Proposed construction of two 132kV transmission lines from the Maanhaarberg and Damfontein Wind Energy Facilities (De Aar 1) near De Aar, Northern Cape

Heritage Impact Assessment Report

Issue Date: 21 December 2012

Revision No.: 1

Client: **AURECON SOUTH AFRICA (PTY) LTD**

Professional Grave Solutions (Pty) Ltd T/A PGS Heritage & Grave Relocation Consultants
PO Box 32542 Totiusdal 0134, T +27 12 332 5305 F: +27 86 675 8077
Reg No 2003/008940/07

ACKNOWLEDGEMENT OF RECEIPT

CLIENT:	Aurecon South Africa (Pty) Ltd
CONTACT PERSON:	Simon Clark, Aurecon South Africa (Pty) Ltd, Tel: +27 21 526 6034, Email: Simon.Clark@aurecongroup.com. Aurecon Centre, 1 Century City Drive, Waterford Precinct, Century City, South Africa
LEADING CONSULTANT:	PGS - Heritage & Grave Relocation Consultants
CONTACT PERSON:	Wouter Fourie, Tel: 086 111 4771, Email: wouter@gravesolutions.co.za
SIGNATURE:	

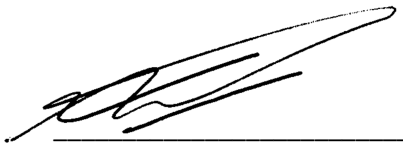
COPYRIGHT

Declaration of Independence

The report has been compiled by PGS Heritage & Grave Relocation Consultants, an appointed Heritage Specialist for Aurecon South Africa (Pty) Ltd. The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes discussed in the Heritage Impact Assessment Process

HERITAGE CONSULTANT: PGS Heritage & Grave Relocation Consultants

CONTACT PERSON: Wouter Fourie
Tel: +27 (0) 86 111 4771
Email: wouter@gravesolutions.co.za

SIGNATURE: 

Report Title	***Proposed construction of two 132kV transmission lines from the Maanhaarberg and Damfontein Wind Energy Facilities (De Aar 1) near De Aar, Northern Cape– Heritage Impact Report***		
Control	**Name**	**Signature**	**Designation**
Author	**W Fourie**		**Project Coordinator/Heritage Specialist**

EXECUTIVE SUMMARY

PGS Heritage & Grave Relocation Consultants was appointed by Aurecon South Africa (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) that forms part of Basic Environmental Assessment report (BAR) the proposed construction of two 132kV transmission lines from the Maanhaarberg and Damfontein Wind Energy Facilities (De Aar 1) near De Aar, Northern Cape

Archaeological Finds

Utilising the archival study completed for the HIA as a guide, the field work identified a total of **2 archaeological find spots** on the alignment provided for the field work of which none will require mitigation work.

The HIA has focused on a 500 meter assessment corridor and the archaeological component on the centre alignment of the 500 meter corridor. Because of subsurface and localised nature of archaeological remains, any deviation or changes within the corridor to the initial layout alignment will require an archaeological walkdown of the new alignment after pylons placement positions have been to identify any possible archaeological and heritage structures and sites before construction commence.

Heritage Structures

The field work has identified two associated structures associated with early farming activities and is most probably older than 60 years. This structures are protected under Section 34 of the national Heritage Resources Act and will require a permit from the Provincial Heritage Authority in the Northern Cape, Ngwao-Boswa Jwa Kapa Bokone, for any alterations to the structure.

It is recommended that:

- The placement of the pylons must be done in such a way as to stay away from the dam wall;
- The site must be demarcated during and a buffer of at least 10 meters kept, during construction.

Cultural Landscape

An evaluation of the 500 meter corridor for the proposed 132kV line has shown a negative impact on the cultural landscape around the Zwartkoppies farmstead on the farm Zwartekopjes 131. It is recommended that the alignment of the proposed 132kV line around the Zwartkoppies farmstead be re-evaluated to move it further to the north away from the farmstead. This alignment recommendation can be accommodated within the 500m corridor. However, it is recommended that the final route be negotiated with the landowner to minimize impacts. Such mitigation will reduce the impact from Moderate Negative to a low negative impact.

Palaeontology

There is a high and moderate possibility that fossils could be encountered during excavation of the Abramskraal and Tierberg Formations respectively. These fossil founds would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would be a highly negative palaeontological impact. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact.

It is therefore recommended that:

- A Palaeontologist be appointed as part of the Environmental Construction Team for preferable all identified palaeontological sensitive areas but definite for the identified high sensitive areas.
- A palaeontological rescue and/or destruction permit is obtained by the Palaeontologist.
- The Palaeontologist accompany the surveyor and foundation teams during the pylon construction phase to move pylons where possible from potential fossil bearing areas or rescue any fossils from construction footprint.
- Compile a Phase 2 report to the Heritage Authority responsible after palaeontological construction inputs.

Handling of chance finds

A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction employees. If a possible heritage site is discovered during construction activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions.

Depending on the type of site this can include initiating a grave relocation process, documentation of structures or archaeological excavations.

CONTENTS **Page**

LIST OF FIGURES

List of Appendices

1 INTRODUCTION

PGS Heritage & Grave Relocation Consultants was appointed by Aurecon South Africa (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) that forms part of Basic Environmental Assessment report (BAR) the proposed construction of two 132kV transmission lines from the Maanhaarberg and Damfontein Wind Energy Facilities (De Aar 1) near De Aar, Northern Cape.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that occur in the proposed development area. The Heritage Impact Assessment aims to inform the BAR in the development of an Environmental Management Programme (EMP) to assist the developer in managing the identified 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 Heritage Impact Report was compiled by PGS Heritage & Grave Relocation Consultants (PGS). The staff at PGS has a combined experience of nearly 40 years in the heritage consulting industry. PGS will only undertake heritage assessment work where their staff has the relevant expertise and experience to undertake that work competently. Wouter Fourie, the Principal Heritage Specialist, is registered with the Association of Southern African Professional Archaeologists (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 – Western Cape (APHP). Marko Hutton, Field Archaeologist, is registered with the Association of Southern African Professional Archaeologists (ASAPA)as a Professional Archaeologist and is accredited as a Field Director .

Dr Gideon Groenewald has a PhD in Geology from the Nelson Mandela Metropolitan University (1996) and the National Diploma in Nature Conservation from the University of South Africa (1990). 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).

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 be contacted immediately.

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:

i. National Environmental Management Act (NEMA), Act 107 of 1998
ii. National Heritage Resources Act (NHRA), Act 25 of 1999
iii. Minerals and Petroleum Resources Development Act (MPRDA), Act 28 of 2002
iv. Development Facilitation Act (DFA), Act 67 of 1995

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

i. 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 Impacts Assessment (EIA) – Section (32)(2)(d)
    d. Environmental Management Plan (EMP) – Section (34)(b)
ii. 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

iii. Minerals and Petroleum Resources Development Act (MPRDA), Act 28 of 2002:
a. Section 39(3)

iv. Development Facilitation Act (DFA), Act 67 of 1995:
a. The GNR.1 of 7 January 2000: Regulations and rules in terms of the Development Facilitation Act, 1995. Section 31.

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…" 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, MPRDA and the DFA 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 Section of these Acts relevant to heritage (Fourie, 2008):

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).

MPRDA defines 'environment' as it is in the NEMA and therefore acknowledges cultural resources as part of the environment. Section 39(3)(b) of this Act specifically refers to the evaluation, assessment and

identification of impacts on all heritage resources as identified in Section 3(2) of the National Heritage Resources Act that are to be impacted on by activities governed by the MPRDA. Section 40 of the same Act requires the consultation with any State Department administering any law that has relevance on such an application through Section 39 of the MPRDA. This implies the evaluation of Heritage Assessment Reports in Environmental Management Plans or Programmes by the relevant heritage authorities (Fourie, 2008).

In accordance with the legislative requirements and EIA rating criteria, the regulations of the South African Heritage Resources Agency (SAHRA) and Association of Southern African Professional Archaeologists (ASAPA) have also been incorporated to ensure that a comprehensive and legally compatible HIA report is compiled.

Table 1 - Terminology

Abbreviations	*Description*
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
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

ROD	Record of Decision
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency

The following definitions are taken from the National Heritage Resources Act, No 25 of 1999 (Section 2. Definitions):

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 the 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

Early Stone Age

The archaeology of the Stone Age between 400 000 and 2500 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 which 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

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 30-300 000 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.

