PROPOSED CONSTRUCTION OF AN ACCESS ROAD FOR THE DWARSRUG WIND FARM, NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE.

Phase 1 – Heritage Impact Assessment

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Declaration of Independence

- I, Ilan Smeyatsky, declare that –
- General declaration:
- I act as the independent heritage practitioner in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting heritage impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

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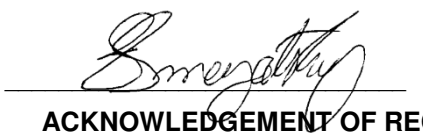
SIGNATURE: 

ACKNOWLEDGEMENT OF RECEIPT

Report Title	***PROPOSED CONSTRUCTION OF AN ACCESS ROAD FOR THE DWARSRUG WIND FARM, NEAR LOERIESFONTEIN, NORTHERN CAPE PROVINCE***		
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SIGNATURE: _____

The Heritage Impact Assessment Report has been compiled considering the National Environmental Management Act (Act No. 107 of 1998) (NEMA): Appendix 6 of the Environmental Impact Assessment (EIA) Regulations of 2014 (as amended) requirements for specialist reports as indicated in the table below.

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Relevant section in report**
1.(1) (a) (i) Details of the specialist who prepared the report	Page 2 of Report – Contact details and company
(ii) The expertise of that person to compile a specialist report including a curriculum vita	Section 1.2 – refer to **Appendix D**
(b) A declaration that the person is independent in a form as may be specified by the competent authority	Page ii of the report
(c) An indication of the scope of, and the purpose for which, the report was prepared	Section 1.1
(cA) An indication of the quality and age of base data used for the specialist report	Section 1.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.1
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 3.6
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Section 3.6 and **Appendix B**
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 3.6 and 5
(g) An identification of any areas to be avoided, including buffers	Section 5
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 3.6
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment	Section 5
(k) Any mitigation measures for inclusion in the EMPr	Section 5
(l) Any conditions for inclusion in the environmental authorisation	Section 5
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5
(n)(i) A reasoned opinion as to whether the proposed activity, activities or portions thereof should be authorised and	Section 5 and 6

(n)(iA) A reasoned opinion regarding the acceptability of the proposed activity or activities; and	
(n)(ii) If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 6
(o) A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. A public consultation process was handled as part of the EIA and EMP process.
(p) A summary and copies if any comments that were received during any consultation process	Not applicable. To date not comments regarding heritage resources that require input from a specialist have been raised.
(q) Any other information requested by the competent authority.	Not applicable.
(2) Where a government notice by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Refer to next section
National Heritage Resources Act – s38(3)	
(a) The identification and mapping of all heritage resources in the area affected;	Section 3.5
(b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;	Section 3.5
(c) an assessment of the impact of the development on such heritage resources;	Section 5
(d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;	Section 5
(e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;	Part of BAR – refer to BAR
(f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and	Section 5
(g) plans for mitigation of any adverse effects during and after the completion of the proposed development.	Section 6

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by Savannah Environmental (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) for the construction of an access road on the Dwarsrug Wind Farm, in the Loeriesfontein area, Northern Cape Province. Two alternatives were assessed.

Heritage resources are unique and non-renewable and as such any impact on such resources must be seen as significant. This report focusses specifically on the newly proposed access road, other management measures as listed and required in other HIA's conducted in the area must still be implemented for other heritage features identified in the larger Loeriesfontein area.

- Archaeology

The archaeological resources identified within the proposed development site comprise a small number of Stone Age surface artefact scatters. These are primarily from the Later Stone Age (LSA), although Middle Stone Age (MSA) material was also identified. All these artefact assemblages occur in heavily deflated and eroded areas, so their scientific potential and heritage significance is somewhat lowered. Based on findings from a range of other heritage reports in the area, these types of sites are to be expected in this region.

Even though heritage features were detected within the development area, serious mitigation measures will not be required.

Recommendations:

- *Develop a chance finds protocol for the mitigation of possible heritage finds, to be implemented as part of the EMP for the construction phase of the project.*
- *If any artefacts are identified during construction the chance finds protocol must be implemented*

- Palaeontology

The Dwarsrug Study Area is mainly underlain by Permian aged rocks of the Ecca Group, Jurassic aged dolerite sills and Quaternary aged dolerite scree, pan sediments and alluvium.

The very high and high fossiliferous potential of the Ecca Group strata warrants an allocation of a High palaeontological sensitivity to the areas underlain by the rocks of these formations. The pan sediments and alluvium is allocated a Moderate palaeontological sensitivity whereas areas underlain by dolerite scree and dolerite are allocated Low and Very Low Palaeontological sensitivities.

Recommendations:

- *The EAP as well as the ECO for this project must be made aware of the fact that the Ecca Group sediments contains significant fossil remains, albeit mostly trace fossil assemblages. Several types of fossils have been recorded from this Group in the Karoo Basin of South Africa, with special mention of the very important Whitehill Formation. The Whitehill Formation outcrops are however very restricted in this study area.*
- *In areas that are allocated a Very High and High Palaeontological sensitivity and specifically where deep excavation into bedrock is envisaged (following the geotechnical investigation), or where fossils are recorded during the geotechnical investigations, a qualified palaeontologist must be appointed to assess and record fossils at specific footprints of infrastructure developments (Phase 1 PIA).*
- *If significant fossil finds (e.g. vertebrate teeth, bones, burrows, petrified wood) are recorded during excavations for infrastructure such as road developments, the palaeontologist must apply for a collection permit to collect the fossils according the SAHRA specifications.*
- *These recommendations should form part of the EMP of the project.*

- General

In the event that heritage resources are discovered during site clearance, construction activities must stop, and the relevant heritage authority must be contacted in order to advise on the necessary actions to take. Generally, a qualified archaeologist must be appointed to evaluate the situation and make recommendations on mitigation measures.

The overall impact of the access road development on heritage resources is seen as acceptably low after the recommendations have been implemented and therefore, impacts can be mitigated to acceptable levels and the project may be authorised from a heritage perspective.

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TERMINOLOGY AND ABBREVIATIONS

Archaeological resources

This includes:

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

Cultural significance

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

Development

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

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

Early Stone Age

The archaeology of the Stone Age between 700 000 and 3 300 000 years ago.

Fossil

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

Heritage

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

Heritage resources

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

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

Holocene

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

Late Stone Age

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

Late Iron Age (Early Farming Communities)

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

Middle Stone Age

The archaeology of the Stone Age between 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.

Table 1 – List of abbreviations used in this report

Abbreviations	Description

Abbreviations	Description
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
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
LCTs	Large Cutting Tools
LSA	Late 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 Authority
PSSA	Palaeontological Society of South Africa
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

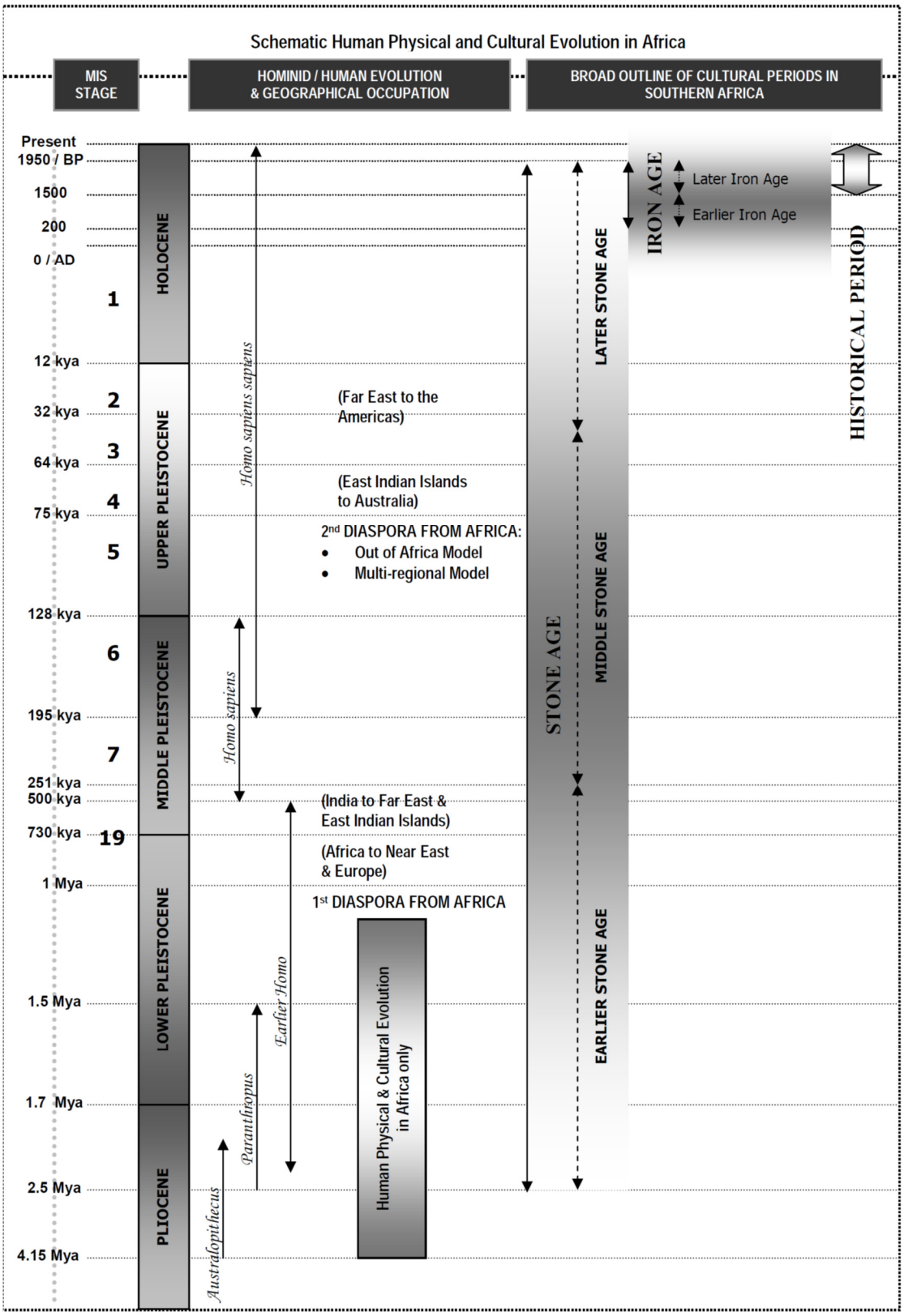

Figure 1 – Human and Cultural Time line in Africa (Morris, 2008)

1 INTRODUCTION

PGS Heritage (Pty) Ltd was appointed by Savannah Environmental (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) for the construction of an access road on the Dwarsrug Wind Farm, in the Loeriesfontein area, Northern Cape Province. Two alternatives were assessed.

