmental management plan should, “…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage”.

A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken account of in the Regulations under NEMA is the Specialist Report requirements laid down in Section 33 of the regulations (Fourie, 2008).

Refer to **Appendix A** for further discussions on heritage management and legislative frameworks

Table 1: Terminology

Acronyms	**Description**
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CI	Cumulative Impacts
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Earlier Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Later Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Agency
PSSA	Palaeontological Society of South Africa
ROD	Record of Decision
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

Archaeological resources

This includes:

i. 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;
ii. 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;
iii. 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;
iv. 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:

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

Earlier 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, such as the caves with archaeological deposits identified close to both development sites for this study.

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

Later 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 30 000-300 000 years ago, associated with early modern humans.

Palaeontology
Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

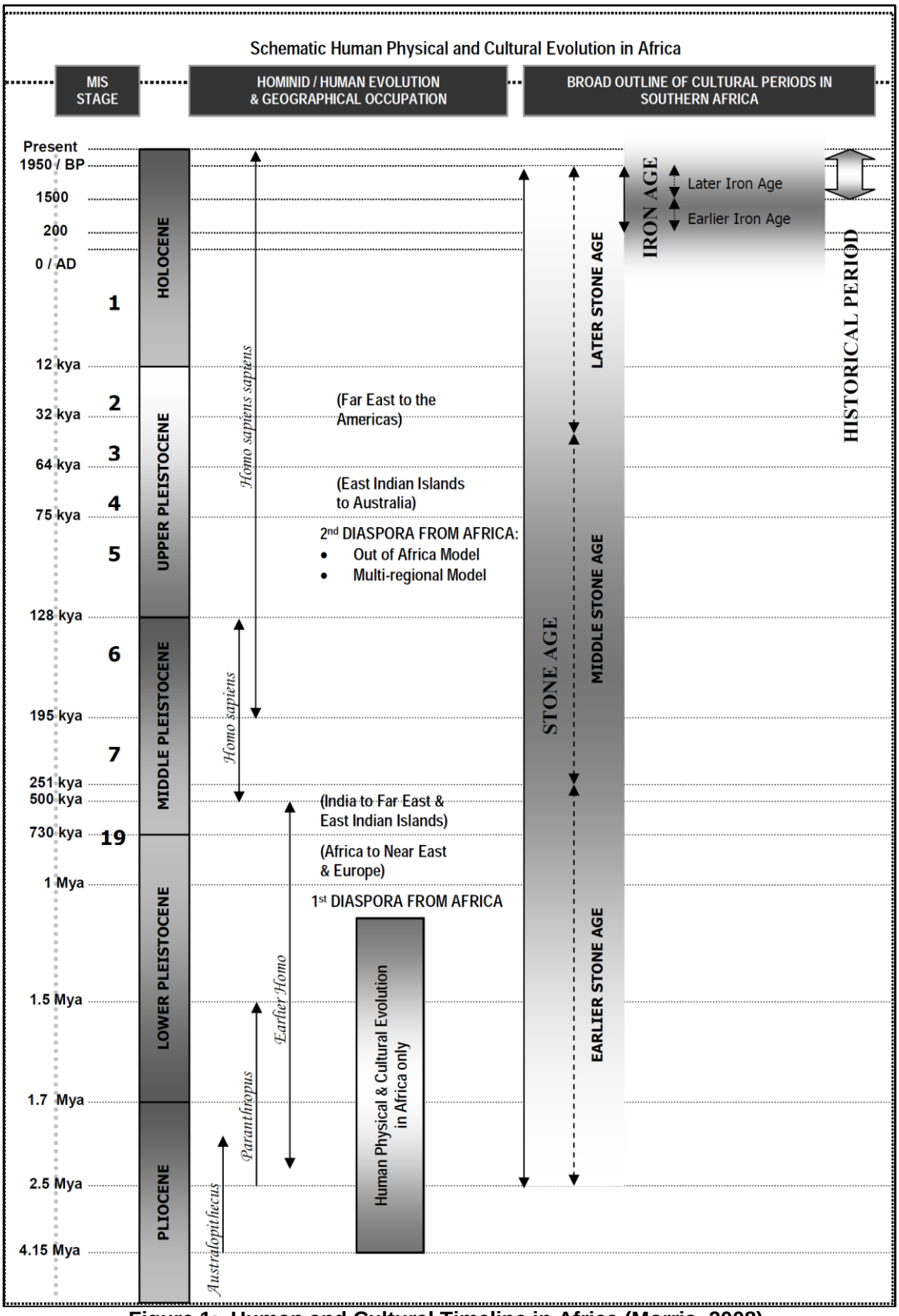


Figure 1: Human and Cultural Timeline in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Project Location

The proposed Aletta Wind Energy Facility (WEF) will be located approximately 17km east of Copperton, within the Siyathemba Local Municipality of the Pixley ka Seme District Municipality in the Northern Cape Province. The proposed project is located on the following properties:

- Portion 1 of Drielings Pan No.101
- Portion 2 of Drielings Pan No.101
- Portion 3 of Drielings Pan No.101
- Remainder of Drielings Pan No.101

2.2 Wind Farm Technical details

The key technical details and infrastructure required is presented in the table below (Table 2).

Table 2:Aletta WEF summary

Project Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for the proposed project
Aletta WEF	14/12/16/3/3/2/945	▪ Portion 1 of Drielings Pan No.101 ▪ Portion 2 of Drielings Pan No.101 ▪ Portion 3 of Drielings Pan No.101 ▪ Remainder of Drielings Pan No.101	▪ **60 wind turbines** with a total export capacity of up to 140MW. Turbines will have a hub height of up to 120m and a rotor diameter of up to 150m. ▪ 132kV onsite Aletta IPP Substation ▪ The turbines will be connected via **medium voltage cables** to the proposed 132kV onsite Aletta IPP Substation. ▪ Internal **access roads** are proposed to be between 4m to 6m wide. ▪ A temporary construction **lay down area.** ▪ A hard standing area / platform per turbine. ▪ The **operations and maintenance buildings**, including an on-site spares storage building, a workshop and an operations building. ▪ **Fencing** (if required) will be up to 5m where required and will be either mesh or palisade.

2.3 Project Location

The proposed Aletta substation and 132kV power will be located on the farm Drielings Pan No. 101 which occurs to the south-east of Copperton, within the Siyathemba Local Municipality of the Pixley ka Seme District Municipality in the Northern Cape Province.

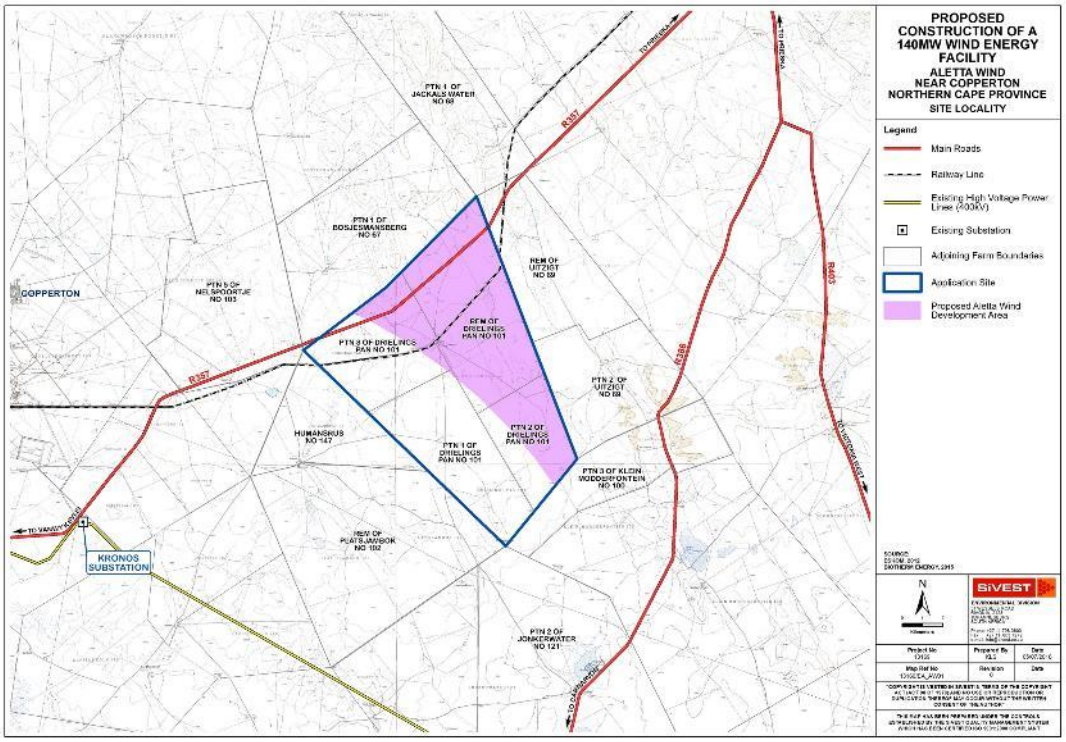


Figure 2: Aletta WEF Locality

2.4 No-go Alternative

The 'no-go' alternative is the option of not establishing the proposed wind farm facility. South Africa is currently under immense pressure to generate electricity to accommodate for the additional demand, which has been identified. With the current global focus on climate change, the government is exploring alternative energy sources in addition to coal-fired power stations. Although wind power is not the only solution to solving the energy crisis in South Africa, not establishing the proposed wind farm facility would be detrimental to the mandate that the government has set to promote the implementation of renewable power. It is a suitable sustainable solution to the energy crisis and this project would contribute to this solution. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

3 ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

3.1 Methodology for Assessing Heritage Site significance

This HIA report was compiled by PGS for the proposed Aletta WEF. The applicable maps, tables and figures, are included as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998). The HIA process consisted of three steps:

3.1.1 Scoping Phase – Completed in February 2016

Step I – Literature Review: The background information to the field survey relies greatly on the Heritage Background Research.

3.1.2 Impact Assessment Phase

Step II – Physical Survey: A physical survey was conducted on foot and by vehicle through the proposed project area by two qualified archaeologists and two field assistants, which 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.

Appendix B, outlines the Heritage Impact Assessment methodology, while **Appendix C** provides the guidelines for the impact assessment evaluation that will be done during the EIA phase of the project.

4 BACKGROUND RESEARCH

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.

4.1 Previous Studies

Researching the SAHRA APM Report Mapping Project records and the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a number of other archaeological or historical studies have been performed within the wider vicinity of the study area. Previous studies listed for the area in the APM Report Mapping Project included a number of surveys within the area listed in chronological order below:

VAN RYNEVELD, K. 2006. Phase 1 Archaeological Impact Assessment - Vogelstruisbult 104, Prieska District, Northern Cape, South Africa. National Museum Bloemfontein

KAPLAN, J.M. 2010. Archaeological Scoping Study and Impact assessment of a proposed photovoltaic power generation facility in Copperton Northern Cape. Agency for Cultural Resource Management

KAPLAN, J.M. & WILTSHIRE, N. 2011. Archaeological Impact Assessment of a proposed wind energy facility, power line and landing strip in Copperton, Siyathemba municipality, Northern Cape. Agency for Cultural Resource Management

ATWELL, M. 2011. Heritage Assessment Proposed Wind Energy Facility And Related Infrastructure, Struisbult: (Farm 103, Portions 4 And 7), Copperton, Prieska, Atwell & Associates

ORTON, JAYSON. 2012a. Heritage Impact assessment for a proposed photovoltaic energy plant on the farm Klipgats Pan near Copperton, Northern Cape. Archaeology Contracts Office Department of Archaeology. University of Cape Town

ORTON, JAYSON. 2012b. Heritage Impact Assessment for a proposed photovoltaic energy plant on the farm Hoekplaas near Copperton, Northern Cape. Archaeology Contracts Office Department of Archaeology. University of Cape Town

ORTON, J & WEBLEY, L. 2013. Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on the Remainder of Farm Klipgats Pan 117, Copperton, Northern Cape

Van der Walt, Jaco. 2012. Archaeological Impact Assessment Report for the proposed Garob Wind Energy Facility Project, located close to Copperton in the Northern Cape. Heritage Contracts and Archaeological Consulting CC (HCAC)

FOURIE, W. 2012. Heritage Impact Assessment for the proposed Eskom Cuprum to Kronos Double Circuit 132kv Power line and Associated Infrastructure, Prieska, Northern Cape.

FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 1 PV project, Copperton Northern Cape.

FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 2 PV project, Copperton Northern Cape.

FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 3 PV project, Copperton Northern Cape.

4.1.1 Findings from the studies

Palaeontology

The following section has been compiled by Gideon Groenewald for PGS Heritage. The full report can be viewed in **Appendix D** of this report.

Olifantshoek Supergroup

- Bulpan Group

Uitdraai Formation

The Mokolian aged Uitdraai Formation have not been studied for fossils up to date and due to the age it was not expected to yield any fossils. Recent research however indicate that earlier, very primitive life forms could have existed during Mogolian times and albeit very difficult to see and normally only described during detailed academic work, the recording of any mico-fossis and trace fossils, including possible algal mat structures from the study are will contribute significantly to the National Heritage Estate of the Northern Province and South Africa.

Karoo Supergroup

- Dwyka Group

Trace fossils have been recorded from the fine-grained shales of the Dwyka Group in KwaZulu-Natal (Linstrom, 1987; MacRae, 1999). All of the following could potentially be found in KwaZulu-Natal. Trackways, produced mostly by fish and arthropods (invertebrates), have been recovered in shales from the uppermost Dwyka Group. Other trace fossils include coprolites (fossilized faeces) of chondrichthyians (sharks, skates and rays).

Body fossils include aranaceous foraminifera and radiolarians (single-celled organisms), bryozoans, sponge spicules (internal support elements of sponges), primitive starfish, orthoceroid nautiloids (marine invertebrates similar to the living *Nautilus*), goniatite cephalopods (*Eoasinites* sp.), gastropods (marine snails such as *Peruvispira viperdorfensis*), bivalves (*Nuculopsis* sp., *Phestia* sp., *Aphanaia haibensis*, *Eurydesma mytiloides*), brachiopods (*Attenuatella* sp.) and palaeoniscoid fish such as *Namaichthys schroederi* and *Watsonichthys lotzi*.

Fossil plants have also been found, including lycopods (*Leptophloem australe*), moss, leaves and stems (possibly belonging to a proto-glossopterid flora). Fossil spores and pollens (such as moss, fern and horsetail spores and primitive gymnosperm pollens) as well as fossilized wood probably belonging to primitive gymnosperms have also been recorded from Dwyka deposits (MacRae, 1999; McCarthy and Rubidge, 2005).

Kalahari Group

- Gordonia Formation

Palynomorphs, root casts (rhizomorphs / rhizoliths) and burrows (eg termitaria), rare vertebrate remains (mammals, fish, ostrich egg shell etc), diatoms, freshwater stromatolites, freshwater and terrestrial shells (gastropods, bivalves), ostracods, charophytes are all described from these deposits.

Fossils are mainly associated with ancient pans, lakes and river systems Palaeontology poorly studied. Basal Late Cretaceous gravels and lacustrine clays probably fossiliferous (bones, teeth, petrified wood, palynomorphs) but very. rarely exposed. Wide range of fossils can be present in these surface deposits, including mammalian bones and teeth, tortoise remains and ostrich egg shells.

Palaeontological Sensitivity

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged (**Figure 3**). The different sensitivity classes used are explained in the full paleontological report in **Appendix D**.