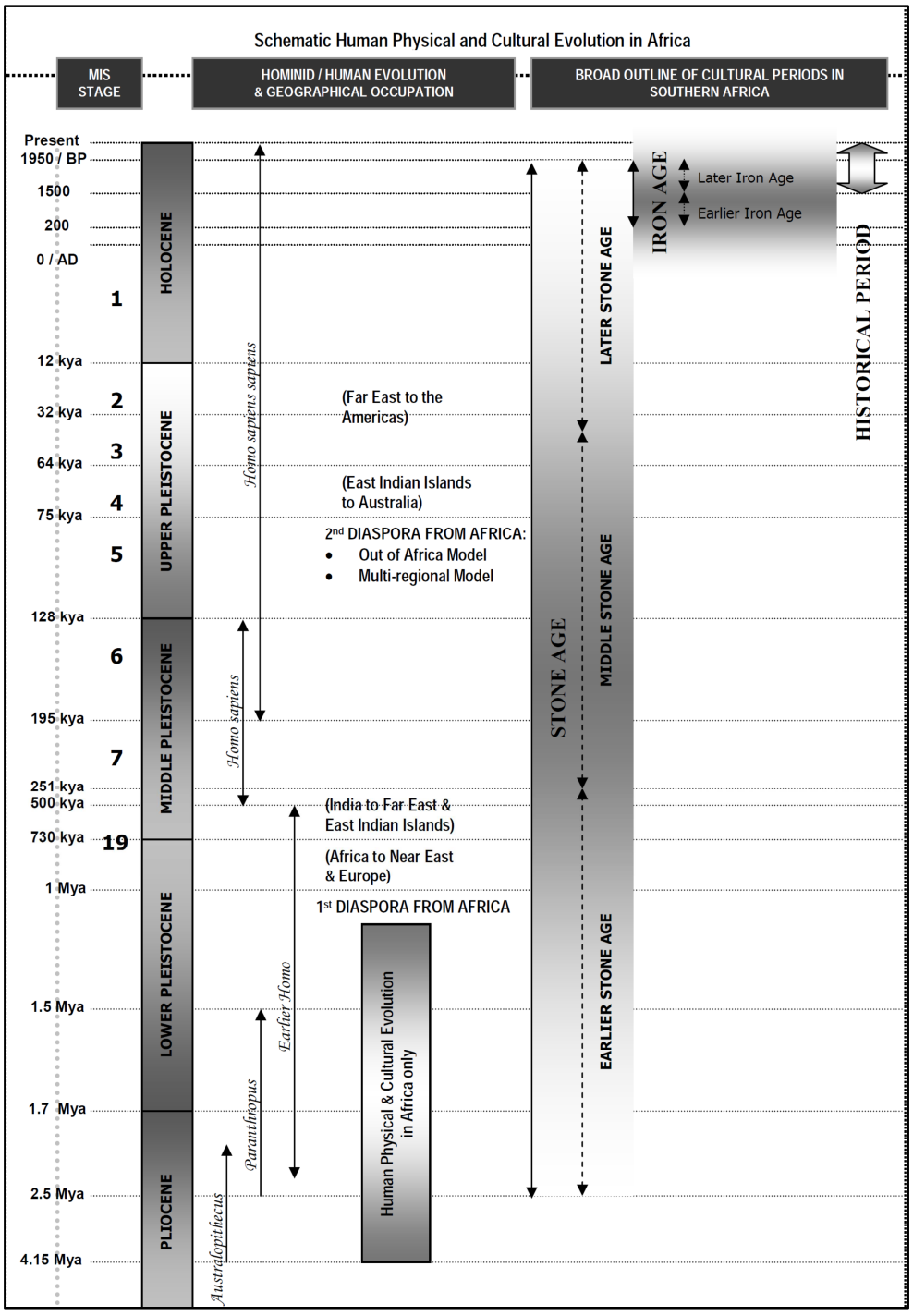


Figure 1 –Human and Cultural Time line in Africa (Morris, 2008)

1.5 Site Location and Project Description De Aar 1 (Maanhaarberg)

Mulilo proposes to construct two 132kV overhead power lines in order to connect a two-phased Wind Energy Facility to be developed to the west of De Aar, Northern Cape to the national transmission grid via the newly proposed Eskom/PV3 substation (Refer to **Figure 2** for a locality map). The first phase of the Wind Energy Facility is the 100.5MW De Aar 1 Maanhaarberg WEF (DEA REF. NO. 12/12/20/1651). The transmission lines would form two phases with the first line connecting the Maanhaarberg substation to a new Eskom/PV3 substation and the second phase connection the Damfontein WEF substation to the Eskom/PV3's substation, via the Maanhaarberg Substation. The new Eskom/PV3 substation is part of a new ring network proposed by Eskom to connect all renewable energy projects in the De Aar area to the national transmission grid. The requirement to construct a new substation is in response to the limited capacity of the existing substations, namely Hydra and De Aar, which will not be sufficient to cater for the high demand from the numerous renewable energy projects being proposed for the De Aar area.

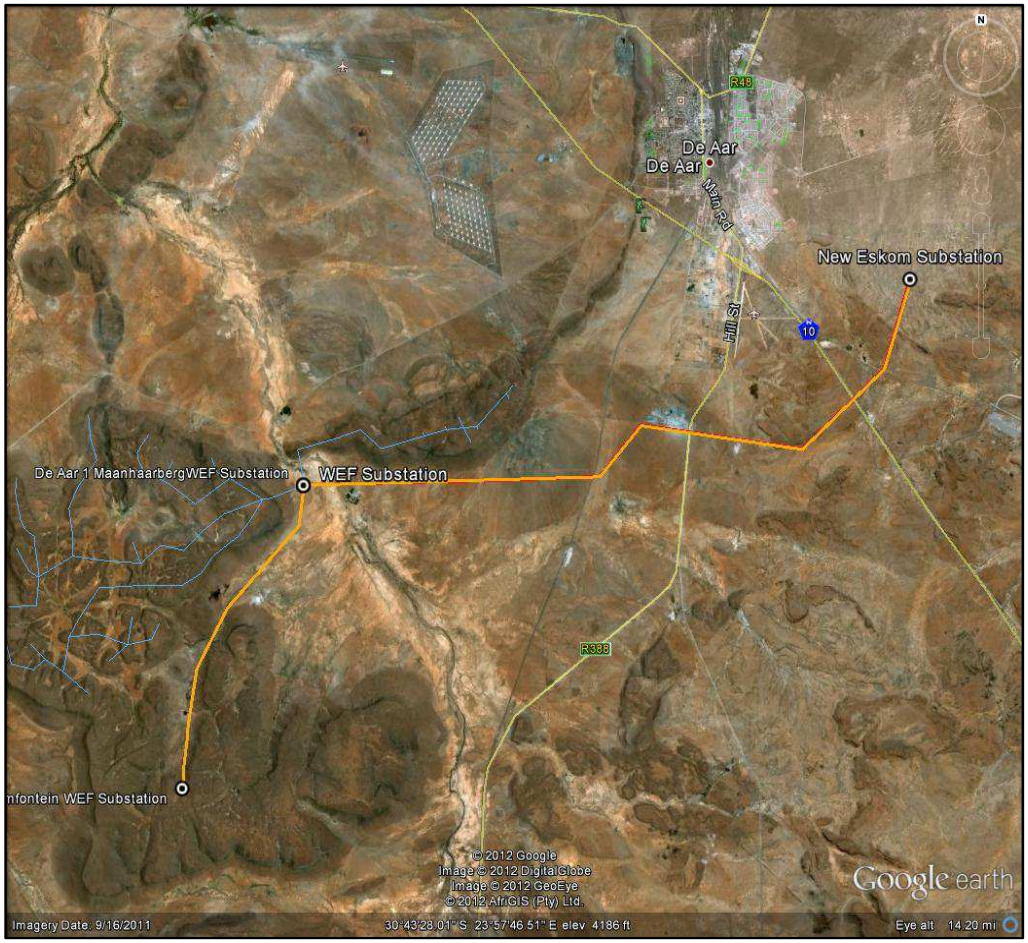


Figure 2 – Regional position and alignment

Include details of the transmission lines:

1. Route (length) of Transmission line 1 is Approximately 17.8 km and Transmission line 2 is Approximately 25.6km
2. Type of tower(s) – steel monopole structure

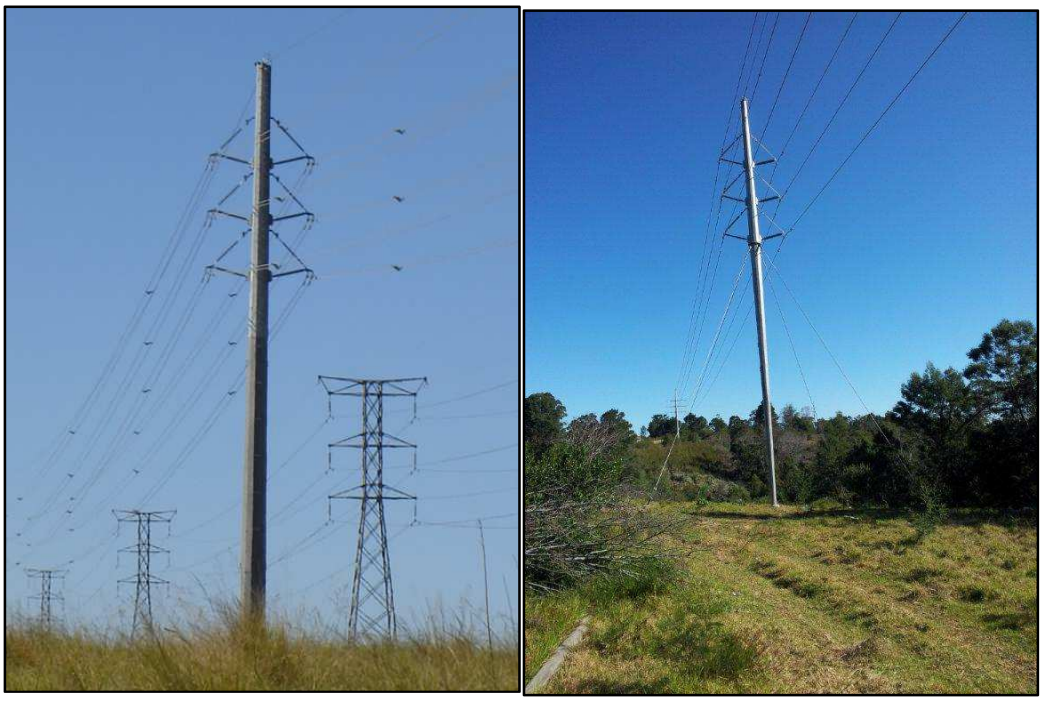


Figure 3 – Type of tower to be used

These poles (**Figure 3**) weigh approximately 1 200 kg each and vary in height from approximately 17,4 m to 21 m. The size of the footprint depends on the type of pole, i.e. whether it is a self-supporting, guyed suspension or an angle strain pole structure. The size of the footprint ranges from 0,6 m x 0,6 m to 1,5 m x 1,5 m, with the larger footprint associated with the guyed suspension and angle strain pole used as bend/strain structures. The average span between two towers is 200 m, but can vary between 250 m and 375 m depending on the ground profile (topography) and the terrain to be spanned. The self-supporting structure (suspension pole) is typically used along the straight sections of the power line, while the guyed intermediate or guyed suspension and angle strain structures are used where there is a bend in the power line alignment.

The final tower sizes and positions will only be determined once the project has received Environmental Authorisation and after negotiations with landowners.

Servitude width

The servitude width for a 132 kV Sub-transmission line is 31 m (15.5 m on either side of the centre line of the power line). If 2 lines it will be 21m line separation with 15,5 m either side (52m).

The HIA has focused on a 500 meter assessment corridor and the archaeological component on the centre alignment of the 500 meter corridor. Because of subsurface and localised nature of archaeological remains, any deviation or changes within the corridor to the initial layout alignment will require an archaeological walkdown of the new alignment after pylons placement positions have been to identify any possible archaeological and heritage structures and sites before construction commence.

Associated infrastructure

Existing roads to be used (distances), and 4x4 jeep tracks required for access to transmission route only where no roads currently exist.