1.1 Scope of the Study

The aim of the study was to identify possible heritage sites and finds that may occur in the proposed study area. The HIA aims 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 Specialist Qualifications

This HIA Report was compiled by PGS.

The staff at PGS has a combined experience of nearly 40 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

Mr. Ilan Smeyatsky, graduated with his Master's degree (MSc) in Archaeology; is registered as a Professional Archaeologist with the Association of Southern African Professional Archaeologists (ASAPA) and is accredited as a Field Supervisor.

Mr. Henk Steyn, heritage specialist and project archaeologist, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist with CRM accreditation. He has been involved in numerous heritage related projects since 1998.

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

1.3 Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites. As such, should any

heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

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

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 – Regulation 326 (7 April 2017)
    - Basic Environmental Assessment (BEA) – Appendix 1 s (2)(d)
    - Environmental Scoping Report (ESR) – Appendix 1 s (3)(h)(iv) and Appendix 2 s(2)(g)(iv)
    - Environmental Impact Assessment (EIA) – Appendix 3 s (3)(h)(iv)/
- National Heritage Resources Act (NHRA) Act 25 of 1999
    - Protection of Heritage Resources – Sections 34 to 36; and
    - Heritage Resources Management – Section 38
- Mineral and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
    - Section 39(3)

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. This study falls under s38(8) and requires comment from the relevant heritage resources authority, namely SAHRA.

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Locality

The project area is located northeast of the town of Loeriesfontein, within the Namakwa District Municipality, Northern Cape Province. The proposed access roads are approximately 47km northeast of Loeriesfontein and 81km from Brandvlei (**Figure 2**). The project proposes the development of an 11km access road to the existing Dwarsrug WEF.

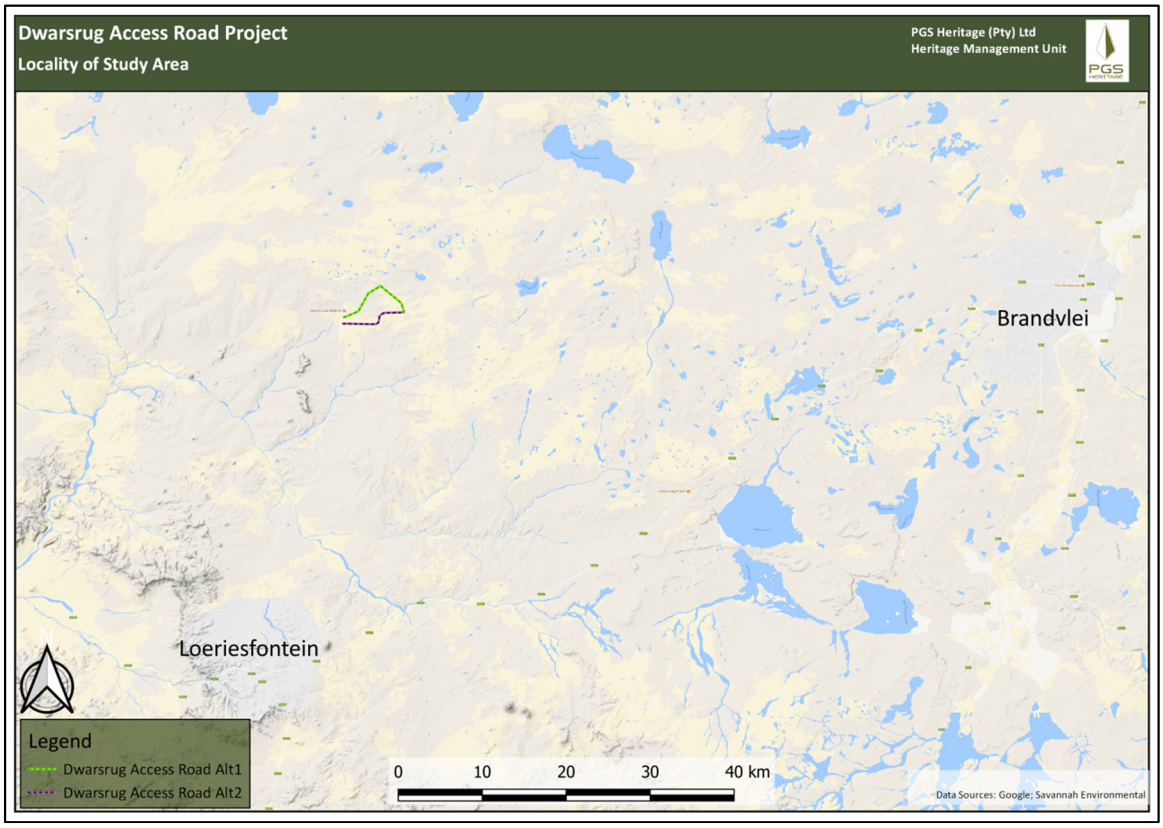

Figure 2 – Locality of study area

2.2 Technical Project Description

The following brief project description for the project has been provided by Savannah Environmental:

South African Mainstream Renewable Power Developments (Pty) Ltd is proposing the construction of an Access Road for the Dwarsrug Wind Energy Facility near Loeriesfontein, Northern Cape Province.

Two alternative access roads which will be assessed are proposed, including:

- Alternative 1 - Gravel road from Granaatboskolk to the project site (approx. 11km); (PREFERRED ALTERNATIVE)
- Alternative 2 - Gravel road from Granaatboskolk to the project site (approx. 8km).

The proposed access road is approximately 60km north of Loeriesfontein, in the Northern Cape Province, and falls within the jurisdiction of the Hantam Local Municipality and within the greater Namakwa District Municipality. The potentially affected properties will include the following:

- Remainder of the Farm Brakpan No. 212;
- Stinkputs No. 229;
- Portion 1 of the Farm Aan de Karee Doorn Pan No. 213;
- Remainder of the Farm Sous No. 226; and
- Narosies No. 228.

At present, untarred roads are planned for a maximum of 12m width, which will be rehabilitated to approximately 6 to 8m wide road following construction (and the agricultural use and zoning thereof restored following decommissioning). The planned power purchasing agreement and project life cycle (unless extended at a later point in time), will most likely be 20 years, for the entirety of which the proposed access road will be actively used (i.e. operational lifetime of approximately 20 years).

Laydown areas required for the project will be identical to those for the already approved Dwarsrug WEF, and as such no additional laydown, storage or site camp facilities will be employed or required for this component of the project – i.e. the only novel infrastructure proposed is the actual road itself. Alternative 1, the preferred alternative, is approximately 11km long, while alternative 2 is approximately 8km long.

The construction period for the proposed access road is approximately 3 months, which will need to be wholly completed to enable access provision for the construction of the associated Dwarsrug WEF. The WEF has a proposed, approved, 132kV steel monopole evacuation power line that would be connecting the onsite substation at the Dwarsrug WEF to the Helios Substation, for connection and further distribution into the national grid. The preferred road alternative occurs along that route, which coincides partially with the existing Eskom 400kV lines to and from Helios Substation. The proposed access road will thus be adjacent this Eskom service road for a moderate portion of the proposed road length. While negotiations are ongoing regarding the potential thereof, the applicant aim to combine this proposed road (for which this Basic Assessment process is being submitted), and the existing Eskom distribution line service road. This road will then service both the Eskom power line and the Dwarsrug WEF traffic for the portion where they align. Should combining the road with the Eskom service road not be possible, the road will be constructed immediately adjacent the existing Eskom service road, with sufficient space provided to avoid the Eskom road and power line servitude.

The proposed access road will service the construction phase traffic for the associated Dwarsrug WEF. Thereafter it will be reduced to an approximately 6 to 8m wide road which will be utilised

during the operation phase. Topsoil material will be removed and stockpiled in an appropriate manner adjacent the road, where it is sufficiently far away from the road to not prove an obstacle during operation of the road, or hampers the road safety. This topsoil will, as far as possible, be utilised for the rehabilitation of the road at both at the end of construction and decommissioning. Solid wastes produced during the construction phase of the road will be either utilised in the construction phase of the associated Dwarsrug WEF, or collected on site and disposed of at a licenced disposal facility. Should the amount of available construction fill material be insufficient, commercially sourced material may be utilised to make up the shortfall, or a separate, approved borrow pit will be utilised (to be authorised under a separate process).