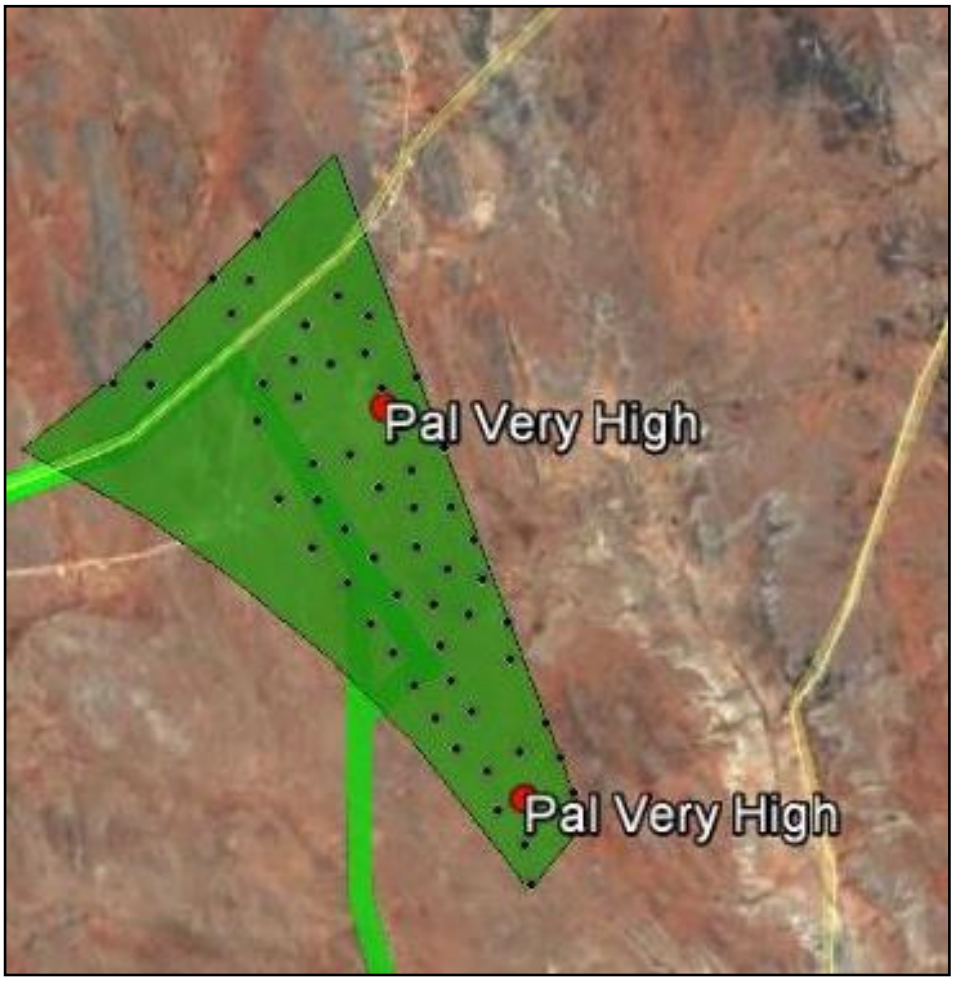


Figure 3: Palaeontological Sensitivity of the entire Study Area is presented. A Moderate sensitivity is allocated to all the geological formations except the two spring sites (Groenewald, 2016)

The Mokolian aged Uitdraai Formation, Carboniferous to Permian aged Dwyka Group and Quaternary aged Gordonia Formation underlying all the alternative layouts for the Aletta as WEF areas and the power line corridors are similarly rated for Palaeontological Impact.

Exceptions are the two historic spring sites that are rated Very Highly sensitive for Palaeontological Heritage.

Archaeology

Most archaeological material in the Northern Cape is found near water sources such as rivers, pans and springs, as well as on hills and in rock shelters. Sites usually comprise of open sites

where the majority of evidence of human occupation is scatters of stone tools (Parsons 2003). Evaluation of the alignment has identified possible sensitive areas.

The areas marked in brown (Figure 6) shows drainage lines and pans in the proposed development areas.

Since September 2011 a large number of Heritage and Archaeological Impact Assessments were completed in the vicinity of the proposed development area. Most notably the work of Orton (2011, 2012 and 2013), Kaplan (2010) and Kaplan and Wiltshire (2011) and Van der Walt (2012), has confirmed the statement by Parsons (2003), as noted earlier.

Figure 4: Early Stone Age stone tools found close to Kronos substation, just west of the study area

Orton (2012) notes that literature has shown that the Bushmanland area is littered by low density lithic scatters, with well weathered Early (ESA) and Middle Stone Age (MSA) artefacts dominating the assemblages. Orton's (2012 and 2013) and Fourie's (2012, 2013, 2015) work on the Klipgats Pan and Hoekplaas, has produced numerous find spots as well as clusters of site located on elevated terraces overlooking pan-like areas (identified as the drainage area as indicated in Figure 6**,** noted by Orton as being of LSA origin.

Fourie (2015) notes that findspots were mostly characterised by three types of setting, deflated red sands, and pebble concentrations associated with a calcrete exposure and non-deflated red sand exposures in between low-density vegetation.

The findspots varied from Later Stone Age (LSA) scatters consisting of flakes, chips and some cores manufactured from fine-grained quartzite, chalcedony, and cryptocrystalline (ccs) material; Middle Stones Age (MSA) lithics consisting of cores, chips and flakes with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops.

Earlier Stone Age (ESA) lithics found at some of these finds spots consisted of hand axes, cleavers and large flakes. Most of the lithics were either rolled or heavily weathered with patination evident on 95% of the lithics.

Figure 5: Close-up view of quartzite flakes and debitage at Kr_Cu/2012/003 (Debitage and lithics indicate by dots) a site situated some 500 meters to the east of the study area (Fourie, 2013)

Kaplan and Wiltshire's (2011) work to the north of the study area has confirmed the presence of Stone Age Sites with a high local significance rating with the sites at Modderpan and Saaipan covering ESA, MAS and LSA finds. A number of knapping occurrences and find spots were also made during the fieldwork.

Van der Walt (2012) indicates that the fieldwork done for the HIA on Bosjesmansberg, adjacent to the study area has shown a high incidence of low-density scatters all over the study area. Wiltshire (2011) indicates the presence of round stone built kraals, close or on low rises that could possibly be associated with herder activity.

4.1.2 *Heritage sensitivities*

The evaluation of the possible heritage resource finds and their heritage significance linked to mitigation requirements was linked to types of landscape. The heritage sensitivity rating does not indicate no-go areas but the possibility of finding heritage significant site that could require mitigation work.

4.1.3 *Possible finds*

Evaluation of aerial photography has indicated that certain areas may be sensitive from an archaeological perspective The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in Table 3**.**

Table 3:Landform to heritage matrix

LAND FROM TYPE	HERITAGE TYPE
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites
Dunes	Dense LSA sites
Outcrops	Occupation sites dating to LSA
Farmsteads	Historical archaeological material

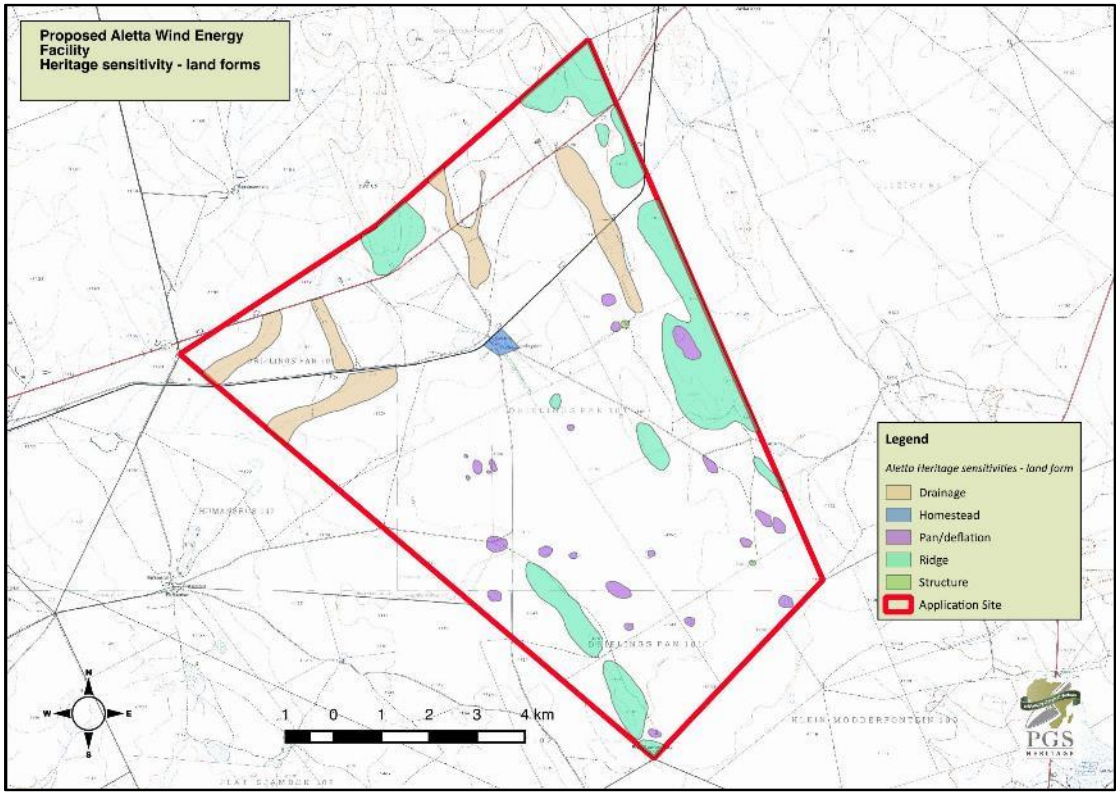


Figure 6: Possible heritage sensitive areas

5 FIELD WORK FINDINGS

5.1 Methodology

A survey of the study area was conducted from 1 - 6 August 2016. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, two archaeologists and two field assistants of PGS conducted a vehicle and foot-survey that covered the study area. The fieldwork was logged with a GPS to provide a background of the areas covered (Figure 8).

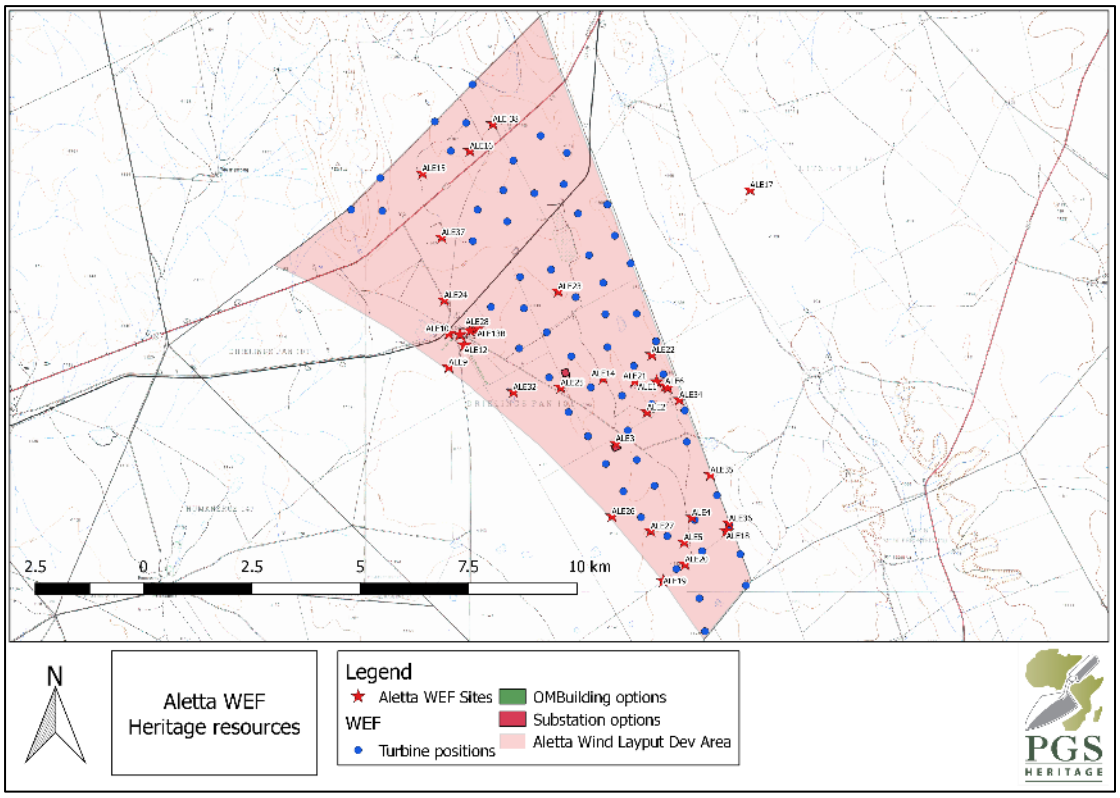


Figure 7: Position of Heritage resources within the Aletta WEF

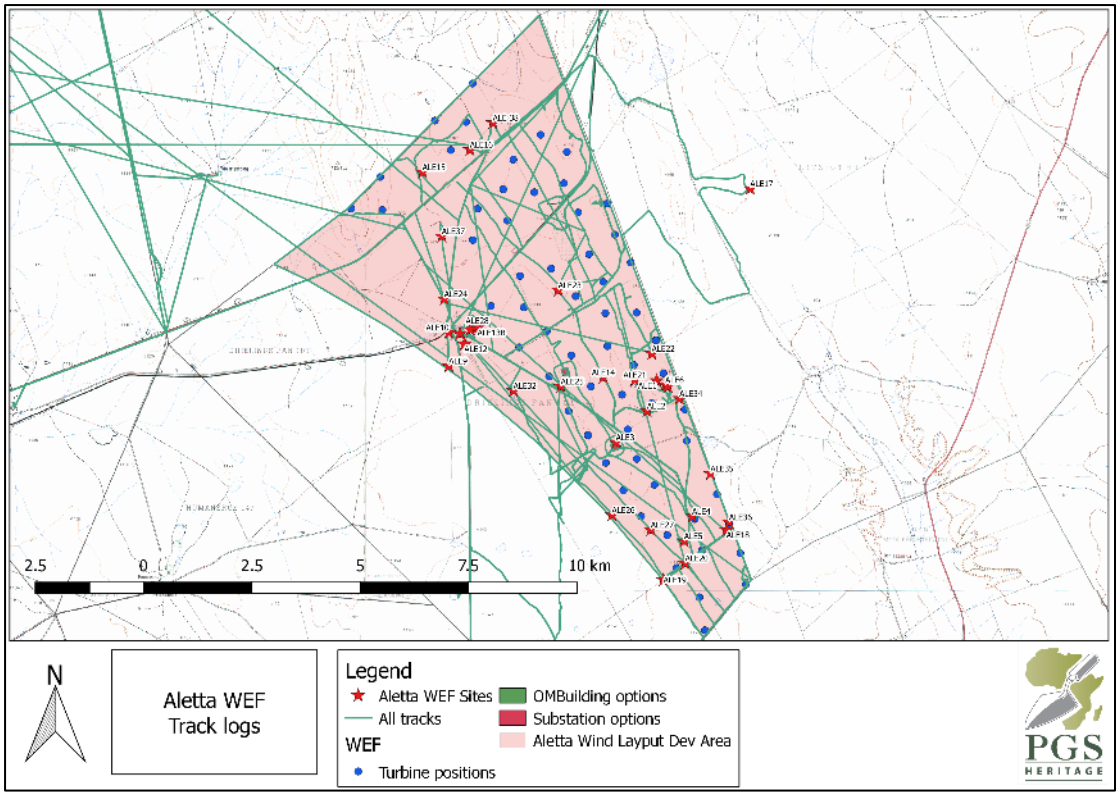


Figure 8: Track logs showing analysis of farm Drielings Pan

The proposed Aletta WEF will be situated on the most of the northeastern portion of the farm Drielings Pan 101. This property is situated approximately 15km southeast of Copperton mining town in the Siyathemba Local Municipality within the Northern Cape Province. Copperton town is situated approximately 60km southwest of the town of Prieska.