Alternatives

- *Technologies* – There is currently no feasible alternative technologies to connect wind energy facilities to the electrical grid.
- *Layout / spacing* - No layout alternatives can be assessed as the placement of the power line towers and any associated infrastructure will be required to be in line with the WEF technical requirements, Eskom's technical requirements, as well as with specific landowner requirements. Layout/spacing alternatives will be negotiated within the broader corridor being considered for the power lines.

1.6 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 and Grave Relocation Consultants (PGS) for the proposed project 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 consisted of three steps:

- Step I – Literature Review: The background information to the field survey leaned greatly on the initial Heritage Impact Assessment Report completed by Matakoma for the Gardener Ross Residential Golf Estate in 2004.

- Step II – Physical Survey: A physical survey was conducted by vehicle and on foot through the proposed project area by a qualified archaeologist and experienced staff, 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 mitigation
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

- 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 2: *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 Significance	**Mitigation before destruction**
Generally Protected B (GP.B)	-	Medium Significance	**Recording before destruction**
Generally Protected C (GP.A)	**-**	**Low Significance**	**Destruction**

2 ARCHIVAL FINDINGS

The aim of the archival background research is to identify possible heritage resources that could be encountered during the field work.

Evaluation of archaeological work completed on the Perseus Hydra Transmission line that traverses the western section of the study area have produced some ground truthed information on archaeology to be expected in the study area. Further to this Archaeological Impact Assessments (AIA) and Heritage Impact Assessments (HIA) completed by Archer, Kaplan (2010a), Kruger (2012), Orton (2012), PGS (2012) and Van Ryneveld (2008), has revealed a rich archaeological and historical back ground to the greater study area ranging from Earlier Stone Age (ESA) through to the Later Stone Age (LSA) and herder settlements represented by stonewalled kraals along numerous ridges throughout the study area (**Figure**

4). The colonial period is represented by abandoned and current historical farmsteads dating from the mid to late 1800's (Kruger 2012, Orton, 2012 and PGS, 2011), while remnants of stone walling and ash middens dating from the turn of the 20th Century representing the South African War (Orton, 2012 and PGS, 2012).

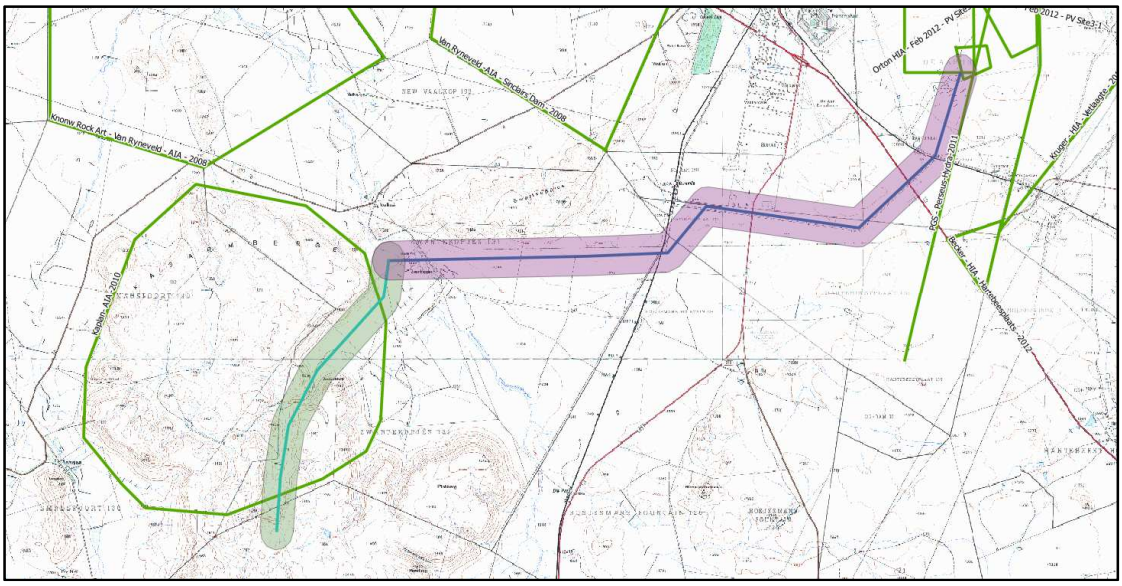


Figure 4 – The study area for this Report (purple and green)) with previous heritage studies conducted indicated (green)

Initial desktop studies completed created a map indicating that area exposed to sheet erosion produced more Stone Age finds as deflated site was exposed during erosion (**Figure 5**).

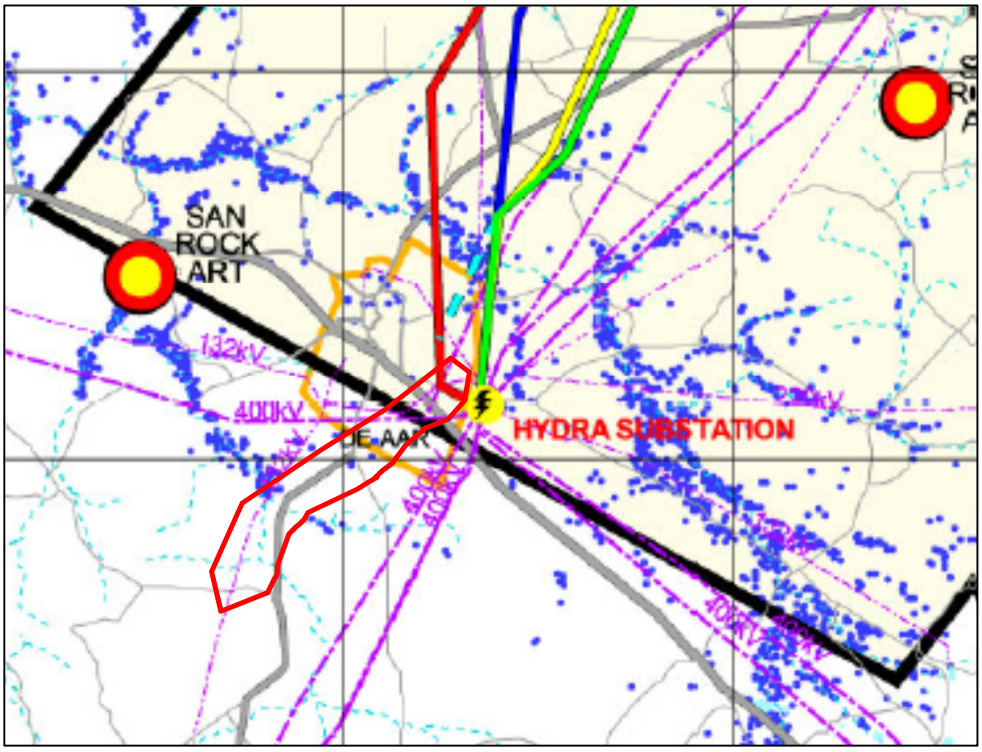


Figure 5 – The greater De Aar region indicating San Rock Art finds – Blue spot indicate areas of sheet erosion (Red outline study area) (Van Jaarsveld, 2006)

2.1 Archaeology

The PGS (2010) revealed numerous find spots from single low concentration Stone Age finds (**Figure 6**) in eroded areas to larger significant Middel Stone Age Scatters (**Figure 7**) in the sections of the study area impacted by the Perseus Hydra Transmission line that runs east of the Renosterberg down to De Aar.

Figure 6 – Low density scatter of MSA finds

Figure 7 – Area scattered with eroded MSA artefacts – Renosterberg in the background

2.2 Historical Context

De Aar Junction played key strategic role during the South Africa War (Anglo-Boer War) and specifically two battles: the Battle of Stormberg and the Battle of Colenso. It acted as both the supply strategic place between Cape Town and the west central regions of South Africa through the Karoo, which remained devoid of any battles during the war. It is located central western region of the country, South Africa.

The town of De Aar was established just after the South African War after two Friedlander brothers, Isaac and Wolf, surveyed the land on farm De Aar which they had purchased during the construction of a junction in the late 1800's when the railway line between Cape Town and Kimberley was built. The site for the construction of the junction was first identified in 1881 and by 1899 the Friedlander brothers were already operating a trading store and a hotel at the junction. It is during this time that they purchased the farm De Aar which the later built the town of De Aar in 1900. However, it took another 5 years after the war had ended (1902) and 6 years after the creation of the town municipality (1900) for the town to elect its first municipal mayor in 1907. The name, De Aar, means 'Artery' after the underground water supply and is the second most important South African rail junction.

2.2.1 Understanding the Importance of De Aar during the Second South Africa War

Two South African war battles become important in the history of De Aar; the Battle of Stormberg and the Battle of Colenso. The Battle of Stormberg was one of the famous encounters between the Boers and the British in the South African war. This skirmish/battle took place when the Boers were triumphant and it formed part of a chain of disasters which the British termed the 'The Black Week' (Meintjes, 1969).

The first involvements of De Aar in the war can be dated to November 1899 when the Boers moved southward from the areas of their strong hold the Orange Free State and the Transvaal. On the 1st of November 1899 a small detachment of Boers from the Orange Free State, had seized the railway bridge over the Orange River at Norvalspont. This bridge was at the time guarded by only six policemen who were quickly overcome by the Boers. On the same day Hans Swanepoel of Smithfield and Floris du Plooy of Bethulie with a combined commando of 900 men and two guns crossed the Bethulie bridges over the Orange River and headed from Naauwpoort and Stormberg (Meintjes, 1969). Up until this time the Boers are argued to have deliberately avoided and neglected to occupy some of the principal railway junctions in the Colony, notably: De Aar, Naauwpoort and Stormberg (ibid).

Idea to deliberately neglect these junctions is argued to have been aimed at offending the Schreiner Ministry based on an agreement made between Steyn and Schreiner, which Steyn withdrew in consultation with President Kruger of the Transvaal after it became apparent that the Cape could play a significant role in the war. Steyn then issued proclamations in which parts of the British

Bechuanaland and the Northern Cape were annexed to the two Boer Republics, the Transvaal and the Orange Free State. The reason behind these annexations is that, they were made to "...permit commandeering of men and supplies as well as to protect rebels who annexed territories of the Cape Colony and the Protectorate would be guilty of High Treason and perhaps be punishable by execution" (Meintjes, 1969).