The precise method statements for the development of the road will be determined prior to construction following the completion of engineering assessments and design, and contractor appointment, however the following general activities may be involved:

i. Staking;
ii. Clearing and grubbing;
iii. Subgrade development;
iv. Fill and cut operations (if necessary);
v. Compaction;
vi. Levelling and grading; and
vii. Signage or markings (if necessary).

The following machinery may likely be employed during construction:

i. Bulldozers;
ii. Front end Loader;
iii. Hydraulic excavators;
iv. Dump trucks or scrapers; and
v. Farm tractors.

The road will be suitably maintained, in line with municipal/provincial requirements or approvals, during both the construction and operation phase. Any waste material from the road construction will firstly be reused, where possible, in the larger construction of the Dwarsrug WEF, or alternatively disposed to the nearest licensed waste disposal site.

3 CURRENT STATUS QUO

3.1 Site Description

The study area is highly eroded, poorly vegetated (**Figure 3**) and is characterised by low rises over large parts of the study area **(Figure 4**). Although the area is disturbed, this is predominantly due to natural processes. The area consists of Nama Karoo Biome vegetation, which is

dominated by low growing shrubs adapted to arid and rocky conditions (**Figure 4**). Overall, the site was accessible by foot and site detection visibility was good.

Figure 3 – View of the highly eroded and poorly vegetated study area floor

Figure 4 – View of the Nama Karoo Biome type vegetation and low rises that characterise the study area

3.2 Archival findings

The archival research focused on available information sources that were used to compile a background history of the study area and surrounds. This data then informed the possible heritage resources to be expected during field surveying.

3.2.1 South African Heritage Resources Information System (SAHRIS)

A scan of SAHRIS has revealed the following studies conducted in and around the study area of this report:

- MORRIS, D. 2007. Archaeological Specialist input with respect to the upgrading railway infrastructure on the Sishen-Saldanha ore line in the vicinity of Loop 7a near Loeriesfontein. McGregor Museum.
- FOURIE, W. 2011. Heritage Impact Assessment for the proposed Solar Project on the farm Kaalspruit, Loeriesfontein. PGS Heritage and Grave Relocation Consultants.
- ALMOND, J.E. 2011. Palaeontological Desktop Study for the Proposed Mainstream Wind Farm Near Loeriesfontein, Namaqua District Municipality, Northern Cape Province.
- VAN SCHALKWYK, J. 2011. Heritage Impact Assessment for the proposed establishment of a wind farm and PV facility by Mainstream Renewable Power in the Loeriesfontein Region, Northern Cape Province.
- VAN DER WALT, J. 2012. Archaeological Impact Assessment for the proposed Hantam PV Solar Energy Facility on the farm Narosies 228, Loeriesfontein, Northern Cape Province.

- WEBLEY, L & HALKETT, D. 2012. Heritage Impact Assessment: Proposed Loeriesfontein Photo-Voltaic Solar Power Plant on Portion 5 of the Farm Klein Rooiberg 227, Northern Cape Province.
- MORRIS, D. 2013. Specialist Input for the Environmental Basic Assessment and Environmental Management Program for the Khobab Wind Energy Facility: Power Line Route Options, Access Road and Substation Positions.
- ORTON, J. 2014. Heritage Impact Assessment for the proposed re-alignment of the authorized 132kV Power Line for the Loeriesfontein 2 WEF, Calvinia Magisterial District, Northern Cape.

Although the study conducted by Morris (2007) have indicated minimal finds of archaeological sites near the upgrade of Loop 7A of the Sishen-Saldanha ore line to the north of the study area, discussions with local framers have indicated the occurrence of some archaeological sites.

Morris (2010) notes that previous studies have indicated that substantial MSA scatters is fairly uncommon in the Bushmanland/Namaqualand areas. While herder sites where more limited to sheltered and dune areas close to water sources such as pans and rivers.

The HIA's (Fourie, 2011; Van Schalkwyk, 2011; Webley & Halkett, 2012 and Orton, 2014) and the AIA's (Morris, 2007; Van der Walt, 2012 and Morris, 2013), have added to the body of work conducted in the area since the observations of Beaumont et al. (1995), that "thousands of square kilometres of Bushmanland area covered by a low density lithic scatter".

Orton (2014) notes that previous studies in the vicinity of the current study area, have found and assessed archaeological material dating to the early (ESA), Middle (MSA) and Later (LSA) Stone Ages.

3.3 Archaeological background

3.3.1 Earlier Stone Age (300 000 – 3.3 million years Before Present/BP)

The Northern Cape Province has a well-documented Earlier Stone Age sequence, most notably from Vaal River Basin sites such as Canteen Kopje (Beaumont & McNabb 2000; McNabb 2001; Beaumont 2004; McNabb & Beaumont 2011a, 2011b; Chazan *et al.* 2013; Leader 2013) and Rietputs (Gibbon *et al.* 2009; Leader 2009), along with deposits from pan sites like Kathu Pan (Wilkins & Chazan 2012; Wilkins *et al.* 2015) and cave sites like Wonderwerk Cave (Chazan *et al.* 2008; Beaumont 2011; Chazan *et al.* 2012; Chazan 2015).

The earliest artefacts from the Earlier Stone Age are produced during the Oldowan. Although the Lomekwian is an earlier industry, found elsewhere in Africa dating to ~3.3 million years ago, it is not relevant here as it does not occur in southern Africa. The Oldowan is a primarily flake and core based industry, and in the Northern Cape it is known from two sites: Canteen Kopje and

Wonderwerk Cave, dating to around 2 million years ago. Following the Oldowan is the Acheulean, beginning at around ~1.5 million years ago, with notable assemblages occurring at all of the Northern Cape sites. This technology is characterised by the presence of Large Cutting Tools (LCTs), in the form of hand axes, cleavers and occasional picks. These are tools that can either be unifacial, partly bifacial or bifacial, and they are important tools that would have been used to perform a range of subsistence based activities during the Acheulean. Occurring with these LCTs is a very important form of core production that becomes more prevalent during later periods of the Stone Age: Prepared Core Reduction. A local variant of this technology, the Victoria West Industry, occurs specifically at Canteen Kopje and it has been dated to >1 million years (Li *et al.* 2017). This type of reduction illustrates that stone cores were reduced in ways to attain predetermined flake blanks of specific shapes and sizes. In addition, this core reduction prolongs the usability of the core as core convexities are continually maintained throughout the process of flake removal. Another notable variant of the Achuelean is the final/Late ESA Fauresmith Industry, now defined from Canteen Kopje. This regional industry, dating to around ~300/350 million years, is often described as a transitional industry between the ESA and the MSA, given that it has artefacts that are characteristic of both periods. However, at Canteen Kopje it is now clear that this is a highly variable form of technology that appears geared towards site specific needs. Fauresmith assemblages from Kathu Pan, showing the highly systematic use of blade cores for blade production, are completely absent from the Fauresmith assemblage at Canteen Kopje and thus illustrate this variability in technology.

3.3.2 Middle Stone Age (30 000 – 300 000 BP)

Notable early MSA assemblages occur at these same sites in the Northern Cape, save for Rietputs, and these contain artefacts that are characteristic of this period: prepared cores, points and blades. During this period the use of prepared core reduction is extremely prevalent and this is used to increase core reduction efficiency, such that predetermined flakes and blades can be manufactured. This phase of stone tool development is associated with modern humans and complex cognition, and elsewhere in South Africa MSA sites provide some of the earliest evidence for ritual symbolism.

3.3.3 Later Stone Age (30 000 BP – recent times)

The Later Stone Age (LSA) is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths. No Later Stone Age sites are known in the direct vicinity of the study area, although a small LSA assemblage has been reported at Canteen Kopje (Forssman et al. 2010).

3.3.4 Rock Art

By the beginning of the Later Stone Age, human behaviours were undoubtedly modern (Huffman 2005). Uniquely human traits, such as rock art and purposeful burials with ornaments, became regular practice (Huffman 2005). These people were most likely the ancestors of the San, who are well known their fine-lined rock art and rock engravings. Engravings occur at Wildebeestkuil, near to Kimberley, and near to Britstown at Keurfontein, Wilde Als Put and Pienaars Pan in the Northern Cape (Morris 1988; Beaumont & Vogel 1989).

3.3.5 Iron Age Sequence

In the northern regions of South Africa at least three settlement phases have been distinguished for early prehistoric agropastoralist settlements during the Early Iron Age (EIA). Diagnostic pottery assemblages can be used to infer group identities and to trace movements across the landscape. The first phase of the Early Iron Age, known as Happy Rest (named after the site where the ceramics were first identified), is representative of the Western Stream of migrations, and dates to AD 400 - AD 600. The second phase of Diamant is dated to AD 600 - AD 900 and was first recognized at the eponymous site of Diamant in the western Waterberg. The third phase, characterised by herringbone-decorated pottery of the Eiland tradition, is regarded as the final expression of the Early Iron Age (EIA) and occurs over large parts of the North West Province, Northern Province, Gauteng and Mpumalanga. This phase has been dated to about AD 900 - AD 1200. These sites are usually located on low-lying spurs close to water (Coetzee 2015).

The Late Iron Age (LIA) settlements are characterised by stone-walled enclosures situated on defensive hilltops c. AD 1640 - AD 1830). This occupation phase has been linked to the arrival of ancestral Northern Sotho, Tswana and Ndebele (Nguni–speakers) in the northern regions of South Africa with associated sites dating between the sixteenth and seventeenth centuries AD. The terminal LIA is represented by late 18th/early 19th century settlements with multichrome Moloko pottery commonly attributed to the Sotho-Tswana. These settlements can in many instances be correlated with oral traditions on population movements during which African farming communities sought refuge in mountainous regions during the processes of disruption in the northern interior of South Africa, resulting from the so-called difaqane (or mfecane) (Coetzee 2015).