The R357 tar road from Prieska to Copperton passes through the proposed property from east to west. The majority of the property is situated to the south of this road and only a small section is situated to the north of the road. The property is neighboured by farms, which have similar agricultural practices, namely sheep farming. Existing power lines are situated to the north as well as to the west of the proposed study site.

The proposed site is generally flat on some of the western and northern parts. Quartzite and gneiss ridges and outcrops dominate the eastern and some of the southern parts of the property. Some of these outcrops, although smaller, as well as some drainage lines occur sporadically across the rest of the property. A few pans do occur across the central and western parts of the proposed development area. The site also has red Kalahari Aeolian sands of various thicknesses on top of a general calcrete layer across most of the western half of the proposed site. These Aeolian red sands are also found in between the ridges on the eastern side of the property.

The vegetation of the general area and the proposed site is typical of the Upper Karoo and consists mainly of Karoo scrub and grass and the occasional Karoo Acacia and forms part of

the Bushmanland Arid Grassland vegetation in the Nama-Karoo biome (Mucina & Rutherford 2006).

The southern side of the property was previously largely undisturbed and were and are presently mainly used for grazing of sheep and cattle. Some game was observed on the property during the survey. Existing farm infrastructure such as windmills, boreholes, fencing and livestock pens are sparsely dotted across this part of the property.

The northern part of the property has the R357 tar road crossing from east to west. The decommissioned railway line situated just to the south of the tar road also crosses the property from east to west parallel to the tar road. An extended farmstead and its associated buildings and features form part of the built environment of the study area. The farmstead and its associated structures and features, although old, are still being occupied and in use at present.

Figure 9: General view of rocky outcrops

Figure 10: View of agricultural practice on the farm

The fieldwork identified 32 heritage finds that were then classified either as find spots [1] or sites[2]. This information was then provided to the developer to take into account during the development of the layout alternatives. The following sections list and describe the finds and sites.

The fieldwork completed for the HIA component in August 2016, has confirmed the presence of 3 archaeological find spots, 3 gravesites, 21 archaeological sites/resources and 5 historical sites. The archaeological sites are associated with the Earlier Stone Age (ESA) Middle (MSA) and Later Stone Age (LSA) and are representative of archaeological sites with a medium to high significance.

5.2 Find spots

The find spots (Table 4) identified during the fieldwork were found to correlate with ridges and drainage lines as predicted in the Scoping Phase of this study. This observation also correlates with the findings of the studies done by Webley (2012) and Orton (2014). The finds spots mostly consist of single or low density finds of Middle Stone Age (MSA) or Later Stone Age

[1] Can be classified as an area where only a single artefact or low density of artefacts occurs. The absence of associated material or artefacts that indicate a temporal shallow or ephemeral occupation

[2] The association of numerous artefacts or structures and /or cultural deposits that all combine to indicate a temporal depth and information to a site.

(LSA) lithics. The material was predominantly crypto-crystalline silica (CCS) and tigers eye with a very low concentration of hornfels material utilized.

Table 4:Find spots

Site Number	Lat	Lon	Description	Sensitivity	Heritage Rating
ALE 19	-29.998137°	22.570920°	Low density MSA scatter	Low	4C
ALE 20	-29.994649°	22.576126°	Low density LSA scatter	Low	4C
ALE 21	-29.956645°	22.564079°	Low density LSA and MSA scatter	Low	4C

5.3 Sites

5.3.1 Archaeological

The archaeological sites **(**Table 5:Archaeological resources**)** identified were mostly associated with the MSA and LSA with some ESA artefacts. The sites are predominantly situated below rocky ridges or low rises and on flat planes. A large proportion of the sites consist of unweathered LSA material manufactured from CCS and tigers eye.

Site **ALE 6 and ALE 7** present stone walls and a historic water source which should be observed in more detail. **ALE 22** is a particularly significant site as it contained numerous artefacts, ostrich egg shell and pottery.

Due to their research value, sites the above mentioned sites as well as many of the others, which are described below, are given a Medium or High archaeological significance.

Table 5:Archaeological resources

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 1	-29.956808°	22.569291°	Site/Resource	A medium density scatter of stone tools was identified at this location (± 10-15 artefacts in 10m x10m). The site is situated all along the valley floor in between two elongated rocky ridges. The artefacts occurred mostly within the sandy valley floor and fewer artefacts were found along the rocky ridges. The artefacts are mainly stone tools from the LSA and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz, hornfels and CCS. The artefacts were found scattered over an area which measured approximately 100m x 300m in size	Medium	4B

Figure 11: Medium density scatter at ALE1

Figure 12: View of the landscape at ALE1

ALE 2	-29.963080°	22.567003°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated within a clearing at the foot of a rocky ridge. The artefacts vary between stone tools from the MSA and the LSA and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, hornfels and CCS. The artefacts were found scattered over an area, which measured approximately 40m in diameter.	Low	4C

Figure 13: Low density scatter at site ALE 2

Figure 14: View of the landscape at ALE 2

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 3	-29.969593°	22.559574°	Site/Resource	A low-density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated within one of the proposed transfer stations on one of the proposed power line routes. The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts vary between stone tools from the Middle Stone Age (MSA) and the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss, hornfels and CCS. The artefacts were found scattered over an area which measured approximately 80m in diameter	Low	4C

Figure 15: Low density scatter at site ALE 3

Figure 16: View of the landscape at ALE 3

ALE 4	-29.984924°	22.577786°	Site/Resource	Another low density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated at the foot of a rocky outcrop and extends onto the outcrop The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Early Stone Age (ESA) and consist mostly of utilised and re-touched flakes, scrapers and blades. A relative high number of cores were also identified. and a few hand axes. The artefacts are mainly made of weathered quartzite, gneiss and quartz. The artefacts were found scattered over an area, which measured approximately 60m in diameter.	Low	4C

Figure 17: Low density scatter at ALE4

Figure 18:view of landscape at ALE4

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 5	-29.990058°	22.575886°	Site/Resource	A medium density scatter of stone tools was identified at this location (± 10-15 artefacts in 10m x10m). The site is situated along the edges of a small pan. The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Early Stone Age (ESA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss, hornfels, haematite and quartz. The artefacts were found scattered in concentrations all along the edges of the pan.	Low	4C

Figure 19: Medium density scatter at ALE5

Figure 20: View of landscape at ALE5

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 6	-29.957699°	22.571379°	Site/Resource	This site was shown by the farm manager, Mr. Jan Opperman, who called it “Boesman Putte” or wells. An area was cleared from rocks and soil was removed to expose a small spring. The cleared area measures approximately 5m in diameter and is situated half way up the slope of the hill and within a dry watercourse. A circular structure was also identified approximately 20m further down the watercourse. A low circular stonewall was built and it captured more of the water that was exposed further up the watercourse. This circular structure measures approximately 10m in diameter. The exact function of this structure is not known as yet This site should be protected not only for its historical value but more importantly because it is a water source in an arid landscape.	High	3A

Figure 21: Boesman wells ALE6

Figure 22 ; Circular structure at ALE6

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 7	-29.958016°	22.571968°	Site/Resource	A small stone packed kraal was identified at this location. The kraal was also shown by the farm manager, Mr. Jan Opperman. The kraal is situated at the foot of a rocky ridge right and at the end of the watercourse identified at Site **ALE 6**. The kraal measures approximately 3m x 3m and the walls, although mostly collapsed, measure approximately a half meter high. A collection of stone tools was also identified around the kraal. The scatter of stone tools extended up the slope of the ridge where the water well was identified. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz, hornfels and CCS. Glass fragments, porcelain fragments and several pieces of metal were identified in close proximity of the small kraal. These artefacts belong to the historic period and are most likely associated with the kraal when it was in use.	Low	4B

Figure 23: Stone packed kraal ALE7

Figure 24: Historical remains at ALE7

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 14	-29.956110°	22.556529°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated in a clearing and the artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 60m in diameter.	Medium	4B

Figure 25: Medium to low density scatter at ALE14

Figure 26: View of landscape at ALE14

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 15	-29.913538°	22.513270°	Site/Resource	This calcrete hollow was presented to us by the farm manager. He presented a story, which his father had relayed, to him regarding the discovery of this site. He explained that during a Jackal hunt, the jackal disappeared into the hollow, as the horses, which the hunters were riding, approached the site. They noticed a hollow sound beneath them and retreated some distance. The men returned on foot to access th hollow. They apparently came across many bones of all sizes. None of the bones remain at easy view at present. It is possible it is only scavenging remains, however closer analysis could reveal fossilized remains. As such the site is classed as medium significance.	Medium	4A

Figure 27: Calcrete hallow ALE15

ALE 18	-29.987774°	22.585998	Site/Resource	A low-density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated on an open plain and the artefacts were identified amongst the exposed calcrete and quartzite gravels. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 50m in diameter.	Low	4C

Figure 28: Low density scatter at ALE18

Figure 29: View of landscape at ALE18

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 22	-29.951180°	22.568152°	Archaeological site	The farm manager, Mr. Jan Opperman, related a story from years ago when he found some ostrich eggs buried in the sand. He collected the eggs and took them home. He showed the place where he collected the eggs. Several other ostrich egg shell fragments were identified at this location. One ceramic potsherd was also identified amongst the collection of ostrich eggshell fragments. A medium/low density scatter of stone tools was also identified at this location (± 5-10 artefacts in 10m x10m). The site is situated within the valley floor in between the upper reaches of two parallel rocky ridges. a clearing at the foot of a rocky ridge. The artefacts are mainly part of the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, hornfels and CCS. The artefacts were found scattered over an area, which measured approximately 60m in diameter. A single potsherd was also located on this site. It is evident much activity took place on this ridge and therefor the site is rated as medium to high. The research value of this site is high.	Medium to high	3B

Figure 30: Archaeological site

Figure 31: View of landscape from ALE22

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 23	-29.938038°	22.545774°	Site/Resource	A low-density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated along the edges of a small pan. The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Early Stone Age (ESA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss, and quartz. The artefacts were found scattered in small concentrations all along the edges of the pan. The site is given a Grade 3A heritage rating and a medium heritage significance.	Medium	4A

Figure 32: Low density scatter at ALE23

Figure 33: Pan at ALE23

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 25	-29.958014°	22.546378°	Site/Resource	A low density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss, and quartz. The artefacts were found scattered over an area, which measured approximately 50m in diameter.	Low	4C

Figure 34: Low density scatter at ALE 25

Figure 35: View of the landscape from site ALE 25

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 26	-29.958014°	22.546378°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 80m in diameter.	Medium	4A

Figure 36: Medium density scatter at ALE26

Figure 37: View of landscape at ALE 26

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 27	-29.987734°	22.567900°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 50m in diameter.	Medium	4B

Figure 38: Medium to low density scatter at ALE27

Figure 39: View of landscape from ALE27

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 28	-29.945407°	22.526367°	Site/Resource	A medium density scatter of stone tools was identified at this location (± 10-15 artefacts in 10m x10m). The site is situated along the edges of two large pans to the east of the farmstead. The artefacts are mainly stone tools from the Middle Stone Age (MSA) and the Early Stone Age (ESA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. One fragmented upper grinding stone was also identified. The artefacts are mainly made of weathered quartzite, gneiss, quartz and CCS. The artefacts were found scattered in small concentrations all along the edges of the two pans.	Medium	4B

Figure 40: Medium density scatter at ALE28

Figure 41: Pans at ALE28

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 33	-29.958890°	22.535017°	Site/Resource	A medium density scatter of stone tools was identified at this location (± 10-15 artefacts in 10m x10m). The site is situated at the foot of a rocky ridge and has with red sandy soils. The majority of artefacts were identified at the foot of the ridge and not on the slopes of the ridge. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz, hornfels and CCS. The artefacts were found scattered over an area which measured approximately 60m x 60m along the foot of the rocky ridge	Medium	4B
 **Figure 42: Medium density scatter at ALE33**				 **Figure 43: View of landscape at ALE33**		
ALE 34	-29.960508°	22.574759°	Site/Resource	A medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated at the foot of a rocky ridge. The artefacts were identified amongst the rocks at the foot of the ridge. The artefacts vary between stone tools from the Middle Stone Age (MSA) and the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, gneiss and some CCS. The artefacts were found scattered over an area, which measured approximately 80m x 40m along the ridge.	Low	4C
 **Figure 44: Medium to low density scatter at ALE34**				 **Figure 45: View of the landscape at ALE34**		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 36	-29.986138°	22.586636°	Site/resource	Another medium/low density scatter of stone tools was identified at this location (± 5-10 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area, which measured approximately 60m in diameter..	Low	4C

Figure 46: Medium to low density scatter at ALE36

Figure 47: View of the landscape at ALE36

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE 37	-29.926841°	22.517901°	Site/Resource	A low-density scatter of stone tools was identified at this location (± 2-5 artefacts in 10m x10m). The site is situated on a flat plain with red sandy soils. The artefacts were exposed due to some measure of sheet erosion. The artefacts are mainly stone tools from the Late Stone Age (LSA) and consist mostly of utilised and re-touched flakes, scrapers, blades and cores. The artefacts are mainly made of weathered quartzite, quartz and CCS. The artefacts were found scattered over an area which measured approximately 40m in diameter	Low	4C

Figure 48: Low density scatter at ALE 37

Figure 49: View of landscape from ALE37

5.3.2 Historical

Four historical sites were located on the farm. A fifth site (**ALE17**), which has been noted, is located on the neighbouring farm, however **ALE 17** is an historical site that aids in placing the historical elements and past activities of the area as a whole

Table 6:Historical sites

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE10	-29.946814°	22.519580°	Historical Site	A stone built kraal was identified at this location. The kraal measures approximately 30m x 20m in size and is divided in three similar sized sections. The walls of the kraal measures approximately 1.4m in height and the bottom half of the walls were built with rocks and mortar. The top half of the walls were built with compressed dung bricks. These bricks were cut and collected from the dung deposits within the kraal. The dung bricks were plastered over to protect them from the elements. A more recent building was placed in the middle section of the kraal. This building still serves as storeroom.	Medium	4A

Figure 50: Kraal at ALE10

Figure 51: Exposed compressed dung bricks

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE11	-29.947082°	22.522212°	Historical site	A farmstead with its associated buildings and infrastructure was identified at this location. The farmstead and its associated buildings and structures cover an area of approximately 400m x 500m in size. It consists of the main farmhouse and adjacent storerooms, another house for other family members, more storerooms and sheds, two sets of farm labourer homesteads and various kraals and other versatile structures. According to the farm owner, Mrs. Aletta de Jager, her grandparents, Mr. Cornelius Frans Vermeulen and his wife, bought the farm in 1893 and built the original farm house in 1905. The other buildings and alterations developed over the years after their occupation of the farm	High	3A

Figure 52: Family farm house near the main house (unused)