When hostility between the British and the Boers across the Orange River commenced, the British had small garrisons at Stormberg Junction, Albert Road, Aliwal North, Norvalspont, Colesberg, Arundel and Naauwpoort (Meintjes, 1969). However, they had no garrison in De Aar which was one of the key strategic supply and distribution junctions. The garrisons along some of the railway line and stations were strategic as the railway lines formed an integral part of the British offensive. During the war they therefore played a significant role throughout South Africa and their disruption became a major target for the Boers; for example, during the capture of armoured train at Kraaipan by De le Ray where the first shots of the war were fired.

Stormberg Junction was chosen as a target junction of annexation, over De Aar Junction, by the Boers advancing south because of its link-up with East London and was an important strategic point for a sprong up through the eastern Cape to Bloemfontein and Kimberley.

De Aar did, however, play a role during the war times as a stop and transfer junction with the transportation of British brigades and Naval Police from Cape Town to the central interior and for the transportation and transfer of supplies. The Naval Brigades who fought in the Stormberg skirmish pass through the large railway junction De Aar then described as a '...dreary sight of platforms and dusty trains, tin shanties and corrugated iron houses, gray boulders and ashy sky...' (Meintjes, 1969).

The De Aar junction further acted as a major stockpile for stores to be sent forward to the British forces. Doyle (1902) noted that "immense" supplies were gathered at De Aar (**Figure 8**). Danes (1903) writes, "…*De Aar was a wonderful sight in those days. Hundreds of mules and oxen were there. Countless wagons, packages and cases of food and ammunition, ambulances, hospitals, medical stores…*"

Figure 8 – Stockpiles of oats at De Aar (ca. 1900)

This stock piling was due to De Aar being a stopover and staging post for troops and supplies towards the Free State and access point from the Cape and Port Elizabeth. A large Remount Depot (Horse and Mule replenishment) was also present at De Aar, which provided much needed fresh horses and mules for the war effort (**Figure 9**).

Figure 9 – The Remount Depot Garrison at De Aar (December 1899)

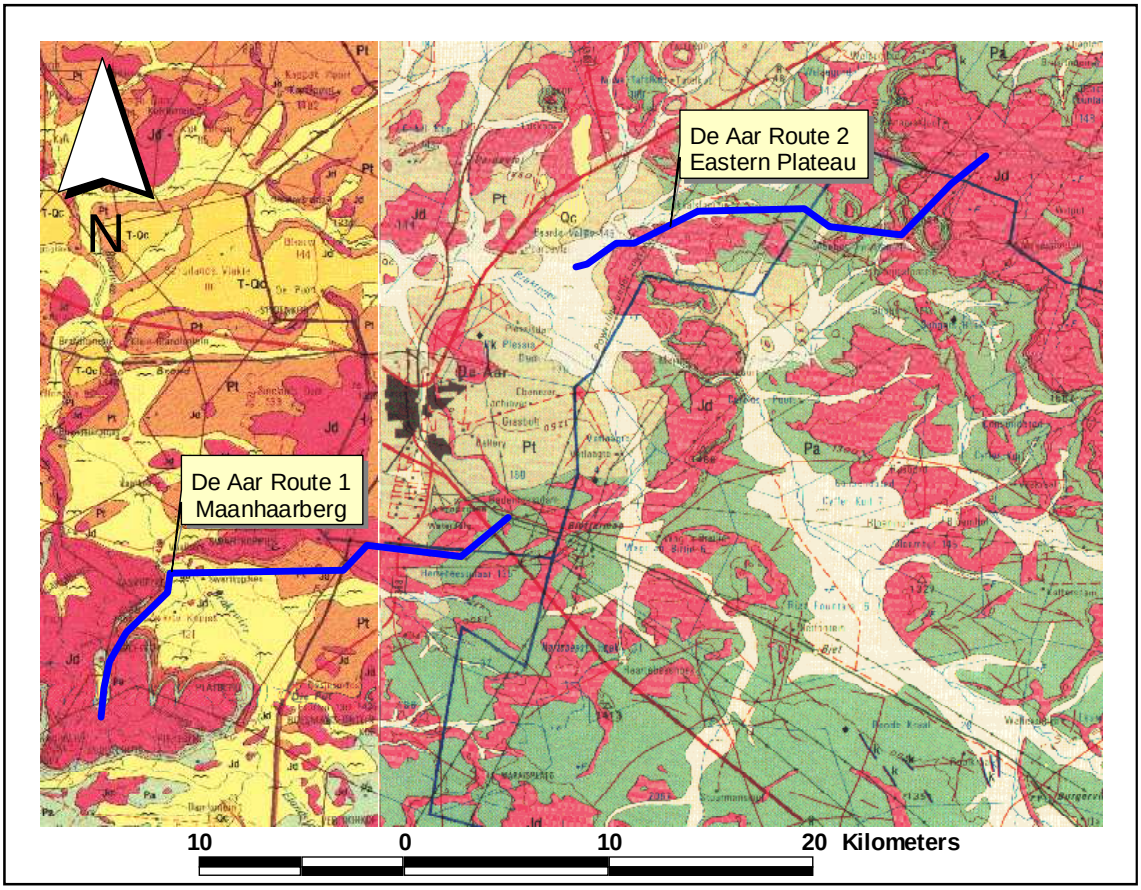
Among the people of Note who passed through De Aar during the war is Winston Spencer Churchill. This is during the time when various war correspondents were travelling between the Cape, the Eastern Cape, Northern Cape and the Transvaal. It is suggested that, after staying at the Mount

Nelson Hotel in Cape, Churchill travelled by rail to East London, via Matjiesfontein, De Aar, Stormberg, Molteno and Queenstown.

During the Colenso Battle, De Aar was used by the British to transfer guns between the Cape Town, the central interior and the Natal region such as, the long Tom-tom guns. The reason for this is that they were encountering hostile enemy lines along the east coast regions of the country (Martins, 1988). Nasson (1999: 135), for example, argues that "the failure of Black Week had prised things open, almost inviting a capitalizing counterstroke from some bold and resolute Boer leadership. Exposed to a broader offensive, the Cape Colony virtually asked for deeper penetration to throttle the strategic junction of De Aar, thereby severing Methuen's supply lines. On the eastern front, almost all of Natal remained under the enemy thumb, with the British confined or paralysed by the Orange Free State commandos who, in their most southerly groupings, had pegged out substantial swathe of land running down to within 120miles of the Indian Ocean".

2.3 Palaeontology

The study area is mainly underlain by Permian sedimentary rocks of the Karoo Supergroup (**Figure 10**). These Permian sedimentary rocks are classified as the Tierberg Formation (Pt) of the Ecca Group of the Karoo Supergroup and the Abramskraal Formation (Pa) of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite (Jd) sills dominate the hilltops while the low laying areas consist of recent Quaternary (^^) Alluvium deposits.



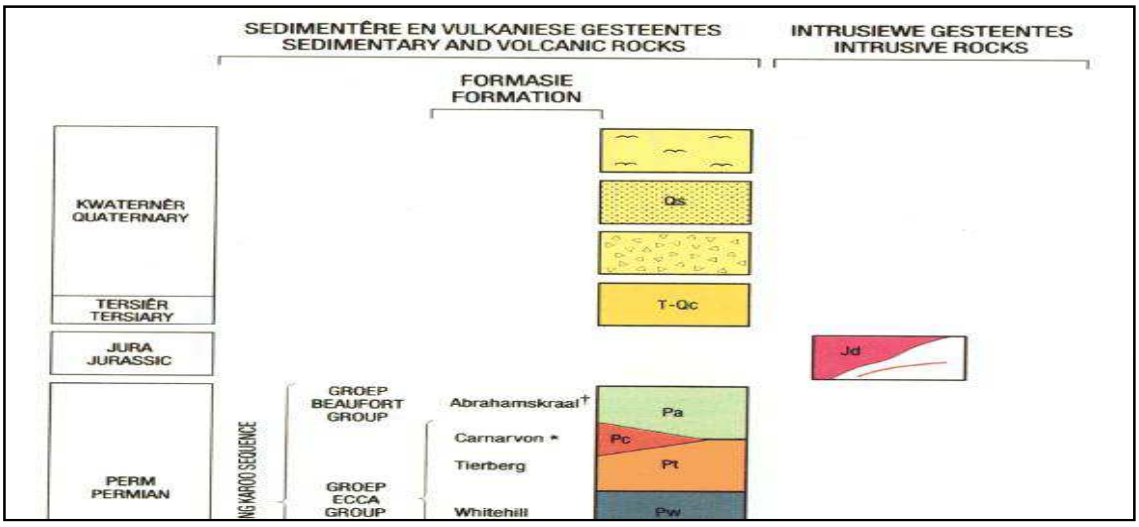


Figure 10 - Geology of the study area at De Aar (Geo Maps 3022 Britstown and 3024 Colesberg)

2.3.1 The Tierberg Formation

The Tierberg Formation (Pt) is interpreted as offshore non-marine mudrocks with distal turbidite beds, prodeltaic sediments and represented by greenish weathering shale with subordinated siltstone and sandstone (Johnson *et al*, 2006).

2.3.2 The Abramskraal Formation

The Abramskraal Formation (Pa) is interpreted as fluvial sediments with channel sandstones (meandering rivers), thin mudflake conglomerates interbedded with floodplain mudrocks (grey-green, purplish), pedogenic calcretes, playa lake and pond deposits and occasional reworked volcanic ashes (Johnson *et al*, 2006 and Almond & Pether, 2008). The Abramskraal Formation is represented by blue-grey mudstone, sandstone and siltstone.

2.3.3 Karoo Dolerite

Dolerite (Jd) is a very hard igneous rock that intruded the sedimentary layers and can occur either as sills or dykes. Sills can be from a few meters to tens of meters thick.

2.3.4 Quaternary Deposits

The Quaternary Deposits consist of alluvial deposits, deposited by rivers in the valley floors.

2.4 PALAEONTOLOGY OF THE AREA

2.4.1 The Tierberg Formation

Trace fossils occur throughout the Tierberg Formation, reflecting specific water depths and energy conditions. Plant impressions, mud and vertebrate fragments in the upper sandstone layers are indications of a sallow water environment. These fossils have a low diversity but are locally abundant when found (Almond & Pether, 2008).