Despite the widespread occurrence of the Iron Age sequence across the northern portions of South Africa, Iron Age remains south of the Orange River moving into the Northern Cape, is noticeably sparse (Humphreys 1976; Humphreys 1988). Humphreys (1977) suggests that the absence of Iron Age occupation in this part of the country is largely due to the falloff of higher rainfall isohyets in the farther south-west portion of the country. Considering that Iron Age peoples were farmers, they were greatly influenced by climatic factors and were most likely deterred by the arid conditions of the Cape (Humphreys 1977). Another possibility for their

absence in the archaeological record could simply be attributed to the lack of Iron Age research conducted in this part of South Africa (Humphreys 1977).

Type R Settlements:

Humphreys (1988) claims that the stone wall settlements found on the southernmost frontier of the southern African Iron Age occupation, having been termed the Type R Settlements, were inhabited by peoples with a hunter-gatherer/herder economy. He argues that through interactions with Iron Age farmers to the north, these people picked up on Iron Age traditions such as ceramic production (that was half-way between Later Stone Age and Iron Age ceramic traditions), sheep and cattle herding as well as stone wall settlement construction (Humphreys 1988).

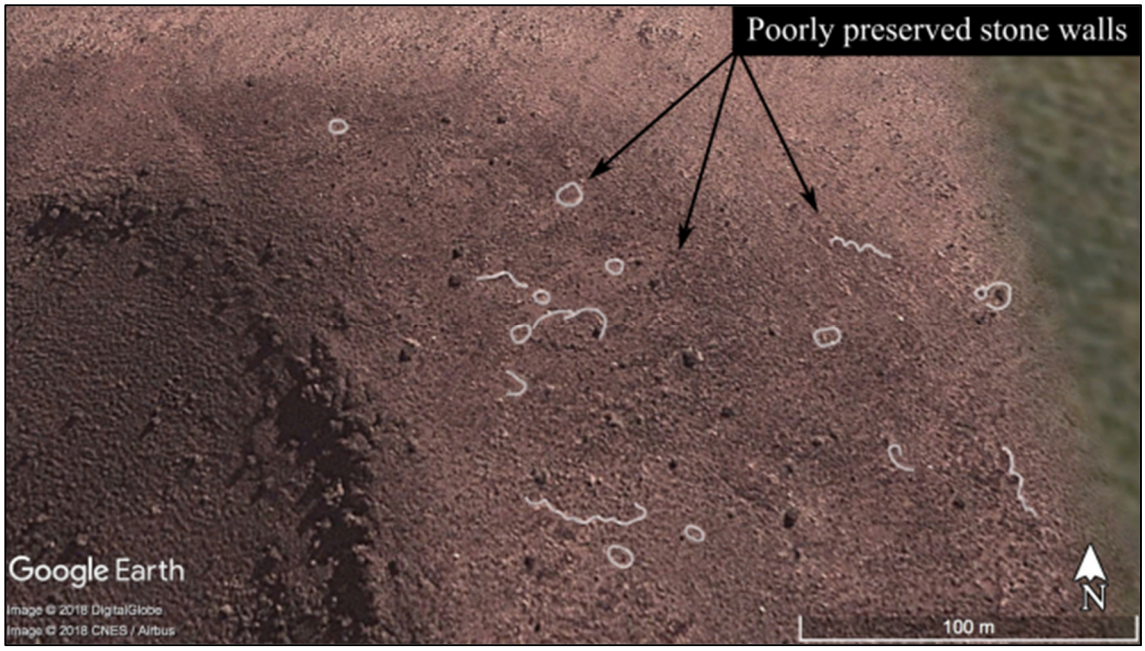

Figure 5 – Type R stone walled structures

3.4 Archival/historical maps

Historical topographic maps were available for utilisation in the study:

- Topographical map 3019BC & 3019DA – First edition 1972 maps. Air photography undertaken in 1967, surveyed in 1972 and drawn in 1974 by the Trigonometrical Survey office (**Figure 6**).

The map was utilised to identify structures that could possibly be older than 50 years and while not protected under Section 34 and 35 of the NHRA, it would have given a good indication of the potential age of known structures. There are no structures that are indicated close enough to the development to be of concern.

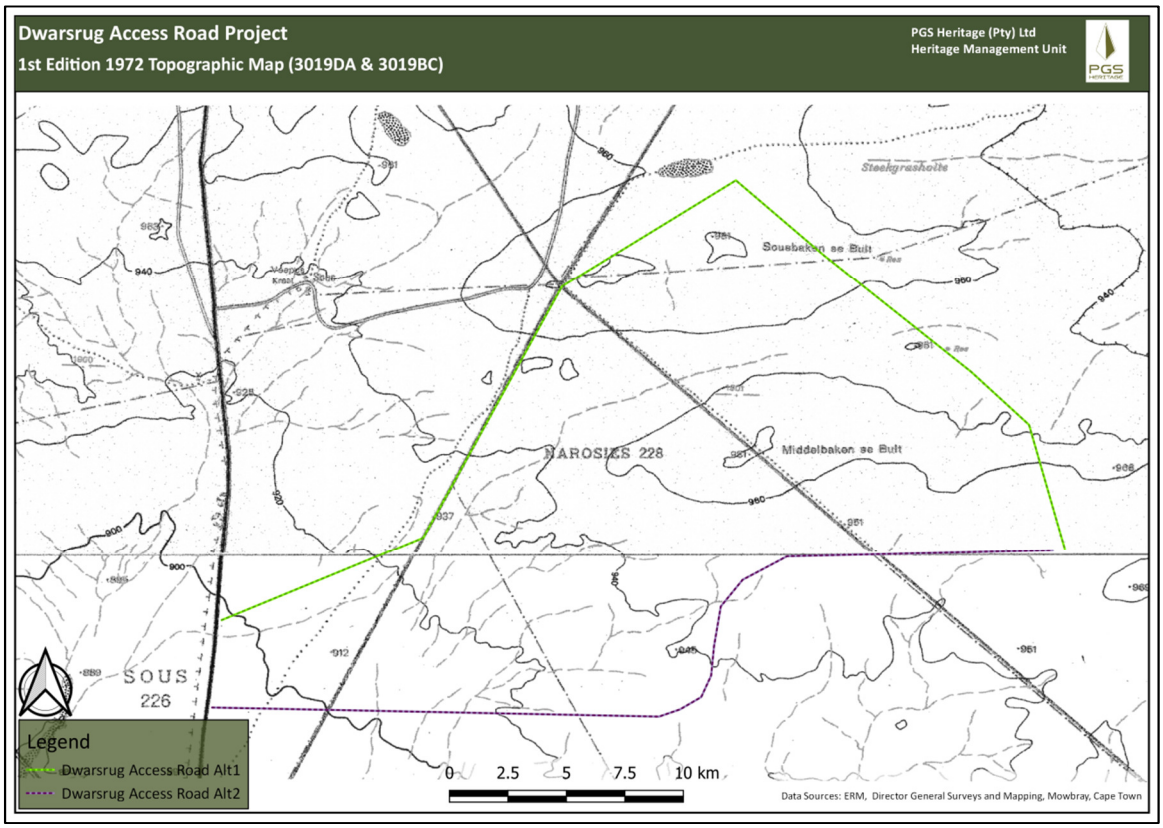

Figure 6 – 1st Edition 1972 Historical Topographic Map (3019DA & 3019BC)

3.5 Fieldwork and Findings

A controlled surface survey was conducted on foot over a period of one days by an archaeologist and assistant from PGS. The fieldwork was conducted on the 25th of October 2018. The track logs (in orange) for the survey are indicated in **Figure 7**. The locations of the heritage sites discovered during the fieldwork component are illustrated in **Figure 8**; two were located. These are detailed in **Table 2.**