Figure 53: Main farm house

Figure 54: Associated structures

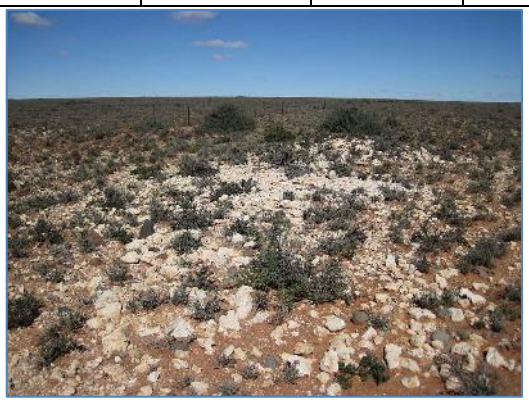
Figure 55: Associated structures

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE13 and ALE13B	-29.946219° -29.945847°	22.524762° 22.526425°	Historical site	Two water reservoirs/towers were identified to the east of the farmstead. The water reservoirs/towers were connected to boreholes and served the farmstead and its associated structures with water. The two water reservoirs/towers are similar in size, shape and construction. The reservoirs/towers are circular in shape and measures approximately 6m high and approximately 2m in diameter. They are brick and cement built and pipes were connected to them. They were also plastered and painted white	Medium	4B
 **Figure 56: Reservoir at ALE13**				 **Figure 57: Reservoir at ALE13B**		
ALE17	-29.916970°	22.591681°	Historical site	This site does not occur in the study area. However, its existence exhibits the extend of occupation in the area as a whole. The site occurred 3 km to the east of the present study area along a ridge. It is about 100m x 100m and includes stone walled structured, upper grinding stones and an assortment of historical debris. This site has a high research element and should be noted as being affected cumulatively by future projects in the area	Low (as not within the area)	3B
 **Figure 58: Historical debris**				 **Figure 59: Packed stone wall structure**		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
 **Figure 60: Upper grinding stones**				 **Figure 61: Rectangular stone structure**		
ALE38	°-29.903310°	°22.530113	Site	The foundations and remains of three similar structures/buildings were identified at this location. The foundations/platforms of these buildings remained, but the rest of these structures were removed. They measure approximately 5m across and 20m in length. It seemed to be the foundations of three storerooms or classrooms. It could possibly also be the working space for the shearing of sheep as one of these structures has a kraal-kind of set-up placed on it. These structures/platforms don't look all that old and its origin might be from within the last sixty years	Low	4C
 **Figure 62: Foundations**				 **Figure 63: foundations converted into pens**		

5.3.3 Graves

Table 7-Grave sites

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE9	-29.953765°	22.519571°	Cemetery	A cluster of fourteen graves was identified at this location. The graves are situated along and on the western side of one of the farm fences. Twelve of the graves were placed in a line next to each other. The two other graves were placed in a second line right next to two graves from the first line. All the graves are orientated from east to west. The graves have oval shaped stone packed mounds as dressings. Most of the graves have upright rocks placed at the western and eastern ends	High	4A
 **Figure 64: View of 14 stone packed graves**				 **Figure 65: Close up showing headstones**		
ALE12	-29.949224°	22.523287°	Cemetery	A small family cemetery was identified at this location. The cemetery is situated to the southwest of the farmstead. It is fenced and eight graves were placed in the cemetery. The graves belong to the Vermeulen and the De Jager families. The graves were placed in two lines next to each other and all are orientated from west to east. All of the graves have formal grave dressings and headstones except for the grave of Mr. Kerneels de Jager who passed away about seven months ago.	High	4A
 **Figure 66: Vermeulen and De Jager family cemetery**				 **Figure 67: Vermeulen grave**		

Site Number	Lat	Lon	Type Find	Description	Significance	Heritage Rating
ALE24	-29.939855°	22.518489°	Cemetery	According to the farm owner, Mrs. Aletta de Jager, some graves, which belong to victims of the “groot griep”, were in the way of the railway line, which crossed the Farm. These graves were relocated for the railway line to be developed. The relocated graves were identified at this location as indicated by Mrs. De Jager. The grave/graves was/were situated next to the access road to the farm an approximately 150m to the north of the disused and decommissioned railway line. A large oval shaped stone packed dressing or outlined was identified. The remains of the exhumed graves were most probably interred in a single mass grave. No other indications, such as headstones or inscription were identified. The interred graves are unknown and the process of their relocation is very vague at this stage.	High	4A

Figure 68: Relocated graves of "Groot griep" victims

Figure 69: Relocated graves

6 IMPACT ASSESSMENT

The impact rating and analysis was done based on the methodology as explained and summarised in **Appendix C** of this report. The design process and methodology followed by the developer for this project enabled the heritage assessment to provide input into the proposed layouts before the impact assessment. This resulted in cognisance being taken of the positions of the heritage resources and thus the reduction of impacts at an early design phase. Analysis of the impact matrix tables will reflect this.

6.1 Impact matrix

Table 8: Impact rating - Paleontology

IMPACT TABLE	
Environmental Parameter	Palaeontological sensitive rock formations
Issue/Impact/Environmental Effect/Nature	The study area is underlain by presumably Mokolian aged Uitdraai Formation of the Brulpan Group Olifantshoek Supergroup, Carboniferous to Permian aged Dwyka Group, Karoo Supergroup and Quaternary aged Gordonia Formation of the Kalahari Group. The allocation of a Moderate sensitivity for Palaeontological Heritage to the entire study area except the five historic spring sites and three potential groundwater aquifer sites, indicates that the EAP must be aware of the seven Very High point sources of Groundwater Heritage and it is recommended for practical reasons that the layout of the distribution of the wind generators be moved away from the five spring sites with a "No-Go" zone of at least 500m from each of the sites. The linear potential groundwater resources along the power line corridors are indicated as sites where activity of the contractors must be monitored especially for prevention of contamination of groundwater and the two zones must be recorded as potentially Very High sensitive zones, albeit possibly not visible to the naked eye in the study area. Although the Uitdraai Formation can provide new information on micro-fossils of Mokolian age, these fossils are very difficult to identify and are more of academic interest. Both the Dwyka Group and Gordonia Formations are however known for some very significant fossil finds and although scarce, the fossils can contribute significantly to our understanding of depositional environments during the Carboniferous, Permain and Quaternary ages in South Africa. It is recommended that the EAP and the ECO be informed of these fossils assemblages known from these groups of rocks and to be aware of the possible presence of the fossils during exposure of rock during the construction phase of this project.
Extent	Localised to deep excavations into bedrock
Probability	A possibility of encountering fossils exist
Reversibility	Fossils are none renewable.
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost
Duration	The loss of the fossil record will be permanent

Cumulative effect	Medium cumulative impact over the site	
Intensity/magnitude	Magnitude of the impact pre-mitigation is rated as High negative however the implementation of the recommended mitigation measures changes this to a Low magnitude of impact.	
Significance Rating	High negative before mitigation and low negative after mitigation for both the expanded and the constrained layout.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	3
Reversibility	4	4
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	-51 (high negative)	-15 (low negative)
Mitigation measures	1. The EAP as well as the ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Palaeontologist be appointed at the start of the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the EAP, ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Palaeontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged. 2. The two historic spring sites indicated on the Palaeontological sensitivity map and database is of extreme importance as Geological Heritage appoints and these points must for at least 500m around them be declared “No-Go” zones. 3. The recommendations must be included in the EMPr of the project.	

Table 9: Impact rating – Archaeological resources

IMPACT TABLE		
Environmental Parameter	Stone Age find spots and Sites	
Issue/Impact/Environmental Effect/Nature	Two types of archaeological finds have been identified during the fieldwork. Find spots that were rated as having low archaeological significance and archaeological sites rated as having medium to high archaeological significance. All the identified find spots could be impacted by construction activities however the impact is seen as negligible. None of the archaeological site identified will be impacted directly by any of the proposed layouts except for ALE3, which is of a low impact. It must be noted however, that this entire farm is abundant with stone age remains and in the time allocated it was not possible to locate all of them. A medium impact rating is given with the implementation of a precautionary mitigation measures.	
Extent	Localised	
Probability	Probable	
Reversibility	Non- renewable.	
Irreplaceable loss of resources	Archaeological sites are irreplaceable	
Duration	Permanent	
Cumulative effect	Medium cumulative impact	
Intensity/magnitude	Medium	
Significance Rating	Negative medium impact before mitigation and low negative after mitigation.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-40 (Negative Medium Impact	-16 (Low negative
Mitigation measures	1. A walk down of the final layout to determine if any significant sites will be affected. Relocate turbines if need be.	

	2. Sites Ale 4 and ALE 36 must be monitored during construction, as they are close to turbine construction activities. 3. Monitor find spot areas if construction is going to take place through them. 4. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by heritage practitioner during the construction phase.

Table 10: Impact rating – Historical/Recent history

IMPACT TABLE		
Environmental Parameter	Historical structures and cemeteries	
Issue/Impact/Environmental Effect/Nature	The historical sites and cemeteries are mostly localised in the southwestern part of the study area away from the proposed development. With the exception of ALE38 which is in the northern corner.	
Extent	Localised	
Probability	Possible	
Reversibility	Non- renewable.	
Irreplaceable loss of resources	Archaeological sites are irreplaceable	
Duration	Permanent	
Cumulative effect	Low	
Intensity/magnitude	Medium	
Significance Rating	Negative medium impact before mitigation and low negative after mitigation.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	-34 (Negative medium impact)	-16 (Low negative)

Mitigation measures	1. Demarcate sites as no-go areas 2. Demarcate and fence during construction if construction activities area to happened within 100 meters from a site. 3. Monitor find spot areas if construction is going to take place through them. 4. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. 1. Adjust the development layout (where possible) and demarcate the gravesites with at least a 5-10-meter buffer. 2. In the event that the sites cannot be excluded from the development footprint a grave relocation process as described in Appendix A of this reports needs to be implemented

Table 11: Impact rating – chance finds

IMPACT TABLE		
Environmental Parameter	Unidentified heritage structures	
Issue/Impact/Environmental Effect/Nature	Due to the size of the area assessed and the design process requiring fieldwork before identification of the layout. The possibility of encountering heritage features in unsurveyed areas does exist.	
Extent	Localised and in most cases no more than 1000m^2	
Probability	Probable	
Reversibility	Heritage resources are non-renewable.	
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost	
Duration	Permanent	
Cumulative effect	Medium	
Intensity/magnitude	Medium	
Significance Rating	Medium negative before mitigation and low negative after mitigation for both the expanded and the constrained layout.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	3
Reversibility	4	4
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	3	3
Intensity/magnitude	2	1

Significance rating	-34 (Medium negative)	-17 (Low negative)
	Post mitigation impact rating	
Mitigation measures	1. A walk down of the final approved layout will be required before construction commence; 2. Any heritage features of significance identified during this walk down will require formal mitigation or where possible a slight change in design could accommodate such resources. 3. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.	

6.2 Confidence in Impact Assessment

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 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.

6.3 Cumulative Impacts

This section evaluates the possible cumulative impacts (CI) on heritage resources with the addition of the Aletta WEF. The CI on heritage resources evaluated a 30-kilometer radius (**Figure 70**). It must further be noted that the evaluation is based on available heritage studies (**Figure 71**) and cannot take the findings of outstanding studies on current ongoing EIA's in consideration.

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 Copperton 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 too individual and between interest groups. Thus implicating that heritage resources' significance can and does change over time. An so will the 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)

Keeping the above short comings in mind, the methodology in evaluating cumulative impacts on heritage resources has been as follows.

The analysis of the competed studies as listed in **Table 12**, took in to account the findings and recommendation of each of the sixteen evaluated HIA's. The cumulative impact on the cultural landscape was discounted as the HIA's, in most cases, did not address this and the Visual Impact Assessment covers such analysis in detail.

The overall findings of the 16 studies all concur that the area is characterised by numerous Stone Age findspots and archaeological resources. A large number of these concentrated around pans and outcrops in a landscape where water, food and shelter came at a premium. The sites around the pans and the outcrops where in most cases given a medium to high heritage significance on a local scale and in the majority of the cases were recommended as being no-go areas or extensive mitigation is required.

This cumulative assessment has also not addressed the possible cumulative impacts on the heritage landscape. The evaluated studies have in most cases not addressed or quantified the possible impact on the cultural landscape.

Table 13 provides an analysis of the projected cumulative impact this project will add to impact on heritage resources.

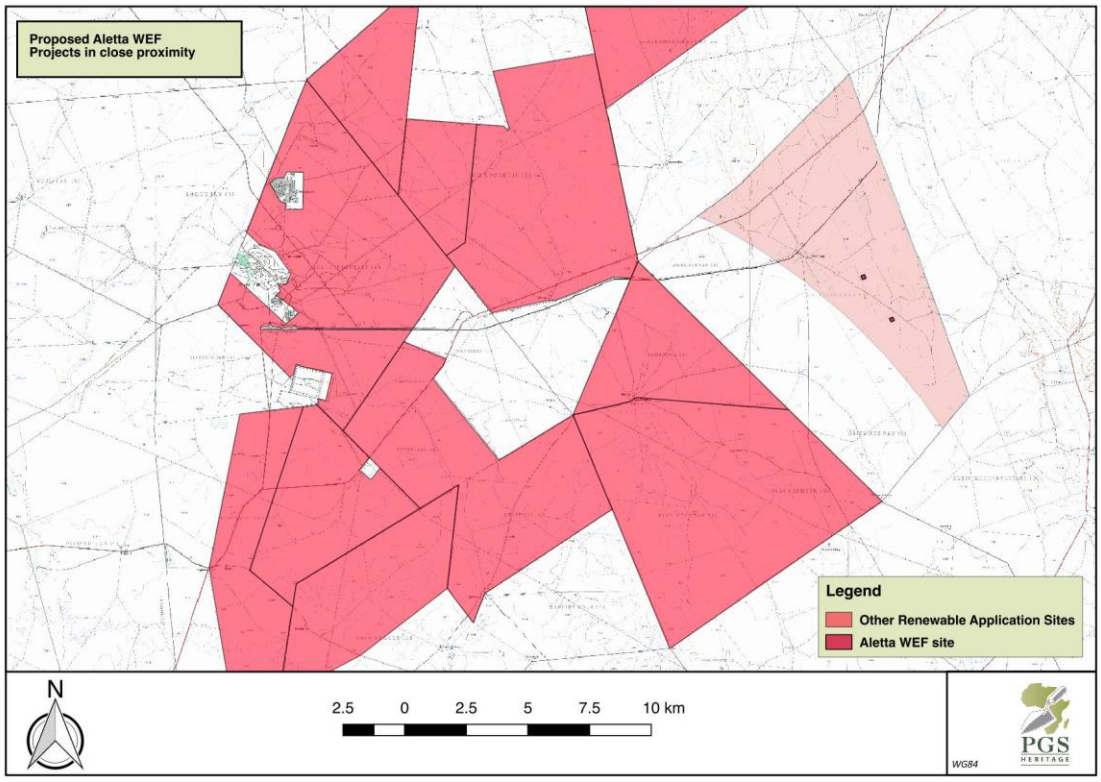


Figure 70: Other RE developments in relation to the Aletta WEF application area

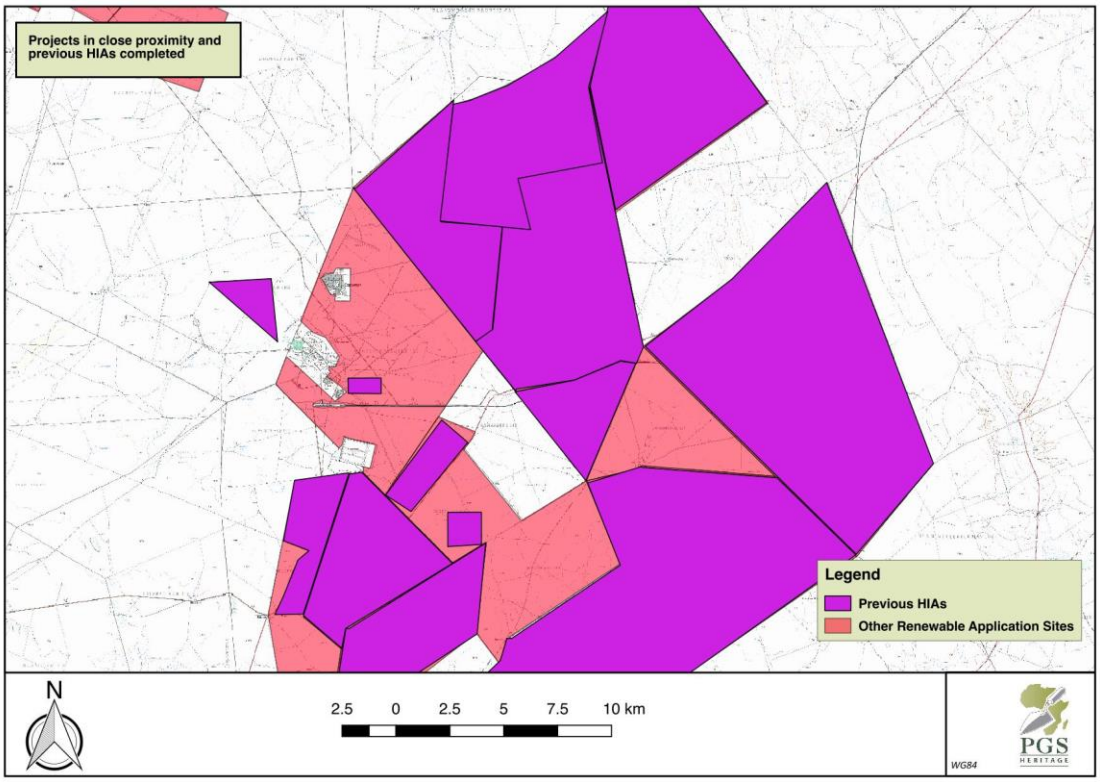


Figure 71: Other RE developments in relation to the Aletta WEF application area, where HIAs were completed