2.4.2 The Abramskraal Formation

The Abramskraal Formation have a diverse continental fossil biota dominated by a variety of *Therapsids* (eg *dinocephalians, dicynodonts, gorgonopsians, therocephalians, cynodonts*) and primitive reptiles (eg *pareiasaurs*), sparse *Glossopteris* Flora (petrified wood, rarer leaves, horsetail stems), tetrapod trackways, burrows and coprolites. Freshwater assemblages include temnospondyl amphibians, palaeoniscoid fish, non-marine bivalves, phyllopod crustaceans and trace fossils (esp. Arthropod trackways and burrows, “worm” burrows, fish fin trails plant rootlet horizons) (Almond & Pether, 2008).

2.4.3 Karoo Dolirite

Due to the ingenious character of Karoo Dolerite it will contain no fossils.

2.4.4 Quaternary Deposits

No fossils are expected in the alluvial deposits of recent rivers.

3 POSSIBLE HERITAGE FINDS

Evaluation of aerial photography has indicated areas in the Corridor and larger De Aar region that may be sensitive from a heritage resources perspective (**Figure 11**). Archaeological surveys and studies in the Northern Cape have shown rocky outcrops, dry river, riverbanks and confluence to be prime localities for archaeological finds and specifically Stone Age sites. Included in the archaeological timeframe is the South African War as well as colonial farmer settlements.

The aerial photography has reference the following as of possible heritage sensitivity:

Drainage lines

Drainage lines, such as dry river beds, erosion dongas as well as sheet erosion has been shown to yield rich archeological deposits due to the exposure of archaeological material as well as the fact that human settlement is drawn to water sources in arid regions (Kruger 2012; Orton 2012; PGS 2012).

Farmsteads

Most of the farmsteads in the study area date from the mid to late 1800's and are of great historical and significance (Kruger 2012; Orton 2012; PGS 2012).

Structures

Numerous structures and outlines of man mad structures have been identified and rated as possible sensitive heritage resources from the aerial survey. Some of the early settler farmsteads have been abandoned for close to 100 years and only the remnants of the walling, middens and paddocks remain. These sites can be of high heritage significance regions (Kruger 2012; Orton 2012; PGS 2011).

Kaplan (2010b), further makes reference to dry stone walling on the farm Smouspoort (Smauspoort) that according to local knowledge could be associated with impoverished black farmers that settled in the area around 1856 after the cattle killings in the Eastern Cape after the prophecy of Nongqawuse.

Pans

Previous research in the Northern Cape has shown that as with drainage line and rivers human occupation is drawn to pans and ephemeral water sources by the chance of water and of hunting due to the availability of game in such areas.

Ridges

Numerous ridges, koppies and mountains have been identified in the study area and are associated with human settlement and activity. Stonewalling from herders, rock engravings and knapping sites associated with Later Stone Age manufacturing technology is known to occur in these areas (Kruger 2012; Orton 2012; PGS 2011 and 2012, Van Ryneveld 2008).

South African War

The archival research has shown that De Aar was a major staging post during the South African War. Along with the infrastructure and remnants found close to town, the railway line running northwards through the study area will have the remains of numerous blockhouse, constructed by the British Forces to protect the railway line from attack, in close vicinity.

Sensitive areas as indicated from previous HIA's

Sensitive areas as identified in previous HIA's and AIA's have been included in the mapping and are in all cases associates with one or more of the categories listed above.

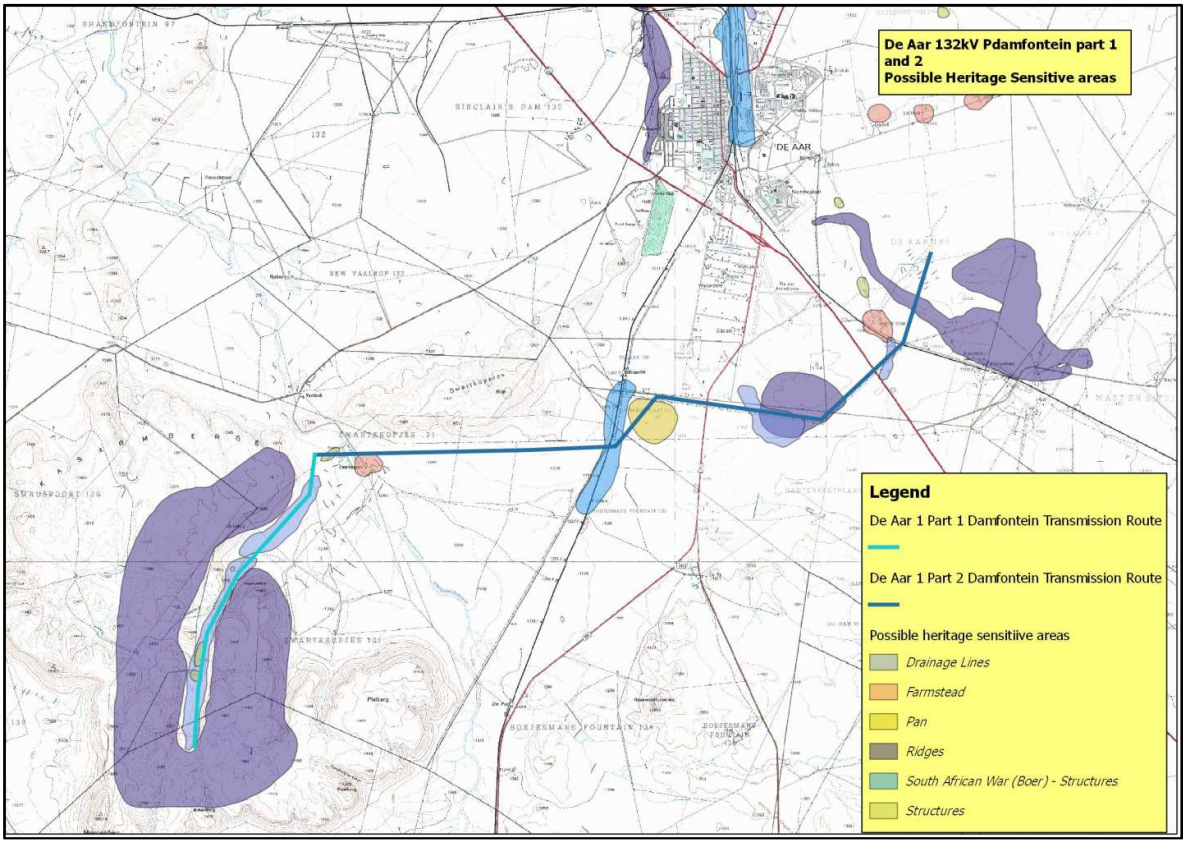


Figure 11 – Possible heritage sensitive areas

4 SITE EVALUATION

The alignment for this project covers approximately 43 kilometres in total. Due to the nature of cultural remains, with the majority of artefacts occurring below surface, a controlled-exclusive surface survey of the centre line of the provided corridor alignment was conducted over a period of 4 days on foot by an archaeologist of PGS. Field work was conducted in the week of 3-6 December 2012. Refer to **Appendix A** for Heritage Maps and tracklogs.

The following archaeological sites were identified during the field work:

4.1 Archaeological Sites

4.1.1 Site DAM 1

GPS: 30,71847 S 24,02698 E

A low density scatter of lithics was identified here (± 2-5 artefacts in 10m x10m) (**Figure 12**). The site was situated in a large extended plain. The stone tools consisted mostly of Middle Stone Age (MSA) blades, scrapers and a few cores and were scattered over an area of approximately 60m in diameter. The lithics were weathered and most patinated (**Figure 13**).

Site size: Approximately 60m in diameter.

Figure 12 – General view of site

Figure 13 – Dorsal view of lithics

Impact Assessment:

Impact	Impact Significance	Heritage Significance	Certainty	Duration	Mitigation
Negative	Low	Grade GP.C	Possible	Permanent	A

Mitigation: No further management required at this site

4.1.2 Site DAM2

GPS: 30,57886 S 24,11906 E

Another low density scatter of lithics was identified here (± 2-5 artefacts in 10m x10m) (**Figure 14**). The site was situated on a small rise which overlooked a watercourse to the west. The artefacts were identified in several clearings which were exposed by sheet erosion along the summit of the rise. The stone tools consisted mostly of Later Stone Age (LSA) blades, scrapers and a few cores and were scattered in small concentrations over an area of approximately 150m x 100m (**Figure 15**).

Site size: Approximately 150m x 100m.

Figure 14 – General view of site

Figure 15 – Dorsal view of lithics

Impact Assessment:

Impact	Impact Significance	Heritage Significance	Certainty	Duration	Mitigation
Negative	low	Grade GP.C	Possible	Permanent	A

Mitigation: No further management required at this site

4.1.3 Site DAM 3

GPS: 30,77495 S 23,87992 E

A dam wall was identified at this location. The dam wall was situated across the valley floor and across a non-perennial stream, which ran down the valley (**Figure 16**). The dam wall consisted of a raised earthen wall which was covered with a layer or layers of packed rocks which prevented the earthen wall to be eroded (**Figure 17**). The dam wall measured approximately 120m across the valley floor and was at least 5m high at its highest point. The wall was also approximately 15m wide and could withstand a reasonable flood of water coming down the valley. There was no water in this dam, even after the recent spate of showers which occurred in the region. It is not known when the dam wall was constructed.
Site size: 150m x 20m.

The dam wall is most probably older than 60 years and associated with site **DAM 4**. This structure is protected under Section 34 of the national Heritage Resources Act and will require a permit from the Provincial Heritage Authority in the Northern Cape, Ngwao-Boswa Jwa Kapa Bokone, for any alterations to the structure.

Impact Assessment:

Impact	Impact Significance	Heritage Significance	Certainty	Duration	Mitigation
Negative	Medium	Grade GP.B	Possible	Permanent	C

Mitigation:

- The placement of the pylons must be done in such a way as to stay away from the dam wall;
- The site must be demarcated during and a buffer of at least 10 meters kept, during construction.

Figure 16 – View of dam wall

Figure 17 – Stone packed wall visible

4.1.4 Site DAM 4

GPS: A: 30,77281 S 23,87998 E

B: 30,76805 S 23,88076

An extended stone-built wall was identified at this location. The stone wall was situated on the downstream side of the dam wall (**DAM 3**) (**Figure 18**) and was situated right next to the identified non-perennial stream, which ran down the valley. The wall consisted of packed rocks and the wall differed in size at various locations. At one place the wall measured approximately 1.5m high and at least 0.75m wide. Most of the stone wall was in a dilapidated state, but it could be estimated that it was at least 1m high and at least 0.5m wide in most places. The stone wall was approximately 550m in length and followed the dry river bed down the valley, and evaluation of the aerial photography indicates and en closure of approximately 6 hectares (**Figure 19**). The wall most probably had something to do with cultivation of crops in the floodplain.