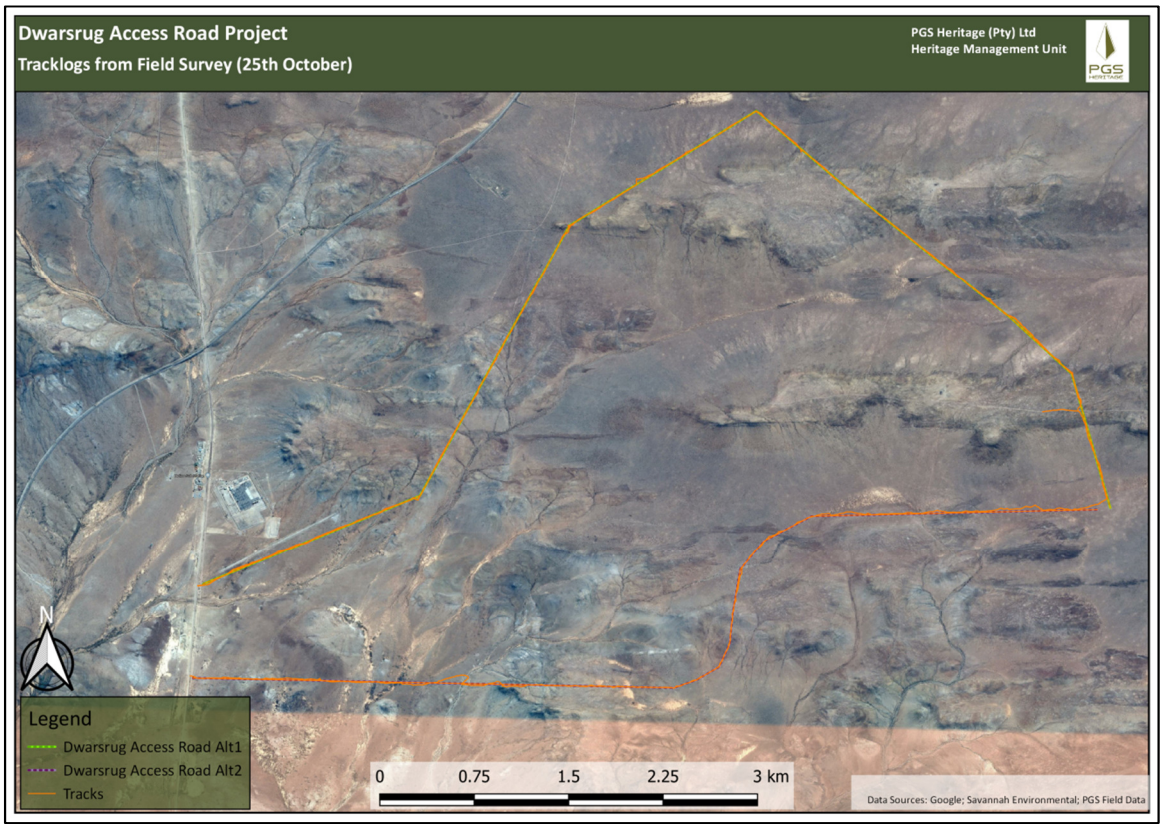

Figure 7 – Track log recordings from site visit (25th of October 2018)

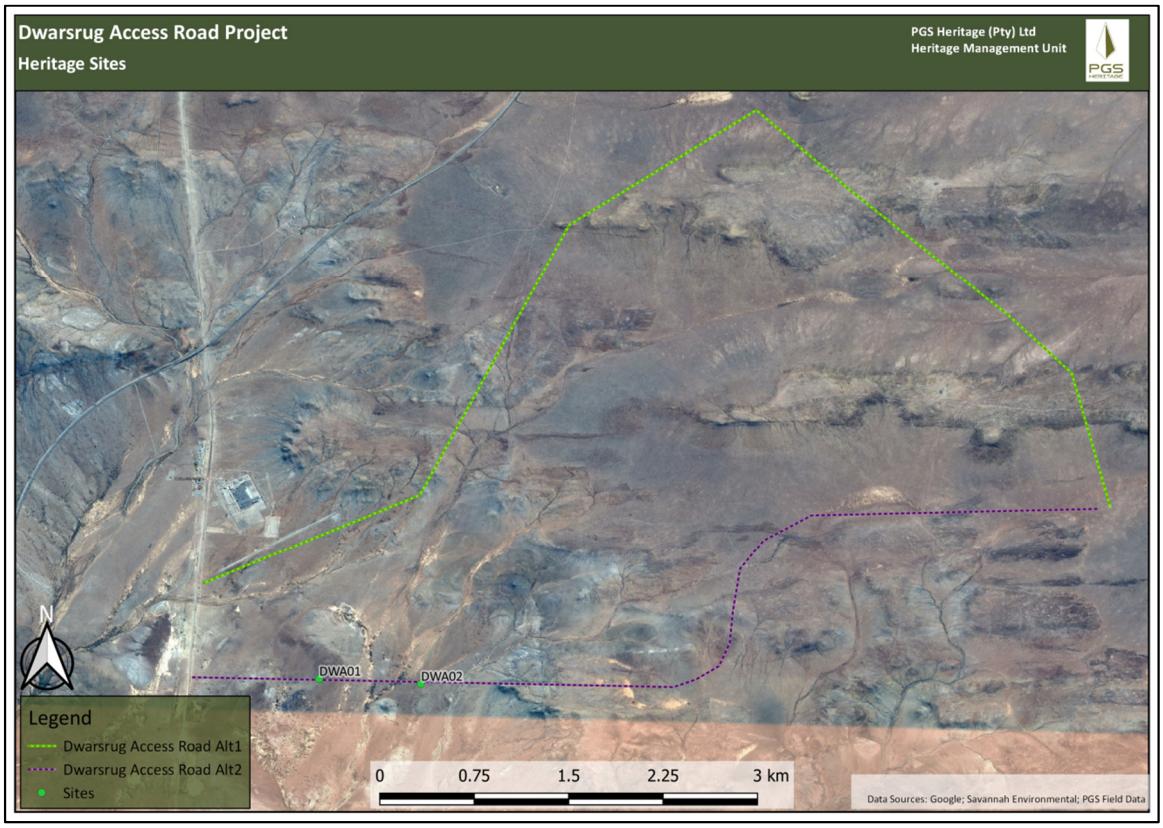

Figure 8 – Heritage site locations within study area

Table 2 – List of heritage sites uncovered during the field survey

Site[1] number	Lat	Lon	Description	Heritage Significance	Heritage Rating
DWA01	S30.51398°	E19.56662°	This find spot comprises a low density surface scatter of two Stone Age flakes, with one made on chert and the other on hornfels. These artefacts are in secondary context. **Site extent**: 5mx5m.	Low	GP.C

Figure 9 – Hornfels flake (left) and chert flake (right)

Figure 10 – General view of site

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

Site[2] number	Lat	Lon	Description	Heritage Significance	Heritage Rating
DWA02	S30.51440°	E19.57504°	This find spot comprises a low density surface scatter of one Stone Age core, with one made on quartzite and the other on hornfels. These artefacts are in secondary context. **Site extent**: 5mx5m.	Low	GP.C

Figure 11 – Possible discoidal core made on chert

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

4 PALAEONTOLOGY

The palaeontological desktop study used in this report was undertaken by Gideon Groenewald for PGS Heritage in 2014. The WEF is underlain by shales of the Permian aged Tierberg Formation, as well as two very small outcrops of Permian aged shales of the Whitehill Formation, Ecca Group of the Karoo Supergroup. Large areas are covered in dolerite scree whilst small areas are covered in Quaternary aged alluvium and pan sediments (Error! Reference source not found.).

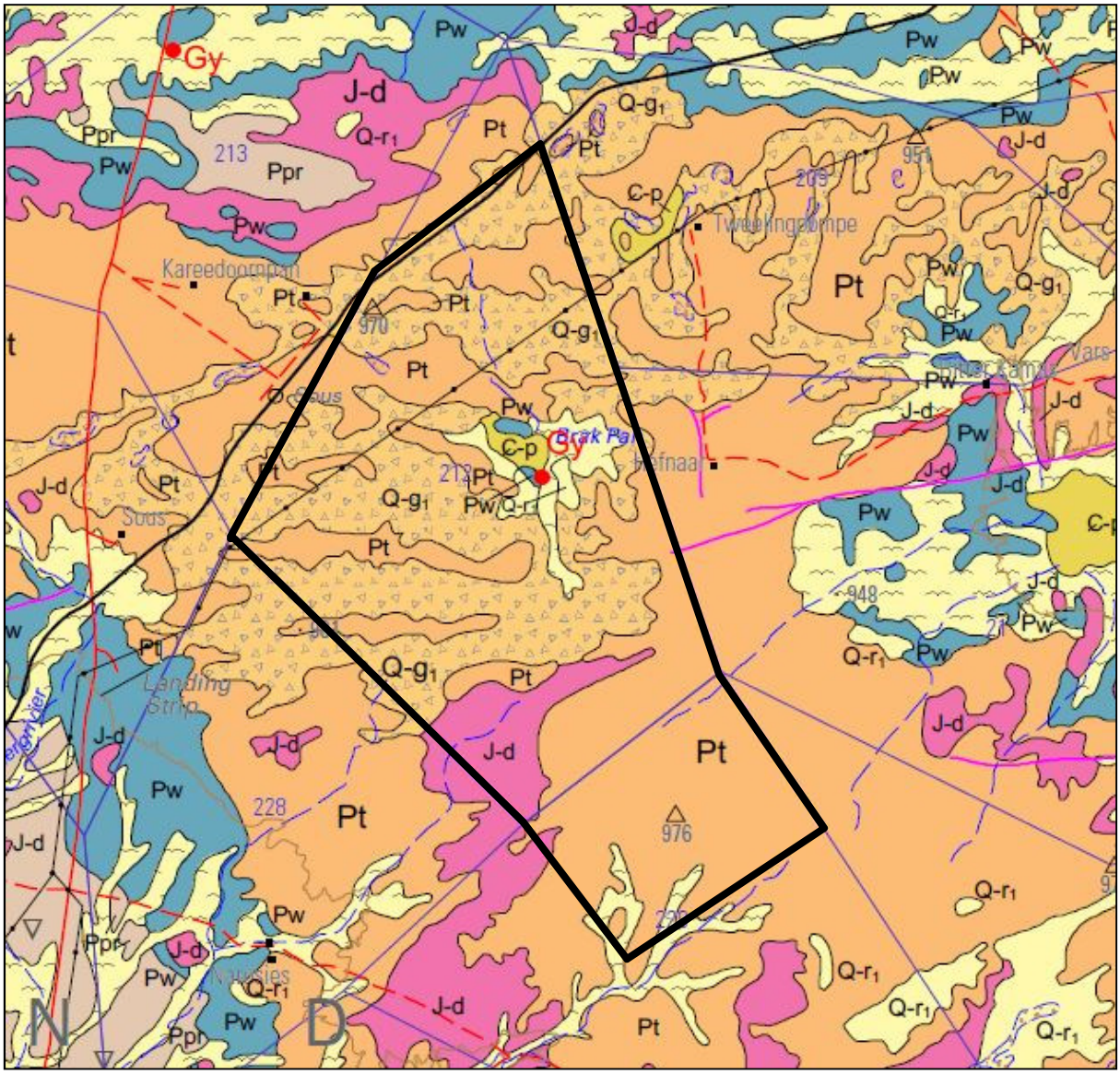

Figure 12 - Geology of the Dwarsrug WEF. Pt - Tierberg Formation, Pw - Whitehill Formation, Jd – Dolerite, Q-g1 - Dolerite scree, C-p - Pan sediments and Alluvium (yelow) (Groenewald 2014)

4.1 Geology

4.1.1 Tierberg Formation (Pt)

The Tierberg Formation is a dominantly shale and mudrock unit, consisting predominantly of dark grey, well laminated carbonaceous shales with subordinate sandstone (Johnson et al, 2006). This geological formation underlays about half of the length proposed roads.