Table 12: Regional HIA's conducted		
Study	**Findings**	**Recommendation**
KAPLAN, J.M. 2010. Archaeological Scoping Study and Impact assessment of a proposed photovoltaic power generation facility in Copperton Northern Cape. Agency for Cultural Resource Management	Rated low significance but recommended further fieldwork before construction.	▪ Further walkdown required
KAPLAN, J.M. & WILTSHIRE, N. 2011. Archaeological Impact Assessment of a proposed wind energy facility, power line and landing strip in Copperton, Siyathemba municipality, Northern Cape. Agency for Cultural Resource Management	Rated as having no go areas of archaeological importance and stress the importance that the proposed wind farm on Struisbult is one of a number of energy related applications in the immediate area surrounding Copperton. Concentrations of lithic material around pans and outcrops	▪ SAHRA must assess this application in the broader context of other applications in the area in order to guide Eskom and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area.) ▪ Avoid pans and historical homesteads
ATWELL, M. 2011. Heritage Assessment Proposed Wind Energy Facility And Related Infrastructure, Struisbult: (Farm 103, Portions 4 And 7), Copperton, Prieska, Atwell & Associates	Found no fatal flaws, however agree that the area is abundant with Stone Age scatters. It is further stated that the scatters are background scatter with little significance except for one site with remains intact and must be avoided or a second phase mitigation to take place	▪ Avoid significant archaeological site
VAN SCHALKWYK, J. 2011. Heritage impact assessment for the Proposed Establishment of PV Solar Facilities by Mainstream Renewable Power on the Farm Mierdam in the Prieska Region Northern Cape Province	A number of open sites with surface scatterings of stone tools dating to the Middle and Later Stone Age were identified. These are mostly located on small hills or at the foot of the hill.	▪ As first option it is recommended that these areas are avoided if possible. If that is not possible, it is recommended that systematic surface collections are made and that this material is housed at a museum.
VAN SCHALKWYK, J. 2011. Heritage impact assessment for the Proposed Establishment of PV Solar Facilities by Mainstream Renewable Power on the Farm Platsjambok in the Prieska Region Northern Cape Province	A number of open sites with surface scatterings of stone tools dating to the Middle and Later Stone Age were identified. These are mostly located on small hills or at the foot of the hill.	▪ As first option it is recommended that these areas are avoided if possible. If that is not possible, it is recommended that systematic surface collections are made and that this material is housed at a museum.

Study	Findings	Recommendation
ORTON, JAYSON. 2012a. Heritage Impact assessment for a proposed photovoltaic energy plant on the farm Klipgats Pan near Copperton, Northern Cape. Archaeology Contracts Office Department of Archaeology. University of Cape Town	A background scatter of Early Stone Age (ESA) and Middle Stone Age (MSA) artefacts was found across the site and is of very low archaeological significance. However, a large number of discrete Later Stone Age (LSA) sites were found focused around ephemeral pans and the hill.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required.
ORTON, JAYSON. 2012b. Heritage Impact Assessment for a proposed photovoltaic energy plant on the farm Hoekplaas near Copperton, Northern Cape. Archaeology Contracts Office Department of Archaeology. University of Cape Town	This assessment found a scatter of stone age sites with concentrations around pans and rated them as medium significance with required mitigation	▪ Overall, impacts to heritage resources are not considered to be highly significant and it is ▪ thus concluded that the project may proceed but subject to the following recommendations: o The suggested archaeological mitigation measures should be implemented as o necessary; o Test excavations around the pans should be done to check for buried archaeological o material (if development encroaches within 100 m of any of the pan margins but excluding for access roads); o Transmission lines should stay at least 100 m away from the edge of any pans implicated in the final route;
ORTON, J & WEBLEY, L. 2013. Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on the Remainder of Farm Klipgats Pan 117, Copperton, Northern Cape	This assessment found background scatter of stone age material and concentrations around pans which are rated as medium significance with required mitigation	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required.
VAN DER WALT, JACO. 2013. Archaeological Impact Assessment Report for the proposed Bosjesmansberg PV Facility Project, located close to Copperton in the Northern Cape. Heritage Contracts and Archaeological Consulting CC (HCAC)	Highlights pans and quartzite ridges as archaeologically highly sensitive and flag them as no-go areas. Wide spread scatters of Stone Age material occur. High concentrations of Stone Age material are associated with quartzite ridges.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required.

Study	Findings	Recommendation
VAN DER WALT, JACO. 2012. Archaeological Impact Assessment Report for the proposed Garob Wind Energy Facility Project, located close to Copperton in the Northern Cape. Heritage Contracts and Archaeological Consulting CC (HCAC)	Highlights pans and quartzite ridges as archaeologically highly sensitive and flag them as no-go areas. Wide spread scatters of Stone Age material occur. High concentrations of Stone Age material are associated with quartzite ridges.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required.
FOURIE, W. 2012. Heritage Impact Assessment for the proposed Eskom Cuprum to Kronos Double Circuit 132kv Power line and Associated Infrastructure, Prieska, Northern Cape.	High density scatters of lithics around quartz outcrops were identified. Avoidance of site were recommended. One site was found to med medium to high significance.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed.
ORTON, J. 2015. Heritage Impact Assessment for Three Proposed Solar Energy Facilities and Three Associated Transmission Lines Near Copperton, Prieska Magisterial District, Northern Cape	The majority of the archaeological heritage resources identified are of low-medium or medium archaeological significance and a suggested grading for these resources would be no more than Grade 3C.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed.
FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 1 PV project, Copperton Northern Cape.	13 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance. Al the sites will require mitigation prior to construction.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required. ▪ Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.
FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 2 PV project, Copperton Northern Cape.	10 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required. ▪ Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.

Study	Findings	Recommendation
FOURIE, W. 2015. Heritage Impact Assessment for the proposed Helena 3 PV project, Copperton Northern Cape.	13 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance. Al the sites will require mitigation prior to construction.	▪ Avoid heritage resources where possible and in the event of direct impacts the resources must be mitigated through the appropriate sampling and excavation methods as proposed. ▪ Mitigation of high density Stone Age scatters will be required. ▪ Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.
FOURIE, W. 2015. Heritage Impact Assessment for the proposed Eureka WEF project, Copperton Northern Cape.	6 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance. Al the sites will require mitigation prior to construction.	▪ Final walkdown of infrastructure footprints ▪ Demarcate sites as no-go areas ▪ Demarcate and fence during construction if construction activities area to happened within 100 meters from a site. ▪ Monitor find spot areas if construction is going to take place through them. ▪ A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

Table 13: Impact rating – Cumulative

IMPACT TABLE		
Environmental Parameter	Heritage Resources	
Issue/Impact/Environmental Effect/Nature	The extent that the addition of this project will have on the overall impact of developments in the region on heritage resources	
Extent	Regional	
Probability	Possible	
Reversibility	Non- renewable.	
Irreplaceable loss of resources	The nature of heritage resources are that they are non-renewable. The proper mitigation and documentation of these resources can however preserve the data for research	
Duration	Permanent	
Cumulative effect	It is my considered opinion that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate.	
Intensity/magnitude	Medium	
Significance Rating	Negative medium impact before mitigation and low negative after mitigation.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	2	1
Reversibility	4	4
Irreplaceable loss	4	4
Duration	4	4
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	-38 (Negative medium impact)	-18 (Low negative)
Mitigation measures	It can clearly be noted that the area in general is abundant with Stone Age remains. I concur with Kaplan and Wiltshire 2011, "S*AHRA must assess this application in the broader context of other present and future applications in the area in order to guide the Client and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area*." It is recommended that SAHRA commissions a regional study that focus on the identification of heritage resources and all documentation and mitigation of heritage resources as part of developments in the region must be aimed at a combined research output for developments in the Copperton area.	

It is my considered opinion that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate.

It can clearly be noted that the area in general is abundant with Stone Age remains. I concur with Kaplan and Wiltshire 2011, "S*AHRA must assess this application in the broader context of other present and future applications in the area in order to guide the Client and the Department of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area*."

It is recommended that SAHRA commissions a regional study that focus on the identification of heritage resources and all documentation and mitigation of heritage resources as part of developments in the region must be aimed at a combined research output for developments in the Copperton area.

6.4 Reversibility of Impacts

Although heritage resources are seen as non-renewable the mitigation of impacts on possible finds through scientific documentation will provided sufficient mitigation on the impacts on possible heritage resources.

6.4.1 Wind Turbine Layouts

Allowing for a 60m diameter construction foot print for on all turbine positions has shown that al the find spots and sites fall outside and in most case more than 100 meters way from any construction activities.

6.4.2 Associated Infrastructure

No heritage resources will be impacted by any of the infrastructure alternatives.

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

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION and O & M Building ALTERNATIVES		
Option 1	Preferred	No heritage resources have been identified in the general area of the substation footprint.

Alternative	Preference	Reasons (incl. potential issues)
Option 2	Favourable	A site occurs at this location however is of a low significance

7 CONCLUSIONS AND RECOMMENDATIONS

PGS Heritage was appointed by SiVEST Environmental Division to undertake a Heritage Impact Report that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the Wind Energy Facility for Biotherm Energy (Pty) Ltd, near Copperton in the Northern Cape Province.

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

The Heritage Scoping Report completed in February 2016 has shown that the proposed Aletta site to be developed as a Wind Energy Facility (WEF) may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.

The subsequent field work completed for the HIA component in August 2016, has confirmed the presence of 3 archaeological find spots, 5 historical sites, 21 archaeological sites or resources and 3 grave sites. The archaeological sites are associated with the Early Stone Age (ESA), Middle (MSA) and Later Stone Age (LSA) and are representative of archaeological sites with a medium to high significance.

The design process and methodology followed by the developer for this project enabled the heritage assessment to provide input into the proposed layouts before the impact assessment. This resulted in cognisance being taken of the positions of the heritage sites and thus the reduction of impacts at an early design phase. Analysis of the impact matrix tables will reflect this

The mitigation measures proposed is a follows:

7.1 Pre-Construction

1. A detailed walk down of the final approved layout will be required before construction commence;
2. Any heritage features of significance identified during this walk down will require formal mitigation or where possible a slight change in design could accommodate such resources.
3. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

7.2 Palaeontology

1. The EAP as well as the ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Palaeontologist be appointed at the start of the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the EAP, ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Palaeontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged.
2. The two historic spring sites indicated on the Palaeontological sensitivity map and database is of extreme importance as Geological Heritage appoints and these points must for at least 500m around them be declared “No-Go” zones.
3. The recommendations must be included in the EMPr of the project.

7.3 Archaeological Sites

1. A walk down of the final layout to determine if any significant sites will be affected. Relocate turbines if need be.
2. Sites Ale 4 and ALE 36 must be monitored during construction, as they are close to turbine construction activities.
3. Demarcate and fence during construction if construction activities are within 100 meters from a site.
4. Monitor find spot areas if construction is going to take place through them.
5. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations. Possible surface collections for sites with a medium to high significance as well as conducting a watching brief by heritage practitioner during the construction phase.

7.4 Historical sites

1. Demarcate sites as no-go areas
2. Demarcate and fence during construction if construction activities area to happened within 100 meters from a site.
3. A management plan for the heritage resources needs then to be compiled and approved for implementation during construction and operations.

7.5 Grave sites and cemeteries

1. Adjust the development layout (where possible) and demarcate the grave sites with at least a 5-10-meter buffer.

2. In the event that the sites cannot be excluded from the development footprint a grave relocation process as described in Appendix A of this reports needs to be implemented

7.6 Comparative Assessment of Alternatives

The comparative assessment of the alternatives has shown that an overall low impact on heritage is foreseen, as the entire heritage sites identified fall outside the proposed alternative foot prints. The application site however holds a Negative Medium Impact.

7.6.1 Wind Turbine Layouts

Allowing for a 60m diameter construction foot print for on all turbine positions has shown that all the find spots and sites fall outside and in most case more than 100 meters away from any construction activities.

7.6.2 Associated Infrastructure

One archaeological resource occurs at the Option 2 substation (Rated as having low heritage significance)

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

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION and O & M Building ALTERNATIVES		
Option 1	Preferred	No heritage resources have been identified in the general area of the substation footprint.
Option 2	Favourable	A site occurs at this location however is of a low significance

7.7 Cumulative Impact

It is my considered opinion that this additional load on the overall impact on heritage resources will be low. With a detailed and comprehensive regional dataset this rating could possibly be adjusted and more accurate.

It can clearly be noted that the area in general is abundant with Stone Age remains. I concur with Kaplan and Wiltshire 2011, "S*AHRA must assess this application in the broader context of other present and future applications in the area in order to guide the Client and the Department*

of Environmental Affairs (DEA) towards an acceptable level of overall heritage impact on the area."

It is recommended that SAHRA commissions a regional study that focus on the identification of heritage resources and all documentation and mitigation of heritage resources as part of developments in the region must be aimed at a combined research output for developments in the Copperton area.

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Appendix A

LEGISLATIVE PRINCIPLES

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

3.1 General principles

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In the new legislation, permits are required to damage, destroy, alter, or disturb them. People who already possess material are required to register it. The management of heritage resources are integrated with environmental resources and this means that before development takes place heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a cemetery (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have interest in the graves: they may be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle will be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the developer's cost. Thus, developers will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:
An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection, to all historic and pre-historic cultural remains, including graves and human remains.

3.2 Graves and cemeteries

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and are the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.

Appendix B

Heritage Assessment Methodology

The section below outlines the assessment methodologies utilised in the study.