Site size: 550m x 5m.

Figure 18 – View of dam wall

The wall is most probably older than 60 years and associated with site **DAM 3**. This structure is protected under Section 34 of the national Heritage Resources Act and will require a permit from the Provincial Heritage Authority in the Northern Cape, Ngwao-Boswa Jwa Kapa Bokone, for any alterations to the structure.

Impact Assessment:

Impact	Impact Significance	Heritage Significance	Certainty	Duration	Mitigation
Negative	Medium	Grade GP.B	Possible	Permanent	C

Mitigation:

- The placement of the pylons must be done in such a way as to stay away from the dam wall;
- The site must be demarcated during and a buffer of at least 10 meters kept, during construction.

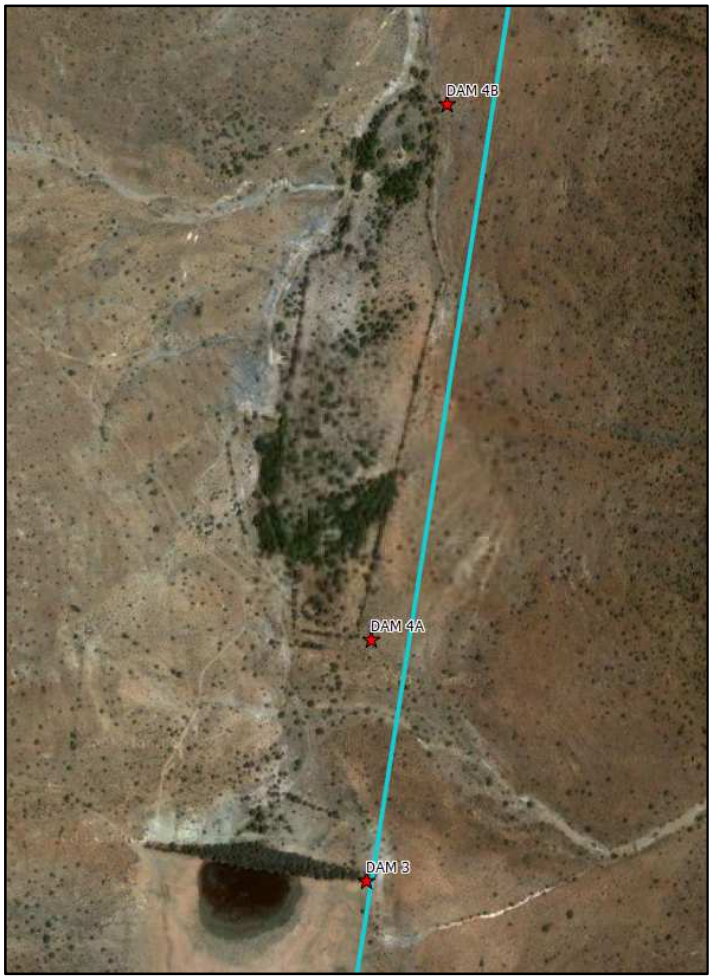


Figure 19 – Aerila view of DAM 3 and Dam 4 indicating the extent of the site

4.2 Palaeontological Sensitivity

The palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units; ascertain the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity is summarised in **Table 3** and illustrated in **Figure 20** below.

Table 3 - Palaeontological Sensitivity of Geological Units on Site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Tierberg Formation ECCA GROUP	Greenish weathered shale, subordinated siltstone and sandstone PERMIAN	Disarticulated microvertebrate remains (eg fish teeth, scales), sponge spicules, spare vascular plants (leaves, petrified wood), moderate diversity trace fossil assemblages such as locally abundant ichnofaunas (horizontal "worm" burrows, arthropod trackways).	*None*	Moderate sensitivity
Abramskraal Formation Adelaide Subgroup BEAUFORT GROUP	Blue-grey mudstone, sandstone and siltstone LATE PERMIAN	Vertebrate fossils of the *Therapsids* group e.g. *Gorgonopsian* and *Dicynodonts* and Plant fossils e.g. *Glossopteris* trees and leaves.	*Dicynodon* Assemblage Zone	High sensitivity

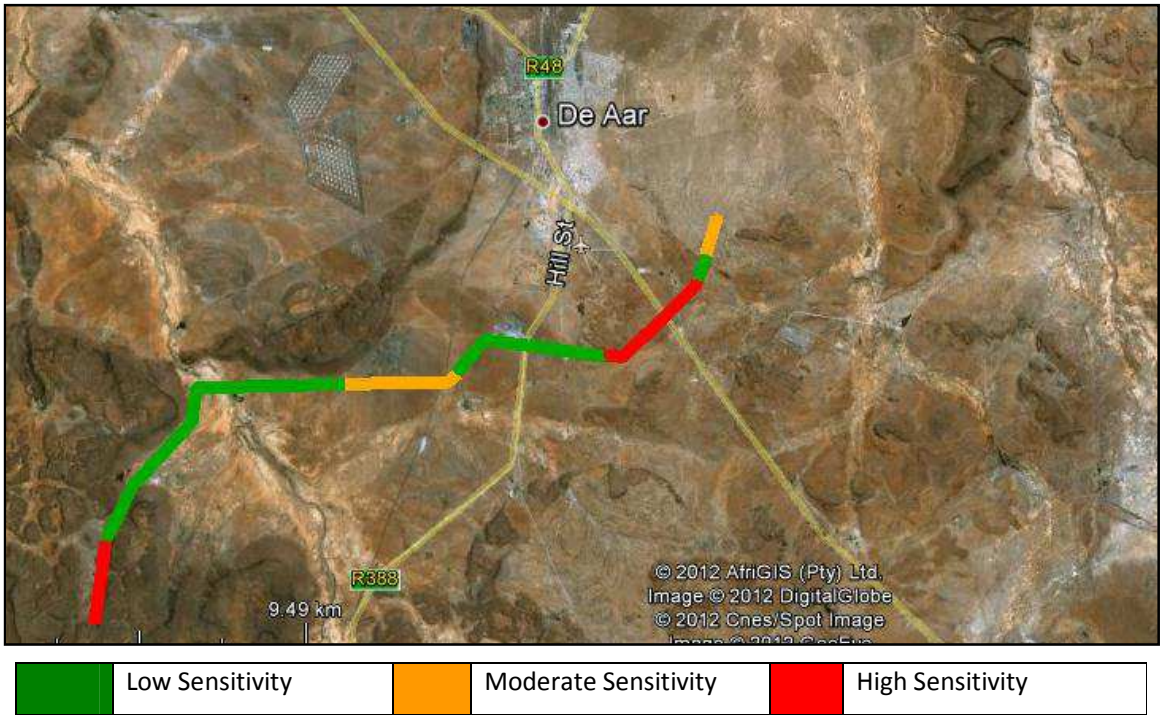


Figure 20 - Palaeontological Sensitivity Localities

The study area is mainly underlain by Permian sedimentary rocks of the Tierberg Formation of the Ecca Group of the Karoo Supergroup and the Abramskraal Formation of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite sills dominate the high laying areas while recent Quaternary Alluvium deposits occur in the river valleys.

There is a high and moderate possibility that fossils could be encountered during excavation of the Abramskraal and Tierberg Formations respectively. These fossil founds would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would be a highly negative palaeontological impact. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact.

It is therefore recommended that:

- A Palaeontologist be appointed as part of the Environmental Construction Team for preferable all identified palaeontological sensitive areas but definite for the identified high sensitive areas.
- A palaeontological rescue and/or destruction permit is obtained by the Palaeontologist.

- The Palaeontologist accompany the surveyor and foundation teams during the pylon construction phase to move pylons where possible from potential fossil bearing areas or rescue any fossils from construction footprint.
- Compile a Phase 2 report to the Heritage Authority responsible after palaeontological construction inputs.

Refer to ***Appendix D*** for the full description of the palaeontology of the study area.

4.3 Cultural Landscape

Heritage significance of the cultural landscape is derived from the interaction between the natural landscape, and access routes, human settlements and farmsteads. Also interacting with these physical entities are intangible and historic landscapes and events that are known to have added to the cultural fabric of a place or area.

Views in the region are extensive and unobstructed for kilometres. The Kasarm Mountains in the western section of the alignment makes way for a large open landscape with low vegetation towards De Aar. The open landscape is however already broken with numerous 132kV and 400kV lines coming from the west and south through the study are towards the Perseus Substation at De Aar some 2 km to the east of the alignment.

The evaluation of the alignment and a 500 meter buffer around the centre line (**Figure 21**Error! Reference source not found.**)** has shown two farmsteads to be of concern with regards to alignments. The first and still being utilised as a going concern is the Zwarkopppies farmstead on the farm Zwartekopjes 131 The farmstead is supplied with electricity via an existing Eskom distribution line from the west, while an Eskom transmission line run 500 metres to the north of the farmstead.

Impact	Impact Significance	Heritage Significance	Certainty	Duration	Mitigation
Negative	Moderate	Grade GP.A	Possible	Permanent	C

The proposed alignment of the 132kV line is judged to have a moderate negative impact on the cultural landscape around the Zwartkoppies farmstead.