4.1.2 Whitehill Formation (Pw)

The Whitehill Formation is a relatively thin succession of well-laminated carbon-rich mudrocks. The mudstone weathers to a distinctive pale grey to creamy white colour (Johnson et al, 2006).

4.1.3 Dolerite (Jd)

Dolerite is a mafic intrusive igneous rock and occurs as dykes or sills. The Jurassic aged dolerite is associated with the "koppies" or high-lying areas in the region.

4.1.4 Dolerite Scree (Q-g1)

This dolerite scree covers most of the primary geology in the area and about half of the length proposed roads.

4.1.5 Pan Sediments (C-p)

A small area is underlain by Quaternary aged pan sediments.

4.1.6 Alluvium

Alluvium underlies a restricted area in the development site.

4.2 Palaeontology of the Area

4.2.1 Tierberg Formation

The Permian aged Tierberg Formation is mainly interpreted as a deep water deposit and fossils are mainly associated with event beds, with the commonest fossils being sparse to locally concentrated assemblages of trace fossils (Johnson et al 2006). Body fossils are very rarely recorded.

4.2.2 Whitehill Formation

The Permian aged Whitehill Formation is well-known for an abundance of trace fossils as well as body fossils.

According to Almond (2011), "the main groups of Early Permian fossils found within the Whitehill Formation include:

- Aquatic **mesosaurid reptiles** (the earliest known sea-going reptiles)
- Rare **cephalochordates** (ancient relatives of the living lancets)
- A variety of **palaeoniscoid fish** (primitive bony fish)
- Highly abundant small **eocarid crustaceans** (bottom-living shrimp-like forms)
- **Insects** (mainly preserved as isolated wings, but some intact specimens also found)
- A low diversity of **trace fossils** (*e.g.* king crab trackways, possible shark coprolites / faeces)
- **Palynomorphs** (organic-walled spores and pollens)
- **Petrified wood** (mainly of primitive gymnosperms, silicified or calcified)
- Other sparse **vascular plant remains** (*Glossopteris* leaves, lycopods *etc*)".

4.2.3 Dolerite

Due to the igneous nature of dolerite, no fossils will be found in the rock units.

4.2.4 Dolerite Scree

Due to the igneous nature of dolerite, no fossils are expected in the dolerite. Where the scree overlies shales of the Ecca Group, fossils might be associated with the shale.

4.2.5 Pan Sediments and Alluvium

Quaternary aged pan sediments can contain local concentrations of more recent fossils. According to Almond (2011) "Caenozoic fossil biotas from these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (*e.g.* calcretised termitaria, coprolites), and plant remains such as peats or palynomorphs (pollens, spores) in organic-rich alluvial horizons (Scott 2000) and siliceous diatoms in pan sediments. In Quaternary deposits, fossil remains may be associated with human artefacts such as stone tools and are also of archaeological interest (*e.g.* Smith 1999 and refs. therein). Stone artefacts of Pleistocene and younger age may additionally prove useful in constraining the age of superficial deposits such as gravelly alluvium within which they are occasionally embedded."

4.3 Palaeontological Sensitivity

The 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 13). The different sensitivity classes used are explained in **Table 3**.

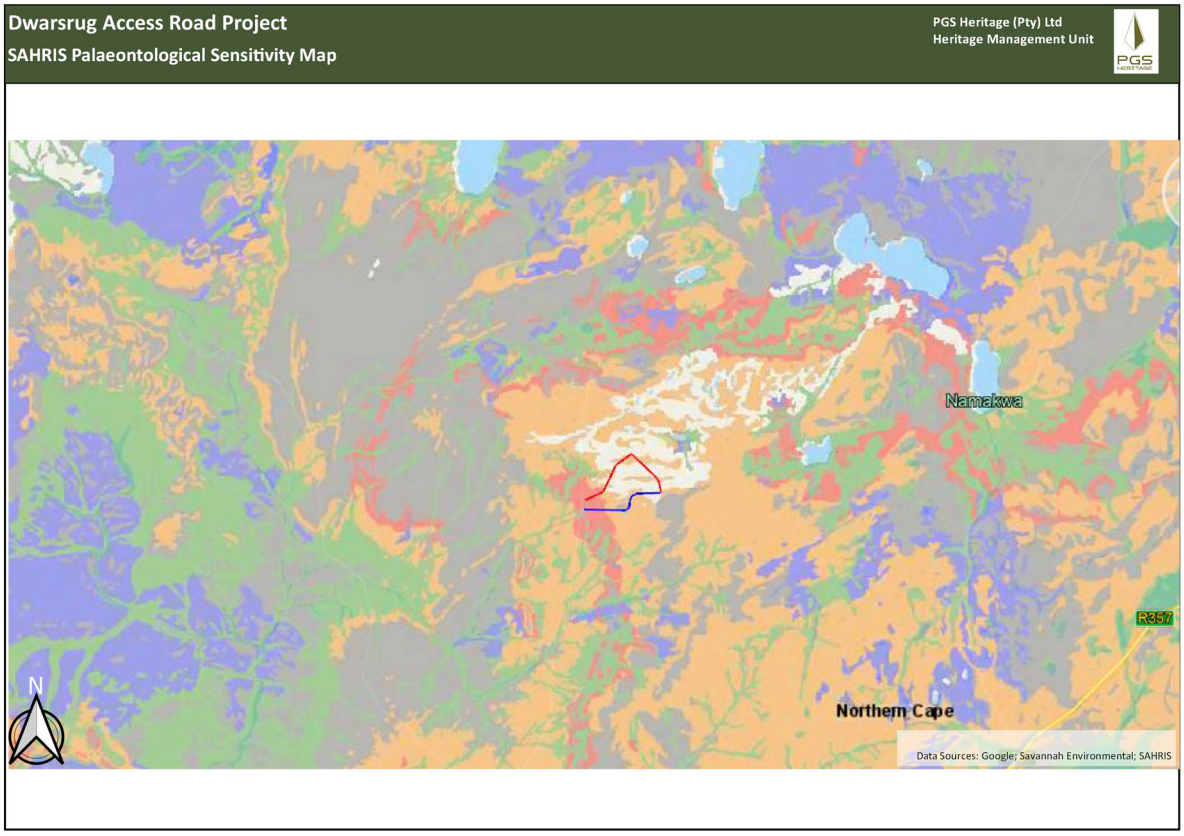

Figure 13 - Paleontological sensitivity of the geological formations in the study area. Key is explained in Table 3 below (no scale)

Table 3 – Key descriptions of SAHRIS palaeontological sensitivity map

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

The Permian aged Tierberg Formation underlies significant sections of the study area and monitoring of the fossil heritage must be planned for these areas. The significantly fossil-rich Whitehill Formation underlies two restricted areas and if development falls within these areas, they must be considered as highly sensitive for palaeontological heritage. Areas overlain by

dolerite scree are allocated a low palaeontological sensitivity and if fossils area recorded in shales underlying the scree, these need to be recorded.

Due to the igneous nature of dolerite, no fossils will be found and areas underlain by dolerite have been allocated a Very Low palaeontological sensitivity.

Areas underlain by pan and alluvium deposits are allocated a moderate palaeontological a low sensitivity and if fossils are recorded a qualified palaeontologist must be appointed to collect and record these finds.

5 IMPACT ASSESSMENT

The impact assessment rating is based on the rating scale as contained in **Appendix A** and **B**.

5.1 Archaeological Resources

Table 4 – Impact rating (SAS=Stone Age sites)

Nature: The one type of Stone Age heritage has been identified during the survey, namely find spots, were rated as having low archaeological significance. All the identified find spots could be impacted by construction activities, however the impact is seen as negligible.		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (30)	Low (24)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: • Develop a chance finds protocol for the mitigation of possible heritage finds, to be implemented as part of the EMP for the construction phase of the project. • If any artefacts are identified during construction, the chance finds protocol must be implemented		

Cumulative impacts:
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
Residual Risks:
Considering the nature of the sites identified in the present study, the residual risk will be minimal.

Taking into consideration the extremely localised nature of the proposed access road development, the study has identified that the activities will have impact on heritage resources. None of the two Alternatives are preferred above the other due to the low impact on heritage resources envisaged.

5.2 Palaeontological Resources

Table 5 – Impact rating for palaeontological resources

Nature: Disturb, damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study.		
	Without mitigation	**With mitigation**
Extent	Low (1)	Low (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	High (8)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Medium (42)	Low/Medium (30)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: 1. The EAP as well as the ECO for this project must be made aware of the fact that the Ecca Group sediments contains significant fossil remains, albeit mostly trace fossil assemblages. Several types of fossils have been recorded from this Group in the Karoo Basin of South Africa, with special mention of the very important Whitehill Formation. The Whitehill Formation outcrops are however very restricted in this study area.		