The Heritage Impact Assessment (HIA) report to be compiled by PGS Heritage (PGS) for the proposed Aletta WEF will assess the heritage resources found on site. This report will contain the applicable maps, tables and figures as stipulated in the NHRA (no 25 of 1999), the National Environmental Management Act (NEMA) (no 107 of 1998) and the Minerals and Petroleum Resources Development Act (MPRDA) (28 of 2002). The HIA process consists of three steps:

- Step I – Literature Review: The background information to the field survey leans greatly on the Heritage Scoping Report completed by PGS for this site.
- Step II – Physical Survey: A physical survey was conducted on foot and by vehicle through the proposed project area by qualified archaeologists, 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, as well as the assessment of resources in terms of the heritage impact assessment criteria and report writing, as well as mapping and constructive recommendations

The significance of heritage sites was based on four main criteria:

- **site integrity** (i.e. primary vs. secondary context),
- **amount of deposit, range of features** (e.g., stonewalling, stone tools and enclosures),
    - Density of scatter (dispersed scatter)
        - Low - <10/50m^2
        - Medium - 10-50/50m^2
        - High - >50/50m^2
- uniqueness and
- **potential** to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate pylon position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

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- Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report.

Table 14: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High Significance	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High Significance	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	Grade 4A	High / Medium Significance	Mitigation before destruction
Generally Protected B (GP.B)	Grade 4B	Medium Significance	Recording before destruction
Generally Protected C (GP.A)	Grade 4C	Low Significance	Destruction

Appendix C

Impact Assessment Methodology to be utilised during EIA phase

9 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGY

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

9.1 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 3.

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.

9.2 Impact Rating System

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

- planning
- construction
- operation
- 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.

9.2.1 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 mitigation of the impact. Impacts have been consolidated into one rating. In

assessing the significance of each issue the following criteria (including an allocated point system) is used:

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.		
GEOGRAPHICAL EXTENT		
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		
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		
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		
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		
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).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY / MAGNITUDE		
Describes the severity of an impact		

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

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:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

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

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.

29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Appendix D

Palaeontological Desktop Assessment

PALAEONTOLOGICAL DESKTOP ASSESSMENT FOR THE PROPOSED ALETTA WIND ENERGY FACILITY (WEF) WILL BE LOCATED APPROXIMATELY 17KM EAST OF COPPERTON AND THE ALTERNATIVE EUREKA WIND ENERGY FACILITY (WEF) WILL BE LOCATED APPROXIMATELY 5KM NORTH-EAST OF COPPERTON, WITH ASSOCIATED CORRIDORS FOR POWER LINES, WITHIN THE SIYATHEMBA LOCAL MUNICIPALITY OF THE PIXLEY KA SEME DISTRICT MUNICIPALITY IN THE NORTHERN CAPE PROVINCE

For:

HIA CONSULTANTS

DATE: 11 August 2016

By

Gideon Groenewald
078 713 6377

EXECUTIVE SUMMARY

Gideon Groenewald was appointed by PGS Heritage to undertake a Desktop Survey, assessing the potential Palaeontological Impact of the Aletta Wind Energy Facility (WEF) will be located approximately 17km east of Copperton and the alternative Eureka Wind Energy Facility (WEF) will be located approximately 5km north-east of Copperton, with associated corridors for Power Lines, within the Siyathemba Local Municipality of The Pixley Ka Seme District Municipality in The Northern Cape Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development. The two alternative Layout sites Aletta and Eureka as well as the power line corridors are all allocated a Moderate Palaeontological Sensitivity and are therefore described in one Desktop Survey which is this report. Geological structures associated with groundwater are mapped as well as spring sites which are part of the Heritage of this area.

The Aletta Wind Energy Facility (WEF) will be located approximately 17km east of Copperton and the alternative Eureka Wind Energy Facility (WEF) will be located approximately 5km north-east of Copperton, with associated corridors for Power Lines, within the Siyathemba Local Municipality of The Pixley Ka Seme District Municipality in The Northern Cape Province.

The study area is underlain by presumably Mokolian aged Uitdraai Formation of the Brulpan Group Olifantshoek Supergroup, Carboniferous to Permian aged Dwyka Group, Karoo Supergroup and Quaternary aged Gordonia Formation of the Kalahari Group.

The allocation of a Moderate sensitivity for Palaeontological Heritage to the entire study area except the five historic spring sites and three potential groundwater aquifer sites, indicates that the EAP must be aware of the seven Very High point sources of Groundwater Heritage and it is recommended for practical reasons that the layout of the distribution of the wind generators be moved away from the five spring sites with a “No-Go” zone of at least 500m from each of the sites. The linear potential groundwater resources along the power line corridors are indicated as sites where activity of the contractors must be monitored especially for prevention of contamination of groundwater and the two zones must be recorded as potentially Very High sensitive zones, albeit possibly not visible to the naked eye in the study area.

Although the Uitdraai Formation can provide new information on micro-fossils of Mokolian age, these fossils are very difficult to identify and are more of academic interest. Both the Dwyka Group and Gordonia Formations are however known for some very significant fossil finds and although scarce, the fossils can contribute significantly to our understanding of depositional environments during the Carboniferous, Permain and Quaternary ages in South Africa. It is recommended that the EAP and the ECO be informed of these fossils assemblages known from these groups of rocks and to be aware of the possible presence of the fossils during exposure of rock during the construction phase of this project.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Palaeontologist be appointed at the start of the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the EAP, ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Palaeontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged.
2. The five historic spring sites indicated on the Palaeontological sensitivity map and database is of extreme importance as Geological Heritage appoints and these points must for at least 500m around them be declared “No-Go” zones. The three linear potential groundwater aquifers need to be recorded and the EAP and ECO must note these areas as highly sensitive for groundwater contamination.
3. The recommendations must be included in the EMPr of the project.

TABLE OF CONTENT

1 INTRODUCTION

1.1 Background

Gideon Groenewald was appointed by PGS Heritage to undertake a Desktop Survey, assessing the potential Palaeontological Impact of the Aletta Wind Energy Facility (WEF) will be located approximately 17km east of Copperton and the alternative Eureka Wind Energy Facility (WEF) will be located approximately 5km north-east of Copperton, with associated corridors for Power Lines, within the Siyathemba Local Municipality of The Pixley Ka Seme District Municipality in The Northern Cape Province.

This report forms part of the Environmental Impact Assessment and complies with the requirements of the South African National Heritage Resource Act No 25 of 1999. In accordance with Section 38 (Heritage Resources Management), a Heritage Impact Assessment (HIA) is required to assess any potential impacts to palaeontological heritage within the development footprint of the development. The two alternative Layout sites Aletta and Eureka as well as the power line corridors are all allocated a Moderate Palaeontological Sensitivity and are therefore described in one Desktop Survey which is this report. Geological structures associated with groundwater are mapped as well as spring sites which are part of the Heritage of this area.

Categories of heritage resources recognised as part of the National Estate in Section 3 of the Heritage Resources Act, and which therefore fall under its protection, include:

- geological sites of scientific or cultural importance;
- objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens;
- objects with the potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage.

1.2 Aims and Methodology

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

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources and
- to make recommendations as to how the developer should conserve or mitigate damage to these resources**.**

In preparing a palaeontological desktop study the potential fossiliferous rock units (groups, formations etc.) represented within the study area are determined from geological maps (2922 Prieska and 2924 Koffiefontein). The known fossil heritage within each rock unit is inventoried from the published scientific literature and previous palaeontological impact studies in the same region. All mapped historic spring sites and potential groundwater zones are included in the PIA Study.

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged. The different sensitivity classes used are explained in Table 1.1 below.

Table 1 Palaeontological Sensitivity Analysis Outcome Classification

PALAEONTOLOGICAL SIGNIFICANCE/VULNERABILITY OF ROCK UNITS	
The following colour scheme is proposed for the indication of palaeontological sensitivity classes. This classification of sensitivity is adapted from that of Almond et al (2008) and Groenewald et al., (2014)	
RED	Very High Palaeontological sensitivity/vulnerability. Development will most likely have a very significant impact on the Palaeontological Heritage of the region. Very high possibility that significant fossil assemblages will be present in all outcrops of the unit. Appointment of professional palaeontologist, desktop survey, phase I Palaeontological Impact Assessment (PIA) (field survey and recording of fossils) and phase II PIA (rescue of fossils during construction) as well as application for collection and destruction permit compulsory. All groundwater resources, present and potential are included in this category for Palaeontological Sensitivity
ORANGE	High Palaeontological sensitivity/vulnerability. High possibility that significant fossil assemblages will be present in most of the outcrop areas of the unit. Fossils most likely to occur in associated sediments or underlying units, for example in the areas underlain by Transvaal Supergroup dolomite where Cenozoic cave deposits are likely to occur. Appointment of professional palaeontologist, desktop survey and phase I Palaeontological Impact Assessment (field survey and collection of fossils) compulsory. Early application for collection permit recommended. Highly likely that a Phase II PIA will be applicable during the construction phase of projects.
GREEN	Moderate Palaeontological sensitivity/vulnerability. High possibility that fossils will be present in the outcrop areas of the unit or in associated sediments that underlie the unit. For example areas underlain by the Gordonia Formation or undifferentiated soils and alluvium. Fossils described in the literature are visible with the naked eye and development can have a significant impact on the Palaeontological Heritage of the area. Recording of fossils will contribute significantly to the present knowledge of the development of life in the geological record of the region. Appointment of a professional palaeontologist, desktop survey and phase I PIA (ground proofing of desktop survey) recommended.
BLUE	Low Palaeontological sensitivity/vulnerability. Low possibility that fossils that are described in the literature will be visible to the naked eye or be recognized as fossils by untrained persons. Fossils of for example small domal Stromatolites as well as micro-bacteria are associated with these rock units. Fossils of micro-bacteria are extremely important for our understanding of the development of Life, but are only visible under large magnification. Recording of the fossils will contribute significantly to the present knowledge and understanding of the development of Life in the region. Where geological units are allocated a blue colour of significance, and the geological unit is surrounded by highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a blue colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. Collection of a representative sample of potential fossiliferous material recommended. At least a Desktop Survey is recommended.

GREY	Very Low Palaeontological sensitivity/vulnerability. Very low possibility that significant fossils will be present in the bedrock of these geological units. The rock units are associated with intrusive igneous activities and no life would have been possible during implacement of the rocks. It is however essential to note that the geological units mapped out on the geological maps are invariably overlain by Cenozoic aged sediments that might contain significant fossil assemblages and archaeological material. Examples of significant finds occur in areas underlain by granite, just to the west of Hoedspruit in the Limpopo Province, where significant assemblages of fossils and clay-pot fragments are associated with large termite mounds. Where geological units are allocated a grey colour of significance, and the geological unit is surrounded by very high and highly significant geological units (red or orange coloured units), a palaeontologist must be appointed to do a desktop survey and to make professional recommendations on the impact of development on significant palaeontological finds that might occur in the unit that is allocated a grey colour. An example of this scenario will be where the scale of mapping on the 1:250 000 scale maps excludes small outcrops of highly significant sedimentary rock units occurring in dolerite sill outcrops. It is important that the report should also refer to archaeological reports and possible descriptions of palaeontological finds in Cenozoic aged surface deposits. At least a Desktop Survey is recommended.

1.3 Scope and Limitations of the Desktop Study

The study will include: i) an analysis of the area's stratigraphy, age and depositional setting of fossil-bearing units; ii) a review of all relevant palaeontological and geological literature, including geological maps, and previous palaeontological impact reports; iii) data on the proposed development provided by the developer (e.g. location of footprint, depth and volume of bedrock excavation envisaged) and iv) where feasible, location and examination of any fossil collections from the study area (e.g. museums).

The key assumption for this scoping study is that the existing geological maps and datasets used to assess site sensitivity are correct and reliable. However, the geological maps used were not intended for fine scale planning work and are largely based on aerial photographs alone, without ground-truthing. There is also an inadequate database for fossil heritage for much of the RSA, due to the small number of professional palaeontologists carrying out fieldwork in RSA. Most development study areas have never been surveyed by a palaeontologist.

These factors may have a major influence on the assessment of the fossil heritage significance of a given development and without supporting field assessments may lead to either:

- an underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- an 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 weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc.).

2 DESCRIPTION OF THE PROPOSED DEVELOPMENTS

2.1 Aletta Wind Energy Facility

The proposed Aletta Wind Energy Facility (WEF) will be located approximately 17km east of Copperton, within the Siyathemba Local Municipality of the Pixley ka Seme District Municipality in the Northern Cape Province. The proposed project is located on the following properties:

- Portion 1 of Drielings Pan No.101
- Portion 2 of Drielings Pan No.101
- Portion 3 of Drielings Pan No.101
- Remainder of Drielings Pan No.101

2.1.1 Wind Farm Technical details

The key technical details and infrastructure required is presented in the table below.

Table 2 Project Details Aletta Wind Energy Facility

Project Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for the proposed project
Aletta WEF	14/12/16/3/3/2/945	• Portion 1 of Drielings Pan No.101 • Portion 2 of Drielings Pan No.101 • Portion 3 of Drielings Pan No.101 • Remainder of Drielings Pan No.101	• **60 wind turbines** with a total export capacity of up to 140MW. Turbines will have a hub height of up to 120m and a rotor diameter of up to 150m. • 132kV onsite Aletta IPP Substation • The turbines will be connected via **medium voltage cables** to the proposed 132kV onsite Aletta IPP Substation. • Internal **access roads** are proposed to be between 4m to 6m wide. • A temporary construction **lay down area.** • A hard standing area / platform per turbine. • The **operations and maintenance buildings**, including an on-site spares storage building, a workshop and an operations building. • **Fencing** (if required) will be up to 5m where required and will be either mesh or palisade.

2.2 Substation and Power Line Technical details

The overall objective of the project is to feed the electricity generated at the proposed Aletta Wind Energy Facility (WEF) into the National Grid.

The proposed project consists of the following main activities:

- Construction of 1 x 132kV substation (referred to as the “proposed Aletta substation”)
- Construction of 1 x 132kV power line from the proposed Aletta substation to one of the following potential connection points:
    a. Kronos Main Transmission Substation;
    b. Cuprum Substation;
    c. Proposed Copperton Wind Substation; or
    d. Cuprum Hydra 1 132kV Power Line (Loop in loop out).

The proposed power line will consist of a series of towers located approximately 200m to 250m apart. The type of power line towers which are being considered at this stage include self-supporting suspension monopole structures where the line is relatively straight and angle strain towers where the line deviates from zero degree with a large angle. The steel monopole tower type is between 18 and 25m in height. The height will vary based on the terrain, but will ensure minimum overhead line clearances with buildings and surrounding infrastructure. The exact location of the towers will be determined during the final design stages of the power line.

A power line corridor of approximately 500m wide is being proposed to allow flexibility when determining the final route alignment, however only a 31m wide servitude would be required for the proposed 132kV power line. As such, the 31m wide servitude would be positioned within the corridor.

Two alternative sites for the proposed Aletta substation will be assessed during the Basic Assessment. The size of the substation site will be approximately 150m x 150m.

2.3 Project Location

The proposed Aletta substation and 132kV power will be located to the south-east of Copperton, within the Siyathemba Local Municipality of the Pixley ka Seme District Municipality in the Northern Cape Province.