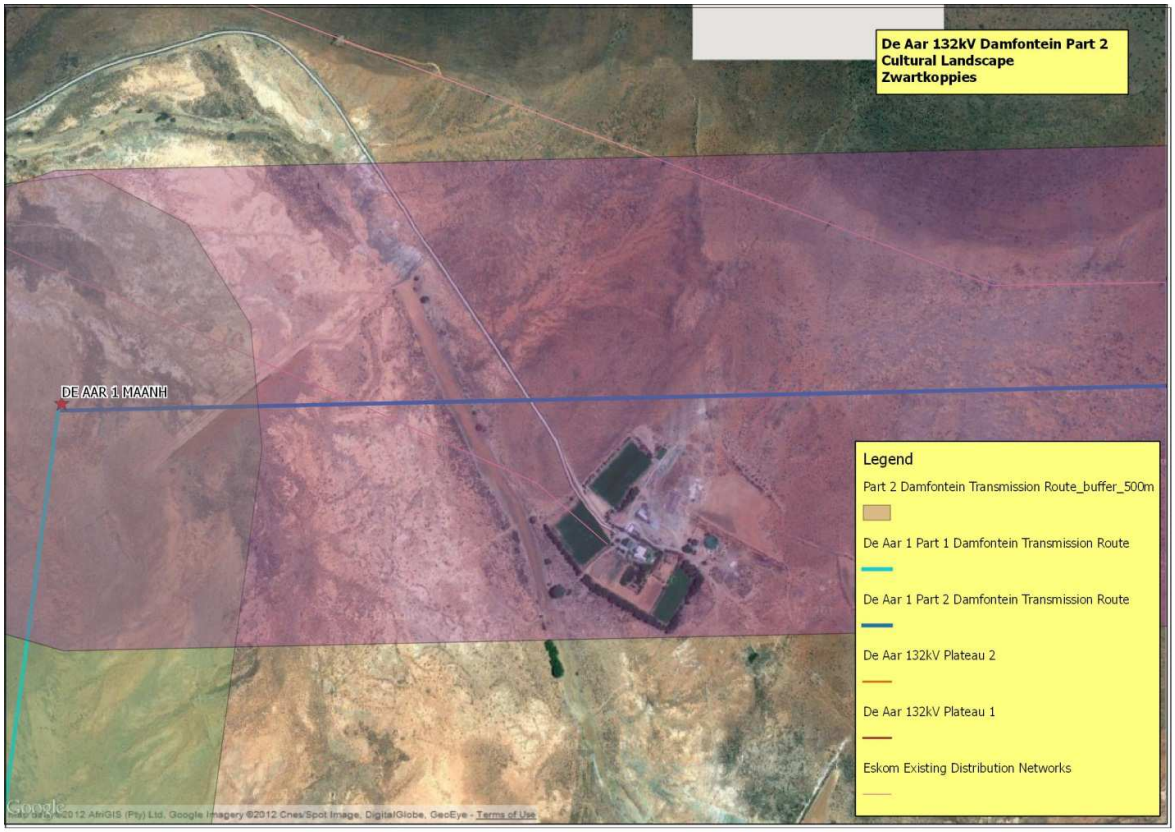


Figure 21 – Zwartkoppies farmstead showing 500m buffer (shaded)

The Second farmstead is Badenhorst dam farmstead situated on the outskirts of De Aar on the farm Badenhorst Dam farm (Portion 1 of Farm No. 180 (**Figure 22**). There is however numerous Eskom Transmission lines, proposed solar parks, roads and rail lines running within a kilometre of this farmstead that has already impacted on the cultural landscape.

Impact	Impact Significance	Heritage Significance	Certainty	Duration	Mitigation
Negative	Low	Grade GP.B	Possible	Permanent	A

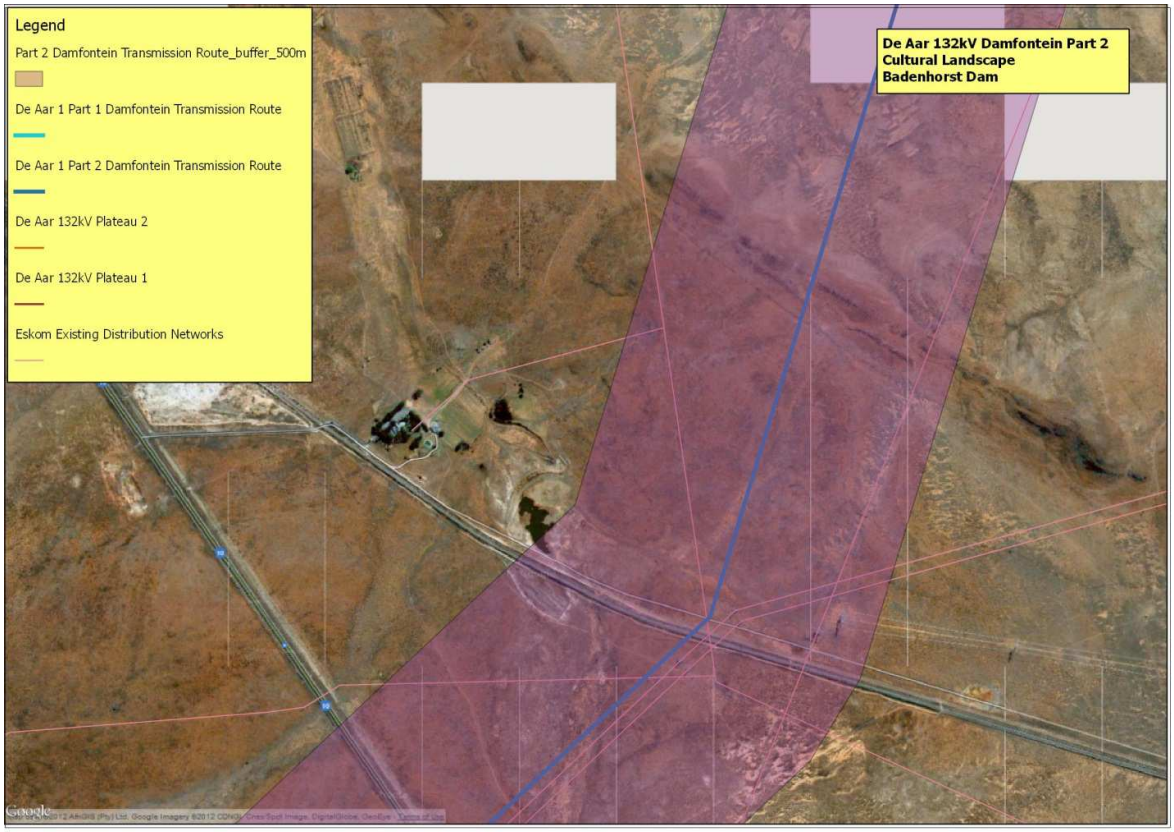


Figure 22 – Badenhorstdamfarmstead showing 500m buffer (shaded)

It is recommended that the alignment of the proposed 132kV line around the Zwartkoppies farmstead be re-evaluated to move it further to the north away from the farmstead and closer to the existing transmission lines. This alignment recommendation can be accommodated within the 500m corridor. However, it is recommended that the final route be negotiated with the landowner to minimize impacts. Such mitigation will reduce the impact from Moderate Negative to a low negative impact.

5 CONCLUSIONS

Utilising the archival study completed for the HIA as a guide, the field work identified a total of **2 archaeological find spots** on the alignment provided for the field work of which none will require mitigation work.

The HIA has focused on a 500 meter assessment corridor and the archaeological component on the centre alignment of the 500 meter corridor. Because of subsurface and localised nature of archaeological remains, any deviation or changes within the corridor to the initial layout alignment will

require an archaeological walkdown of the new alignment after pylons placement positions have been to identify any possible archaeological and heritage structures and sites before construction commence.

5.1 Heritage Structures

The field work has identified two associated structures associated with early farming activities and is most probably older than 60 years. These structures are protected under Section 34 of the national Heritage Resources Act and will require a permit from the Provincial Heritage Authority in the Northern Cape, Ngwao-Boswa Jwa Kapa Bokone, for any alterations to the structure.

It is recommended that:

- The placement of the pylons must be done in such a way as to stay away from the dam wall;
- The site must be demarcated during and a buffer of at least 10 meters kept, during construction.

5.2 Cultural Landscape

An evaluation of the 500 meter corridor for the proposed 132kV line has shown a negative impact on the cultural landscape around the Zwartkoppies farmstead on the farm Zwartekopjes 131. It is recommended that the alignment of the proposed 132kV line around the Zwartkoppies farmstead be re-evaluated to move it further to the north away from the farmstead. This alignment recommendation can be accommodated within the 500m corridor. However, it is recommended that the final route be negotiated with the landowner to minimize impacts. Such mitigation will reduce the impact from Moderate Negative to a low negative impact.

5.3 Palaeontology

There is a high and moderate possibility that fossils could be encountered during excavation of the Abramskraal and Tierberg Formations respectively. These fossil founds would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would be a highly negative palaeontological impact. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact.

It is therefore recommended that:

- A Palaeontologist be appointed as part of the Environmental Construction Team for preferable all identified palaeontological sensitive areas but definite for the identified high sensitive areas.
- A palaeontological rescue and/or destruction permit is obtained by the Palaeontologist.
- The Palaeontologist accompany the surveyor and foundation teams during the pylon construction phase to move pylons where possible from potential fossil bearing areas or rescue any fossils from construction footprint.
- Compile a Phase 2 report to the Heritage Authority responsible after palaeontological construction inputs.

5.4 Handling of chance finds

A short induction on possible heritage resources that maybe found in the area should be included in the induction program for construction employees. If a possible heritage site is discovered during construction activity, all operations in the vicinity of the discovery should stop and a qualified specialist contracted to evaluate and recommend appropriate actions. Depending on the type of site this can include initiating a grave relocation process, documentation of structures or archaeological excavations.

6 LIST OF PREPARERS

Marko Hutten, Heritage Specialist and Accredited Professional Archaeologist (ASAPA), Field Director (CRM Accredited).
Wouter Fourie, Accredited Professional Archaeologist (ASAPA), Principal Investigator (CRM Accredited), Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners – Western Cape (APHP)

7 REFERENCES

ALMOND, J.E. AND PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA Technical Report. Natura Viva cc., Cape Town.

ARCHER, WILL. Undated. Archaeological Impact Assessment: proposed photovoltaic power generation facility in De Aar, Northern Cape.

BECKER, ELIZE. 2012. Phase 2 Heritage Impact Assessment De Aar Solar One Photovoltaic Power Project. Hatch Africa (Pty) Ltd

DANES, RICHARD. 1903. *Cassells's History of the Boer War, 1899-1902*. Cassell And Company, Limited London, Paris, New York & Melbourne

DOYLE, A.C. 1902. The Great Boer War.

FOURIE, WOUTER. 2008. *Archaeological Impact Assessments within South African Legislation*. South African Archaeological Bulletin 63 (187): 77–85, 2008

GROENEWALD GH.1996. Stratigraphy and Sedimentology of the Tarkastad Subgroup, Karoo Supergroup, South Africa. Unpubl PhD Thesis, University of Port Elizabeth.