2. In areas that are allocated a Very High and High Palaeontological sensitivity and specifically where deep excavation into bedrock is envisaged (following the geotechnical investigation), or where fossils are recorded during the geotechnical investigations, a qualified palaeontologist must be appointed to assess and record fossils at specific footprints of infrastructure developments (Phase 1 PIA).
3. If significant fossil finds (*e.g.* vertebrate teeth, bones, burrows, petrified wood) are recorded during excavations for infrastructure such as road developments, the palaeontologist must apply for a collection permit to collect the fossils according the SAHRA specifications.
4. These recommendations should form part of the EMP of the project.

Cumulative impacts:

The proposed alignment will not add to the current impact on heritage resources from the proposed WEF or grid connections on the Dwarsrug project.

Residual Risks:

With the implementation of the proposed mitigation measures no residual risk is envisaged.

The very high and high fossiliferous potential of the Ecca Group strata warrants an allocation of a High palaeontological sensitivity to the areas underlain by the rocks of these formations. The pan sediments and alluvium is allocated a Moderate palaeontological sensitivity whereas areas underlain by dolerite scree and dolerite are allocated Low and Very Low Palaeontological sensitivities.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Archaeology

The archaeological resources identified within the proposed development site comprise a small number of Stone Age surface artefact scatters. These are primarily from the Later Stone Age (LSA), although Middle Stone Age (MSA) material was also identified. All these artefact assemblages occur in heavily deflated and eroded areas thus indicating a total lack of context, so their scientific potential and heritage significance is particularly low. Based on findings from a range of other heritage reports in the area, these types of sites are to be expected in this region.

Even though heritage features were detected within the development area, serious mitigation measures will not be required.

6.1.1 Recommendations

- Develop a chance finds protocol for the mitigation of possible heritage finds, to be implemented as part of the EMP for the construction phase of the project.

- If any artefacts are identified during construction the chance finds protocol must be implemented

6.2 Palaeontology

The Dwarsrug Study Area is mainly underlain by Permian aged rocks of the Ecca Group, Jurassic aged dolerite sills and Quaternary aged dolerite scree, pan sediments and alluvium.

The very high and high fossiliferous potential of the Ecca Group strata warrants an allocation of a High palaeontological sensitivity to the areas underlain by the rocks of these formations. The pan sediments and alluvium is allocated a Moderate palaeontological sensitivity whereas areas underlain by dolerite scree and dolerite are allocated Low and Very Low Palaeontological sensitivities.

6.2.1 Recommendations

- The EAP as well as the ECO for this project must be made aware of the fact that the Ecca Group sediments contains significant fossil remains, albeit mostly trace fossil assemblages. Several types of fossils have been recorded from this Group in the Karoo Basin of South Africa, with special mention of the very important Whitehill Formation. The Whitehill Formation outcrops are however very restricted in this study area.
- In areas that are allocated a Very High and High Palaeontological sensitivity and specifically where deep excavation into bedrock is envisaged (following the geotechnical investigation), or where fossils are recorded during the geotechnical investigations, a qualified palaeontologist must be appointed to assess and record fossils at specific footprints of infrastructure developments (Phase 1 PIA).
- If significant fossil finds (*e.g.* vertebrate teeth, bones, burrows, petrified wood) are recorded during excavations for infrastructure such as road developments, the palaeontologist must apply for a collection permit to collect the fossils according the SAHRA specifications.
- These recommendations should form part of the EMP of the project.

6.3 General

In the event that heritage resources are discovered during site clearance, construction activities must stop, and the relevant heritage authority must be contacted in order to advise on the necessary actions to take. Generally, a qualified archaeologist must be appointed to evaluate the situation and make recommendations on mitigation measures.

The overall impact of the access road development on heritage resources is seen as acceptably low after the recommendations have been implemented and therefore, impacts can be mitigated to acceptable levels and the project may be authorised from a heritage perspective.

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Appendix A

Heritage Assessment Methodology

The applicable maps, tables and figures are included, as stipulated in the NHRA (Act No 25 of 1999) and NEMA (Act No 107 of 1998). The HIA process consisted of three steps;

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

Step II – Physical Survey - A physical survey was conducted predominantly by foot within the proposed areas by two qualified archaeologists, 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.

The significance of identified heritage sites are 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 - <10/50m2
    - Medium/High - 10-50/50m2
    - High - >50/50m2
- 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 development activity position;
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site.

Impacts on these sites by the development will be evaluated as follows -

Site Significance

Site significance classification standards prescribed by the SAHRA (2006) and approved by the ASAPA for the Southern African Development Community (SADC) region, were used for the purpose of this report (**Table 6**).

Table 6 - 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)		High / Medium/High Significance	Mitigation before destruction
Generally Protected B (GP.A)		Medium/High Significance	Recording before destruction
Generally Protected C (GP.A)		Low Significance	Destruction

Appendix B

The Significance Rating Scales for the Proposed Prospecting Activities on Heritage Resources

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the management and approval process; secondly, it shows the primary impact characteristics, as defined above, used to evaluate impact significance.

Direct, indirect and cumulative impacts of the issues identified through the EIA process, as well as all other issues identified due to the amendment must be assessed in terms of the following criteria:

- The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - medium-term (5–15 years) – assigned a score of 3;
  - long term (> 15 years) - assigned a score of 4; or
  - permanent - assigned a score of 5;
- The **consequences (magnitude)**, quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The **probability** *of occurrence*, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- the **significance**, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- the **status**, which will be described as either positive, negative or neutral.
- the degree to which the impact can be reversed.
- the degree to which the impact may cause irreplaceable loss of resources.
- the *degree* to which the impact can be *mitigated.*

The **significance** is calculated by combining the criteria in the following formula:

S = (E+D+M)P
S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» 30-60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

Assessment of impacts must be summarised in the following table format. The rating values as per the above criteria must also be included. The table must be completed and associated ratings for **each** impact identified during the assessment should also be included.

Appendix C

Project team CV's

ILAN SMEYATSKY

Professional Archaeologist

Personal Details

- **Name:** Ilan
- **Surname:** Smeyatsky
- **Identity Number:** 9109275072080
- **Date of Birth:** 27-09-1991
- **Citizenship:** South African
- **Gender:** Male
- **Marital Status:** Single
- **Languages Spoken**: English

Education History

2010-2013: **BSc bachelor's Degree**

University of the Witwatersrand, Johannesburg, South Africa

- Archaeology
- Psychology
- Statistics
- Research Design and Analysis
- 67% Pass (**2:1 Qualification**)

2014: **BSc (Hons) in Archaeology**

AWARDS:

- Received the 2014 Centre of Excellence in Palaeoscience award - **Bursary to the value of ZAR 30000 ≈ $2500**
- Received the Post-Graduate Merit Award in 2015 for academic merit for my Honours academic results - **Bursary to the value of ZAR 25000 ≈ $1800**

University of the Witwatersrand, Johannesburg, South Africa

- Archaeology
- Excavation techniques
- Theory
- 69% Pass (**2:1 Qualification**)
- **Distinction** received for thesis entitled: "Stylistic variation in Later Stone Age tanged arrowheads: a pilot study using geometric morphometrics"

2015-2017: **MSc by Research (Archaeology)**

University of the Witwatersrand, Johannesburg, South Africa

- Archaeology
- Statistical analysis
- GIS (Geographic Information Systems)
- Thesis entitled: "Discerning and explaining shape variations in Later Stone Age tanged arrowheads, South Africa"

Aug 2016 –
Jan 2017: **Semester of Archaeology Masters**

AWARD: Received the 2016 AESOP+ full Masters scholarship to study at Uppsala University, Uppsala, Sweden – **Scholarship to the value of ZAR 160,000 ≈ $11,000**
Uppsala University, Uppsala, Sweden

- Archaeological theory
- GIS (Geographic Information Systems)
- Invitational research

Employment History
Part time employment as a student:

- **2009-2013**: Part-Time Electrician Apprentice: Assisting in home electrical repair jobs.
- **2014-2015:** Lab Research Assistant: Analysing and classifying lithic artefacts, Data capturing, Mentoring trainee research assistants.

Experience in the field of archaeology:

- **2013-2015: Fieldwork/Excavator - Responsibilities:** Feature detection, excavation, sieving, sorting, analysis, soil sampling, field documentation, 'dumpy' operation, Total Station operation, DGPS operation, rock art tracing and photography, engraving tracing and photography.
    - South African excavations:
        - Early Stone Age excavation at Maropeng World Heritage Site in Gauteng (1 Week – August 2015)
        - Pig cadaver exhumation as part of forensic experiment near Pretoria, Gauteng (1 Week – December 2014) - Praised for having the determination of returning for each subsequent excavation day as it was performed on a purely volunteer basis and the work conditions were particularly strenuous - Dr. Coen Nienaber

    - Iron Age excavation at Komati Gorge, Mpumalanga (1 Week – August 2014) - Praised for being exceptionally "methodical and proficient" with my excavation techniques – Dr. Alex Schoeman
    - Rock art fieldwork at Komati Gorge, Mpumalanga (1 Week – August 2014)
    - Underwater archaeology site mapping Komati Gorge, Mpumalanga (1 Week – August 2014)
    - Early Stone Age excavation at Maropeng World Heritage Site in Gauteng (2 Weeks - September 2013) - Personally uncovered some of the only stone tools (~1.8 million years old) found during that digging season.
- **2016: Excavation Supervisor - Responsibilities:** Supervision of two junior excavators, site detection, decision of excavation grid placement, excavation, sieving, sorting, soil sampling, field documentation.
    - Historical (farm site) excavation at Graaff-Reinet, Eastern Cape, South Africa (2 Weeks)
    - Completed dig 1 week ahead of schedule aided by my efficient direction, drive and support to the excavators under my supervision.
- **April 2017 – April 2018:** Intern Archaeologist – PGS Heritage: Heritage Impact assessments, background research, report writing, permit applications, collections management, stakeholder engagement and grave relocation.
- **April 2018 – PRESENT:** Archaeologist – PGS Heritage: Heritage Impact assessments, background research, report writing, permit applications, collections management, stakeholder engagement and grave relocation.