3 EUREKA WIND ENERGY FACILITY

3.1 Project Location

The proposed Eureka Wind Energy Facility (WEF) will be located approximately 5km north-east of Copperton, within the Siyathemba Local Municipality of the Pixley ka Seme District Municipality in the Northern Cape Province. The proposed project is located on the following properties:

- Portion 8 of Nelspoortje No. 103
- Portion 9 of Nelspoortje No. 103
- Portion 3 of Blaauwbosch Poortje No. 66
- Remainder of Blaauwbosch Poortje No. 66

3.2 Wind Farm Technical details

The key technical details and infrastructure required is presented in the table

Table 3 Project Detail Eureka Wind Energy Facility

Project Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for the proposed project
Eureka WEF	To be announced	▪ Portion 8 of Nelspoortje No. 103 ▪ Portion 9 of Nelspoortje No. 103 ▪ Portion 3 of Blaauwbosch Poortje No. 66 ▪ Remainder of Blaauwbosch Poortje No. 66	• **60 wind turbines** with a total export capacity of up to 140MW. Turbines will have a hub height of up to 120m and a rotor diameter of up to 150m. • 132kV onsite Eureka IPP Substation • The turbines will be connected via **medium voltage cables** to the proposed 132kV onsite Eureka IPP Substation. • Internal **access roads** are proposed to be between 4m to 6m wide. • A temporary construction **lay down area.** • A hard standing area / platform per turbine. • The **operations and maintenance buildings**, including an on-site spares storage building, a workshop and an operations building. • **Fencing** (if required) will be up to 5m where required and will be either mesh or palisade.

3.3 Substation and Power Line Technical details

The overall objective of the project is to feed the electricity generated at the proposed Eureka Wind Energy Facility (WEF) into the National Grid.

The proposed project consists of the following main activities:

- Construction of 1 x 132kV substation (referred to as the “proposed Eureka substation”)
- Construction of 1 x 132kV power line from the proposed Eureka substation to one of the following potential connection points:
    a. Kronos Main Transmission Substation;
    b. Cuprum Substation; or
    c. Proposed Copperton Wind Substation.

The proposed power line will consist of a series of towers located approximately 200m to 250m apart. The type of power line towers which are being considered at this stage include self-supporting suspension monopole structures where the line is relatively straight and angle strain towers where the line deviates from zero degree with a large angle. The steel monopole tower type is between 18 and 25m in height. The height will vary based on the terrain, but will ensure minimum overhead line clearances with buildings and surrounding infrastructure. The exact location of the towers will be determined during the final design stages of the power line.

A power line corridor of approximately 500m wide is being proposed to allow flexibility when determining the final route alignment, however only a 31m wide servitude would be required for the proposed 132kV power line. As such, the 31m wide servitude would be positioned within the corridor.

Two alternative sites for the proposed Eureka substation will be assessed during the Basic Assessment. The size of the substation site will be approximately 150m x 150m.

3.4 Locality of entire Project Area Assessed in this Desktop PIA study

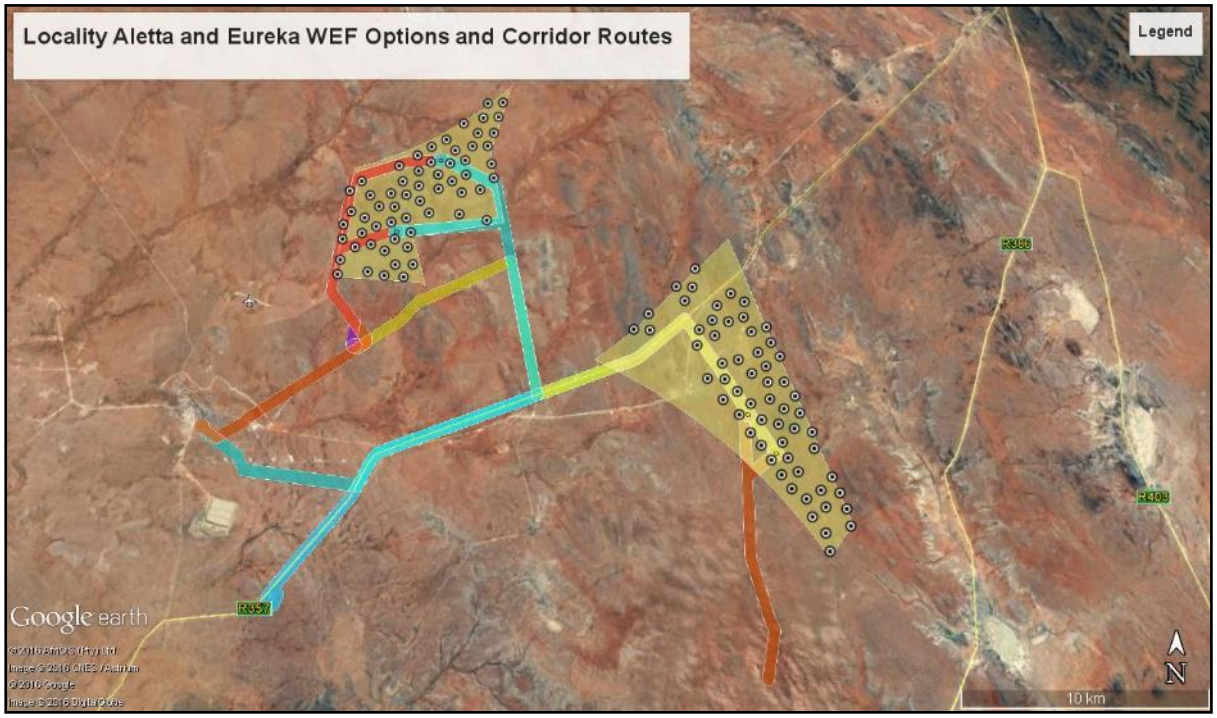


Figure 1 Locality Entire Study Area reviewed in Desktop PIA

4 GEOLOGY

The study area is underlain by presumably Mokolian aged Uitdraai Formation of the Brulpan Group Olifantshoek Supergroup, Carboniferous to Permian aged Dwyka Group, Karoo Supergroup and Quaternary aged Gordonia Formation of the Kalahari Group.

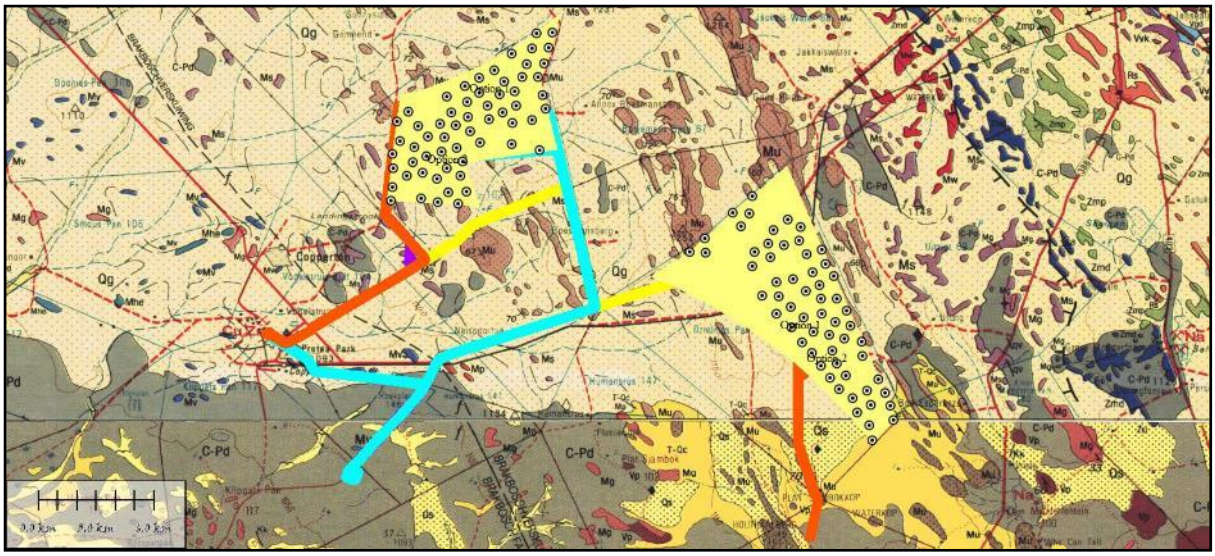


Figure 2 Geology of the Study Area. For Legends see Explanations below

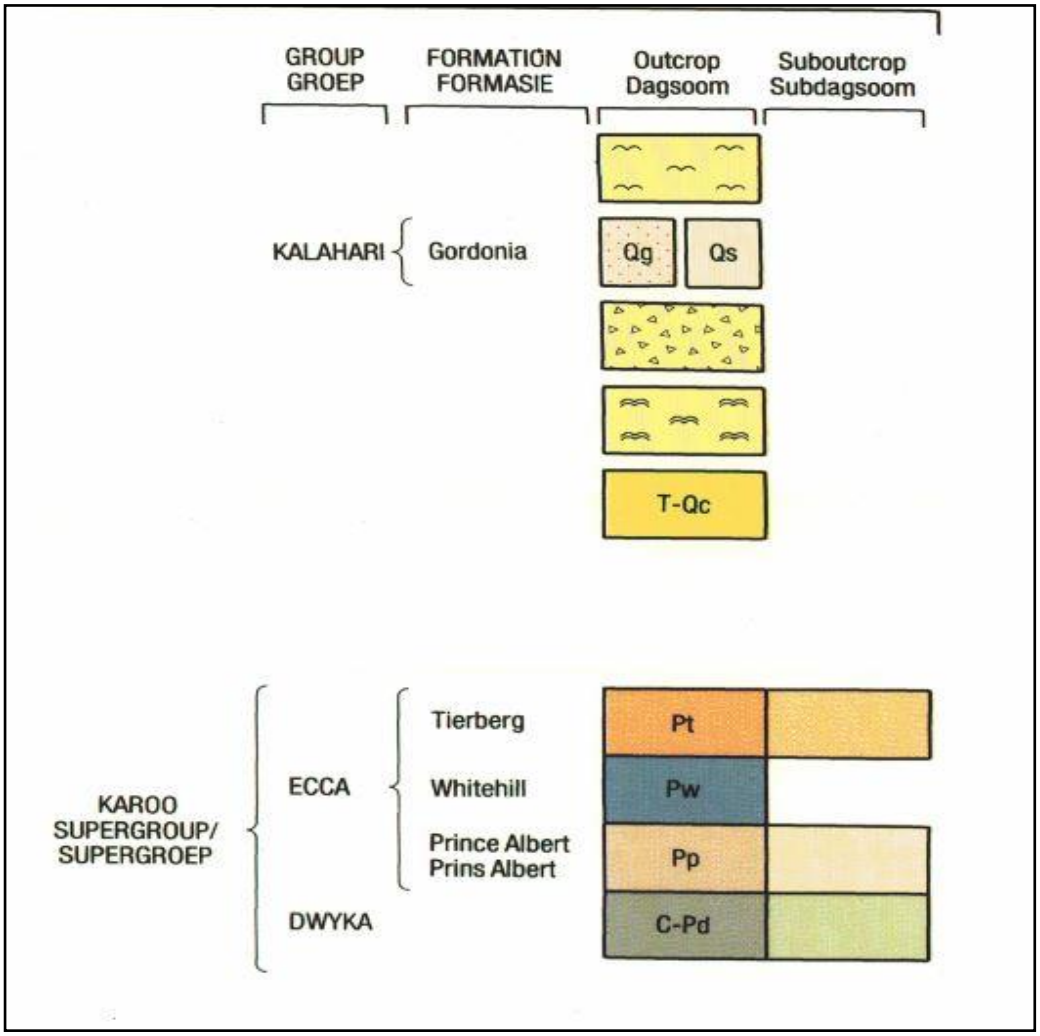
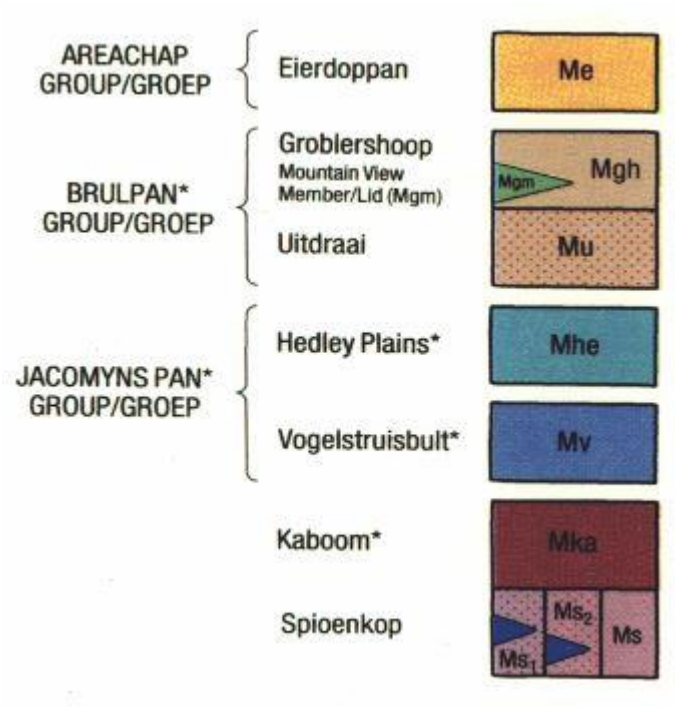


Figure 3 Legend Geology 1



4.1 Olifantshoek Supergroup

4.1.1 Brulpan Group

Uitdraai Formation

The Mokolian ged Uitdraai Formation is predominantly a light to dark grey banded to massive quartzite with haematite nodules in places and subordinate quartz-sericite schist (Johnson et al, 2009).

4.2 Karoo Supergroup

4.2.1 Dwyka Group

The Carboniferous to Permian aged Dwyka Group consists primarily of tillite, sandstone and shale, forming the prominent outcrops in the southern part of the study area (Johnson et al, 2009)

4.2.2 Kalahari Group

Gordonia Formation

The Quaternary aged Gordonia Formation underlies very large parts of the study area and consists predominantly of red coloured windblown sand as well as sand and sandy soils with calcrete that underlies the lower lying areas in the study area.

Fluvial gravels, sands, lacustrine and pan mudrocks, diatomite sand diatomaceous limestones, evaporites, consolidated to unconsolidated aeolian sands, pedocretes (especially calcrete). Late Cretaceous to Recent<90 Ma to 0 Ma.

4.3 Groundwater Related Features

A total of five historical spring sites and three potential fault-bounded groundwater aquifers are mapped in the study area. It is possible that more springs might be present and the HIA study must include mapping of all presently used groundwater points in the study area.

5 PALAEONTOLOGY OF THE AREA

5.1 Olifantshoek Supergroup

5.1.1 Bulpan Group

Uitdraai Formation

The Mokolian aged Uitdraai Formation have not been studied for fossils up to date and due to the age it was not expected to yield any fossils. Recent research however indicate that earlier, very primitive life forms could have existed during Mogolian times and albeit very difficult to see and normally only described during detailed academic work, the recording of any mico-fossis and trace fossils, including possible algal mat structures from the study are will contribute significantly to the National Heritage Estate of the Northern Province and South Africa.

5.2 Karoo Supergroup

5.2.1 Dwyka Group

Trace fossils have been recorded from the fine-grained shales of the Dwyka Group in KwaZulu-Natal (Linstrom, 1987; MacRae, 1999). All of the following could potentially be found in KwaZulu-Natal. Trackways, produced mostly by fish and arthropods (invertebrates), have been recovered in shales from the uppermost Dwyka Group. Other trace fossils include coprolites (fossilized faeces) of chondrichthyians (sharks, skates and rays).