Professional Body Membership:

- Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member
- CRM Accreditation (ASAPA) -
    - Field Supervisor – Stone Age, Iron Age & Grave Relocations

CURRICULUM VITAE

Name:	HS (Henk) Steyn
Profession:	Archaeologist
Date of birth:	1971-09-15
Parent Firm:	PGS Heritage (Pty) Ltd
Position at Firm:	Managing Director
Years with firm:	15
Years of experience:	20
Nationality:	South African
HDI Status:	White Male

EDUCATION

Name of University or Institution: University of Pretoria

Degree obtained:	BA
Major subjects:	Archaeology, History & Cult. History
Year:	1996

Name of University or Institution: University of Pretoria

Degree obtained:	BA [Hons] (Cum laude)
Major subjects:	Archaeology
Year:	1997

Professional Qualifications:

Professional Archaeologist - Association of Southern African Professional Archaeologists -
Professional Member
CRM Accreditation:
• Principal Investigator - Grave Relocations
• Field Director – Iron Age
• Field Supervisor – Colonial Period and Stone Age
Treasurer of ASAPA (Association of Southern African Professional Archaeologists) from 2012 -
2017

Languages:

Afrikaans – First language
English – Speaking (Good) Reading (Good), Writing (Good)

KEY QUALIFICATIONS

Grave Relocation Management, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Business Management

EXPERIENCE

Heritage Assessments

As a heritage practitioner I have been involved with approximately 60 Heritage Impact Assessments including, but not limited to:

• Archaeological Walkdown, Hydra-Perseus Transmission line (260km), Northern Cape Province - Eskom
• Phase 2 Heritage Impact Assessment and EMP, Gamma-Omega Transmission line (550km), Western Cape Province - Nature Conservation Corporation
• Archaeological Walk Down and EMP, Eros-Neptune Transmission Line (380km), Transkei,
Eastern Cape Province – Aurecon
• Phase 2 Heritage Impact Assessment in terms of the proposed Comet Ext. 8 Development, Ekurhuleni Metropolitan Municipality – Urban Dynamics
• Heritage Impact Assessment for the proposed development of Comet Ext. 14, Ekurhuleni
Metropolitan Municipality, Marsh Environmental
• Nature Conservation Corporation, Phase 2 Heritage Impact Assessment and EMP, Hydra-
Perseus Transmission line (260km – selected areas), Northern Cape Province
• Heritage Assessment, Friarsdale, Northern Cape – Afrimat
• Heritage Assessments for three SCP Projects (De Aar, Kimberley, Loeriesfontein) – SiVEST
• Co-Author of a Cultural Resources Management Plan for Marakele National Park.
• Co-Author of a Cultural Resources Management Plan for Augrabies National Park.

Grave Relocations

As Managing Director of PGS, I have been involved in a large number of grave relocation
projects, including:

• iMpunzi Division of Duiker Mining, Witbank, Relocation of 950 graves.
• University of Pretoria, Nandoni Dam Grave Relocation Project, Thohoyandou, Limpopo Province. Relocation of approximately 1,000 graves.
• Alveda Park Development, NewHco. Relocation of 114 graves.
• Tselentis Colliery, Duiker Mining. Relocation of 80 graves.
• Tselentic Colliery, Expansion of mining activities. Relocation of 15 graves.
• Abland, Proposed development of Portion 41 of the farm Wonderboom 302-JR. Relocation of 17 graves
• TCTA, VRESAP Development. Relocation of 56 graves.
• Biscuit Trading, Proposed Development of Portion 97 of the farm Knopjeslaagte 385-JR. Relocation of 5 graves.
• Savannah Country Estates, Mamelodi, Pretoria, Gauteng Province. Relocation of 7 graves.
• Atterbury Property Developments, Hartebeespoort Dam, Pretoria. Relocation of 11 graves.
• The Outpost Estate, Bela-Bela, Limpopo Province. Relocation of 78 graves.
• Nkomati Mine, Onverwacht grave relocation, near Badplaas, Mpumalanga. Relocation of 45 graves.
• Nkomati Mine, Nkomati Mine grave relocation, near Badplaas, Mpumalanga. Relocation of 60 graves..
• New Vaal Colliery, Mac West Project, Free State, Relocation of 650 graves.
• Phokathaba Platinum, Smokey Hills Mine, Maandagshoek, Burgersfort, Limpopo Province. Relocation of 11 graves.
• Martins Funerals (Randburg), Garstfontein Road grave relocation, Pretoria, Gauteng Province. Relocation of 1 grave.
• Bombela CJV, Graves affected by Gautrain Development, Midrand, Gauteng Province. Relocation of 26 graves.
• Cranbrook Properties, Motaganeng Project, Burgersfort, Limpopo Province. Relocation of 60 graves..
• Silver Glade Investments, Swavelpoort, Pretoria. Relocation of 45 graves.
• Anglo Coal (Kleinkopje Colliery), Zondagsvlei, near Ogies, Mpumalanga Province. Relocation of 110 graves.
• Anglo Coal (Kleinkopje Colliery), Kleinkopje Coppiery, Witbank, Mpumalanga Province. Relocation of 4 graves.
• Africon. Rescue excavation of 1 grave near Silvertondale, Pretoria, Gauteng Province.

• Osizweni Plaza, Newcastle, KwaZulu-Natal. Relocation of 65 graves.
• Anglo Coal, Farm Straffontein, Delmas, Mpumalanga. Relocation of 16 graves.
• Beaurivage, Relocation of 3 graves, Hartebeestpoort, North West Province.
• EIMS, Rescue excavation of 2 graves, Waltloo, Pretoria, Gauteng Province. Project Manager and Permit Holder with WC Nienaber as PI.
• Xstrata Coal, Phoenix Plant. Relocation of 1 grave.
• Xstrata Coal, ATCOM East. Relocation of 53 graves.
• AGES Environmental, Sephaku Fluoride Chemical Plant, Ekandustria, Bronkhorstspruit, Gauteng Province.
• Nkomati Mine, near Badplaas, Mpumalanga Province. Relocation of approximately 70 graves in various phases.
• SMEC South Africa/Hillary Construction (on behalf of SANRAL). Relocation of 64 graves affected by the widening of the N1 at Holfontein, Kroonstad. (Current project)
• Crystal Park Development Pty (Ltd). Rescue excavation of 17 graves exposed during construction activities. Crystal Park, Benoni (Current Project)
• Hatch-Goba, relocation of 30 graves from the Coega Industrial Development Zone, Port Elizabeth.
• Transnet, Relocation of 190 graves from the Coega Industrial Development Zone, Port Elizabeth.
• Glencore, relocation of 850 graves from the Tweefontein Optimisation Project, Ogies, Mpumalanga
• Rietvlei Mining, relocation of 59 graves near Middelburg, Mpumalanga (current project)
• Kophia Diamonds, relocation of 5 graves exposed during mining activities. Boshoff, Free State (current project).
• Estor Properties, relocation of 90 graves from The Orchards, Pretoria (current project)

EMPLOYMENT SUMMARY

Managing Director of PGS Heritage (Pty) Ltd 2003 - current
Director of PGS Heritage (Pty) Ltd – Lesotho
Director of PGS Heritage Africa
Shareholder in PGS Heritage Mozambique

Countries of work experience:

• South Africa

• Botswana

WOUTER FOURIE

Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage

Summary of Experience

Specialised expertise in Archaeological Mitigation and excavations, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including *inter alia* -

Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave "rescue" excavations in the various provinces of South Africa

Involvement with various Heritage Impact Assessments, within South Africa, including -

- Archaeological Walkdowns for various projects
- Phase 2 Heritage Impact Assessments and EMPs for various projects
- Heritage Impact Assessments for various projects
    - Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring
    - Involvement with various Heritage Impact Assessments, outside South Africa, including -
- Archaeological Studies in Democratic Republic of Congo
- Heritage Impact Assessments in Mozambique, Botswana and DRC
- Grave Relocation project in DRC

Key Qualifications

BA [Hons] (Cum laude) - Archaeology and Geography - 1997

BA - Archaeology, Geography and Anthropology - 1996

Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member

Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)

CRM Accreditation (ASAPA) -

- Principal Investigator - Grave Relocations
- Field Director – Iron Age
- Field Supervisor – Colonial Period and Stone Age
- Accredited with Amafa KZN

Key Work Experience

2003- current - Director – Professional Grave Solutions (Pty) Ltd

2007 – 2008 - Project Manager – Matakoma-ARM, Heritage Contracts Unit, University of the Witwatersrand

2005-2007 - Director – Matakoma Heritage Consultants (Pty) Ltd

2000-2004 - CEO– Matakoma Consultants
1998-2000 - Environmental Coordinator – Randfontein Estates Limited. Randfontein, Gauteng
1997-1998 - Environmental Officer – Department of Minerals and Energy. Johannesburg, Gauteng

Worked on various heritage projects in the SADC region including, Botswana, Mozambique and the Democratic Republic of the Congo