Body fossils include aranaceous foraminifera and radiolarians (single-celled organisms), bryozoans, sponge spicules (internal support elements of sponges), primitive starfish, orthoceroid nautiloids (marine invertebrates similar to the living *Nautilus*), goniatite cephalopods (*Eoasinites* sp.), gastropods (marine snails such as *Peruvispira viperdorfensis*), bivalves (*Nuculopsis* sp., *Phestia* sp., *Aphanaia haibensis*, *Eurydesma mytiloides*), brachiopods (*Attenuatella* sp.) and palaeoniscoid fish such as *Namaichthys schroederi* and *Watsonichthys lotzi*.

Fossil plants have also been found, including lycopods (*Leptophloem australe*), moss, leaves and stems (possibly belonging to a proto-glossopterid flora). Fossil spores and pollens (such as moss, fern and horsetail spores and primitive gymnosperm pollens) as well as fossilized wood probably belonging to primitive gymnosperms have also been recorded from Dwyka deposits (MacRae, 1999; McCarthy and Rubidge, 2005).

5.3 Kalahari Group

5.3.1 Gordonia Formation

Palynomorphs, root casts (rhizomorphs / rhizoliths) and burrows (eg termitaria), rare vertebrate remains (mammals, fish, ostrich egg shell etc), diatoms, freshwater stromatolites, freshwater and terrestrial shells (gastropods, bivalves), ostracods, charophytes are all described from these deposits.

Fossils are mainly associated with ancient pans, lakes and river systems Palaeontology poorly studied. Basal Late Cretaceous gravels and lacustrine clays probably fossiliferous (bones, teeth, petrified wood, palynomorphs) but very. rarely exposed .Wide range of fossils can be present in these surface deposits, including mammalian bones and teeth, tortoise remains and ostrich egg shells.

6 GROUNDWATER HERITAGE SITES AND POTENTIAL AQUIFERS

The existing historic springs are associated with the Gordonia Formation and only one spring is clearly marked at a prominent associated fault zone. The three potential groundwater aquifers are associated with prominent fault zones in the study area. Any newly discovered groundwater resources must be mapped by the HIA team and recorded as Very Highly sensitive zones with at least no-go zones up to 500m from these sites within this study, mainly because the wind energy generators do not influence groundwater quality but if placed too close to the spring sites, associated activities during construction will influence the quality of the spring water and it is recommended that the layout be adopted to exclude at least 500m form these historic water points in the landscape.

7 PALAEONTOLOGICAL SENSITIVITY

The likely impact of the proposed development on local fossil heritage is determined on the basis of the palaeontological sensitivity of the rock units concerned and the nature and scale of the development itself, most notably the extent of fresh bedrock excavation envisaged (Figure 4). The different sensitivity classes used are explained in Table 1 above.

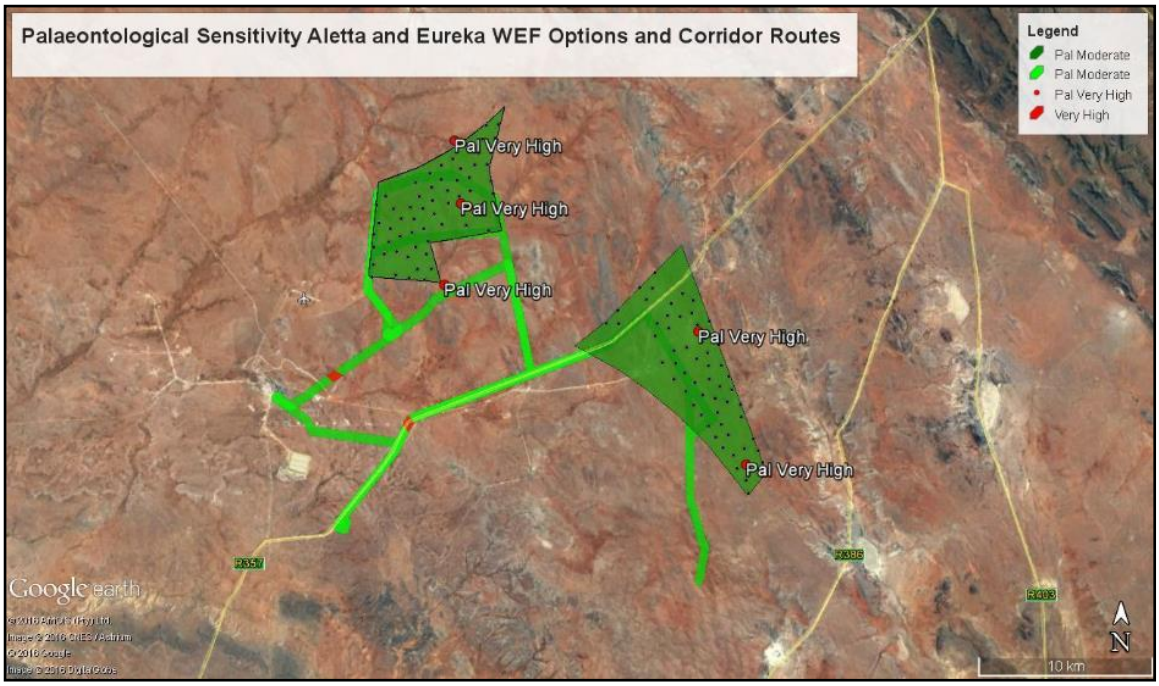


Figure 4: Palaeontological Sensitivity of the entire Study Area is presented. A Moderate sensitivity is allocated to all the geological formations except the five spring sites and three potential groundwater aquifers sites

The Mokolian aged Uitdraai Formation, Carboniferous to Permian aged Dwyka Group and Quaternary aged Gordonia Formation underlying all the alternative layouts for the Aletta as well as the Eureka WEF areas and the power line corridors are similarly rated for Palaeontological Impact. Exceptions are the five historic spring sites and three potential groundwater aquifers that are rated Very Highly sensitive for Palaeontological Heritage.

8 CUMULATIVE IMPACT ASSESSMENT FOR PALAEONTOLOGY

The study area forms part of a large area in South Africa where associated applications for Wind Energy Facilities are presently considered. Following this desktop assessment it is clear that, although a Moderate Sensitivity is allocated to the entire study area, most of the fossils expected are difficult to observe and most of the fossils will only be exposed during construction phases of the projects.

Cumulative effects will however be an important factor and the EAP must note specifically where groundwater aquifers can extend into different study areas and need to be assessed carefully to prevent adverse contamination of these historic watering points that are key to the survival of Man and animals in this dry region of South Africa.

Table 3 Farms and areas where WEF's are planned in the area surrounding the study area

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
The Badudex Solar Project	14/12/16/3/3/2/546	EIA underway	Budadex (Pty) Ltd	74 MW	Portion 1 of the Farm Volgelstruis Bult No 104
The Moiblox Solar Project	14/12/16/3/3/2/547	EIA underway	Moiblox (Pty) Ltd	75 MW	Remainder of the Farm Bosjesmansberg

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
Garob Wind Energy Facility Project	14/12/16/3/3/2/279	Awarded Preferred Bidder Status.	Garob Wind Farm (Pty) Ltd	140 MW	Portion 5 of the Farm Nelspoortje No. 103
Copperton Wind Energy Facility	12/12/20/2099	Awarded Preferred Bidder Status.	Plan 8 Infinite Energy (Pty) Ltd	140 MW	Portion 4 of the Farm Nelspoortje No. 103; and Portion 7 of the Farm Nelspoortje No. 103.
Humansrus Solar PV Energy Facility 1 and 2	14/12/16/3/3/2/707 14/12/16/3/3/2/708	Authorised	Humansrus Solar PV Energy Facility 1 (Pty) Ltd	75 MW	Remainder the Farm Humansrus No. 147
Humansrus Solar PV Energy Facility 2 and 3	14/12/16/3/3/2/888 14/12/16/3/3/2/887	EIA underway	Humansrus Solar PV Energy Facility 3/4 (Pty) Ltd	75 MW	Remainder the Farm Humansrus No. 147
Mierdam Solar Photovoltaic Facility	12/12/20/2320/2	Authorised	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd	75 MW	Portion 1 of the Farm Kaffirs Kolk No. 118
Platsjambok East and West Solar Photovoltaic Facility	12/12/20/2320/4 12/12/20/2320/5	Authorised	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd	75 MW	Remainder of the Farm Platsjambok 102
Helena Solar 1, 2, and 3 PV energy facility	14/12/16/3/3/2/765 14/12/16/3/3/2/766 14/12/16/3/3/2/767	EIA underway	BioTherm Energy (Pty) Ltd	75 MW	Portion 3 of the Farm Klipgats Pan No. 117
Renewable Energy Farm near Prieska	14/12/16/3/3/2/608 14/12/16/3/3/2/609	EIA underway	NK Energie (Pty) Ltd	UNKNOWN	Portion 3 of the Farm Hedley Plains No. 64 and Portion 5 of the Farm Doonies Pan No. 106
Photovoltaic Power Generation Facility near Prieska	12/12/20/1722	Awarded Preferred Bidder Status in REIPPP Window 1.	Mulilo Renewable Energy Solar PV Prieska (RF) (Pty) Ltd	19.9 MW	Portion 1 of the Farm Volgelstruis Bult No 104
PV Energy Plant near Copperton	12/12/20/2502	Authorised	Mulilo Renewable Energy (Pty) Ltd	100 MW	Portion 1 of the Farm Volgelstruis Bult No 104
Mulilo Sonnedix Prieska PV	12/12/20/2503	Awarded Preferred Bidder Status in REIPPP Window 3. Currently being constructed.	Mulilo Sonnedix Solar Enterprises (Pty) Ltd	75 MW	Remainder of the Farm Hoekplaas No. 146
Mulilo Prieska PV	12/12/20/2501	Awarded Preferred Bidder Status in REIPPP Window 3. Currently	Mulilo Prieska PV (Pty) Ltd	75 MW	Portion 4 of the Farm Klipgats Pan No. 117

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Capacity	Farm Details
		being constructed.			
PV 2, PV 3, PV 4, PV 5 and PV 7 Energy Plants on the Farm Klipgats Pan	14/12/16/3/3/2/486 14/12/16/3/3/2/487 14/12/16/3/3/2/488 14/12/16/3/3/2/489 14/12/16/3/3/2/491	EIA underway	Mulilo Renewable Energy (Pty) Ltd	75 MW	Portion 4 of the Farm Klipgats Pan No. 117
PV 2, PV 3, PV 4, PV 6, PV 7, PV 11 and PV 12 Solar Energy Plants on the Farm Hoekplaas	14/12/16/3/3/2/493 14/12/16/3/3/2/494 14/12/16/3/3/2/495 12/12/16/3/3/2/497 14/12/16/3/3/2/498 14/12/16/3/3/2/502 14/12/16/3/3/2/503	EIA underway	Mulilo Renewable Energy (Pty) Ltd	75 MW	Remainder of the Farm Hoekplaas No. 146
Proposed Aletta Wind Energy Facility	14/12/16/3/3/2/945	EIA underway	BioTherm Energy (Pty) Ltd	140MW	Portion 1 of Drielings Pan No.101 Portion 2 of Drielings Pan No.101 Portion 3 of Drielings Pan No.101 Remainder of Drielings Pan No.101

9 COMPARATIVE ASSESSMENT OF ALTERNATIVES – ALETTA WEF

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

Alternative	Preference	Reasons (incl. potential issues)
SUBSTATION and O & M Building ALTERNATIVES		
Option 1	NO PREFERENCE	The areas are all underlain by Moderately sensitive Palaeontological formations and the proviso is that the development must be away from existing Groundwater Resources, most notably historic spring sites and the ECO must work closely with the HIA specialist to ensure that all new, chance finds of fossils be recorded during the construction phase of the project
Option 2	NO PREFERENCE	The areas are all underlain by Moderately sensitive Palaeontological formations and the proviso is that the development must be away from existing Groundwater Resources, most notably historic spring sites and the ECO must work closely with the HIA specialist to ensure that all new, chance finds of fossils be recorded during the construction phase of the project

10 CONCLUSION AND RECOMMENDATIONS

The Aletta Wind Energy Facility (WEF) will be located approximately 17km east of Copperton and the alternative Eureka Wind Energy Facility (WEF) will be located approximately 5km north-east of Copperton, with associated corridors for Power Lines, within the Siyathemba Local Municipality of The Pixley Ka Seme District Municipality in The Northern Cape Province.

The study area is underlain by presumably Mokolian aged Uitdraai Formation of the Brulpan Group Olifantshoek Supergroup, Carboniferous to Permian aged Dwyka Group, Karoo Supergroup and Quaternary aged Gordonia Formation of the Kalahari Group.

The allocation of a Moderate sensitivity for Palaeontological Heritage to the entire study area except the five historic spring sites and three potential groundwater aquifer sites, indicates that the EAP must be aware of the seven Very High point sources of Groundwater Heritage and it is recommended for practical reasons that the layout of the distribution of the wind generators be moved away from the five spring sites with a “No-Go” zone of at least 500m from each of the sites. The linear potential groundwater resources along the power line corridors are indicated as sites where activity of the contractors must be monitored especially for prevention of contamination of groundwater and the two zones must be recorded as potentially Very High sensitive zones, albeit possibly not visible to the naked eye in the study area.

Although the Uitdraai Formation can provide new information on micro-fossils of Mokolian age, these fossils are very difficult to identify and are more of academic interest. Both the Dwyka Group and Gordonia Formations are however known for some very significant fossil finds and although scarce, the fossils can contribute significantly to our understanding of depositional environments during the Carboniferous, Permain and Quaternary ages in South Africa. It is recommended that the EAP and the ECO be informed of these fossils assemblages known from these groups of rocks and to be aware of the possible presence of the fossils during exposure of rock during the construction phase of this project.

Recommendations:

1. The EAP as well as the ECO for this project must be made aware of the fact that sediments of the Uitdraai Formation, Bulpan Group, can contain significant micro-fossil remains, albeit mostly algal structures. The shale of the Dwyka Group can contain significant fossils and it is advisable that a Palaeontologist be appointed at the start of the construction in areas underlain by this group, to visit the site initially to ensure that no significant fossils are damaged. The Gordonia Formation is mainly windblown sand but if the EAP, ECO and/or HIA specialist observe any suspiciously looking structures during excavation into these rock types, the Palaeontologist must be informed and at least one site visit is recommended to ensure that no fossils are damaged.
2. The five historic spring sites indicated on the Palaeontological sensitivity map and database is of extreme importance as Geological Heritage appoints and these points must for at least 500m around them be declared “No-Go” zones. The three linear potential groundwater aquifers need to be recorded and the EAP and ECO must note these areas as highly sensitive for groundwater contamination.

The recommendations must be included in the EMPr of the project.

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11 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the University of Port Elizabeth (Nelson Mandela Metropolitan University) (1996) and the National Diploma in Nature Conservation from Technicon RSA (the University of South Africa) (1989). He specialises in research on South African Permian and Triassic sedimentology and macrofossils with an interest in biostratigraphy, and palaeoecological aspects. He has extensive experience in the locating of fossil material in the Karoo Supergroup and has more than 20 years of experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the southern, western, eastern and north-eastern parts of the country. His publication record includes multiple articles in internationally recognized journals. Dr Groenewald is accredited by the Palaeontological Society of Southern Africa (society member for 25 years).

12 DECLARATION OF INDEPENDENCE

I, Gideon Groenewald, declare that I am an independent specialist consultant and have no financial, personal or other interest in the proposed development, nor the developers or any of their subsidiaries, apart from fair remuneration for work performed in the delivery of palaeontological heritage assessment services. There are no circumstances that compromise the objectivity of my performing such work.

Dr Gideon Groenewald

Geologist