HENDERSON, ZOË. 2002. *A dated cache of ostrich egg flasks from Thomas' Farm, Northern Cape Province, South Africa*. The South African Archaeological Bulletin.Volume 57 (175).

JOHNSON MR , ANHAEUSSER CR AND THOMAS RJ (EDS) (2006). The Geology of South Africa. GSSA, Council for Geoscience, Pretoria.

KAPLAN, JONATHAN. 2010a. Archaeological Impact Assessment for a proposed photovoltaic (PV) power generation facility in De Aar in the Northern Cape Province. Agency for Cultural Resource Management.

KAPLAN, JONATHAN. 2010b. Archaeological Scoping Study of a Proposed Wind Energy Facility on the Maanhaarberge & Kombuisfonteinberge, De Aar, Northern Cape.

KENSLEY, BRIAN. 1975. Taxonomic Status of the Pygocephalomorphic Crustacea from the Dwyka 'White Band' (Permo-Carboniferous) of South Africa. Annals of the South African Museum, 67: 25-33

KRUGER, NELIUS. 2012. Archaeological Impact Assessment (AIA) of Demarcated Surface areas on the Farm Vetlaagte 4, De Aar, Northern Cape Province. AGES Gauteng

MARTIN, D. 1988. *Duelling with Long Toms: An Account of the 16th Battery Southern Division R.G. A during the Anglo-Boer War 1899-1902*. In Memorium, Henry Powell, 1877-1958.

MEINTJES, J. 1969. *Stormberg a Lost Opportunity*. Nasionale Boekhandel.

MORRIS, DAVID. 2002. *Another spouted ostrich eggshell container from the Northern Cape*. The South African Archaeological Bulletin. Volume 57 (175).

MORRIS, DAVID, 2010. Specialist input fort the Scoping Phase of the Environmental Impact Assessment for the proposed Pofadder Solar Thermal Facility, Northern Cape Province. Archaeology. McGregor Museum.

NASSON, B. 1999.*The South African War 1899-1902*. Arnold. A member of the Hodder Headline Group. London. Sydney. Auckland. Co-published in the United States of America by Oxford University Press Inx., New York.

ORTON, JAYSON. 2012. Heritage Impact Assessment for three Solar Energy Facilities at De Aar,Western Cape. ACO Associates cc

PGS HERITAGE & GRAVE RELOCATION CONSULTANTS, 2010.*Perseus Hydra Transmission Line, Archaeological Walk down*. Completed for Eskom

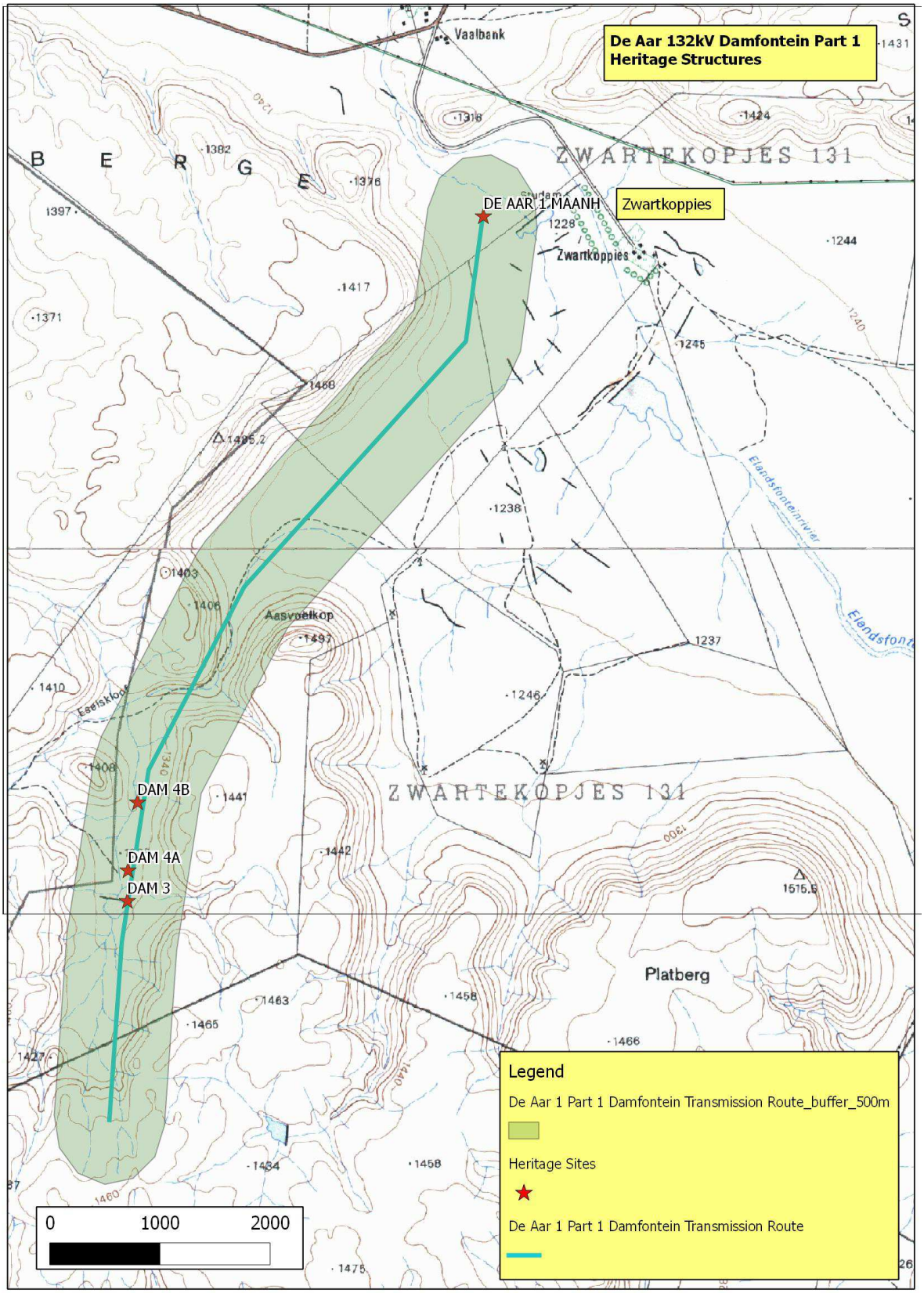
PGS HERITAGE & GRAVE RELOCATION CONSULTANTS, 2012. Concentrated Solar Project for Mainstream Renewable Power South Africa, on the farm PaardeVley 145 close to De Aar in the Northern Cape Province. SiVest Environmental Division.

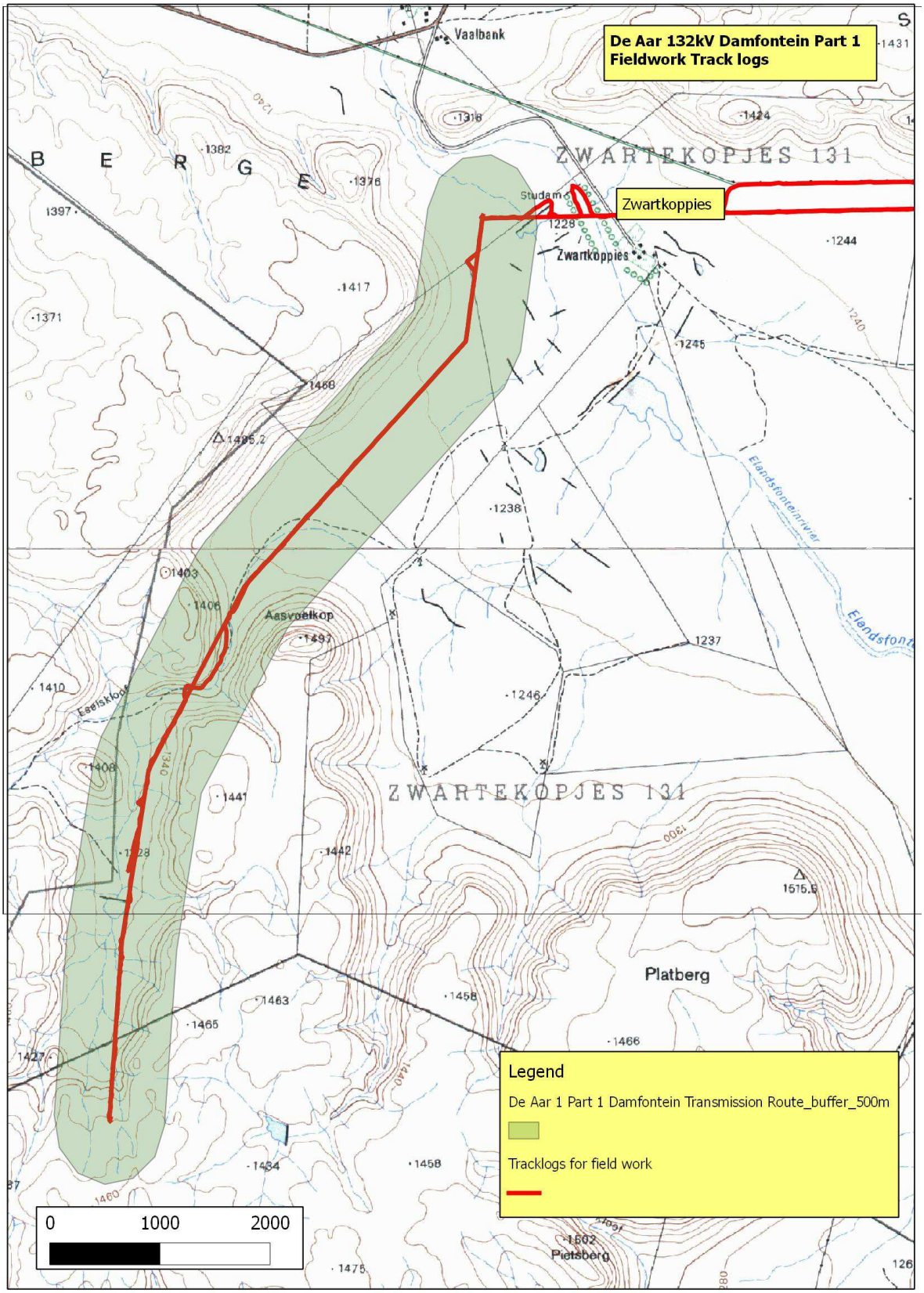
RUBIDGE BS (ED) 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup), South Africa. South African Committee for Stratigraphy.

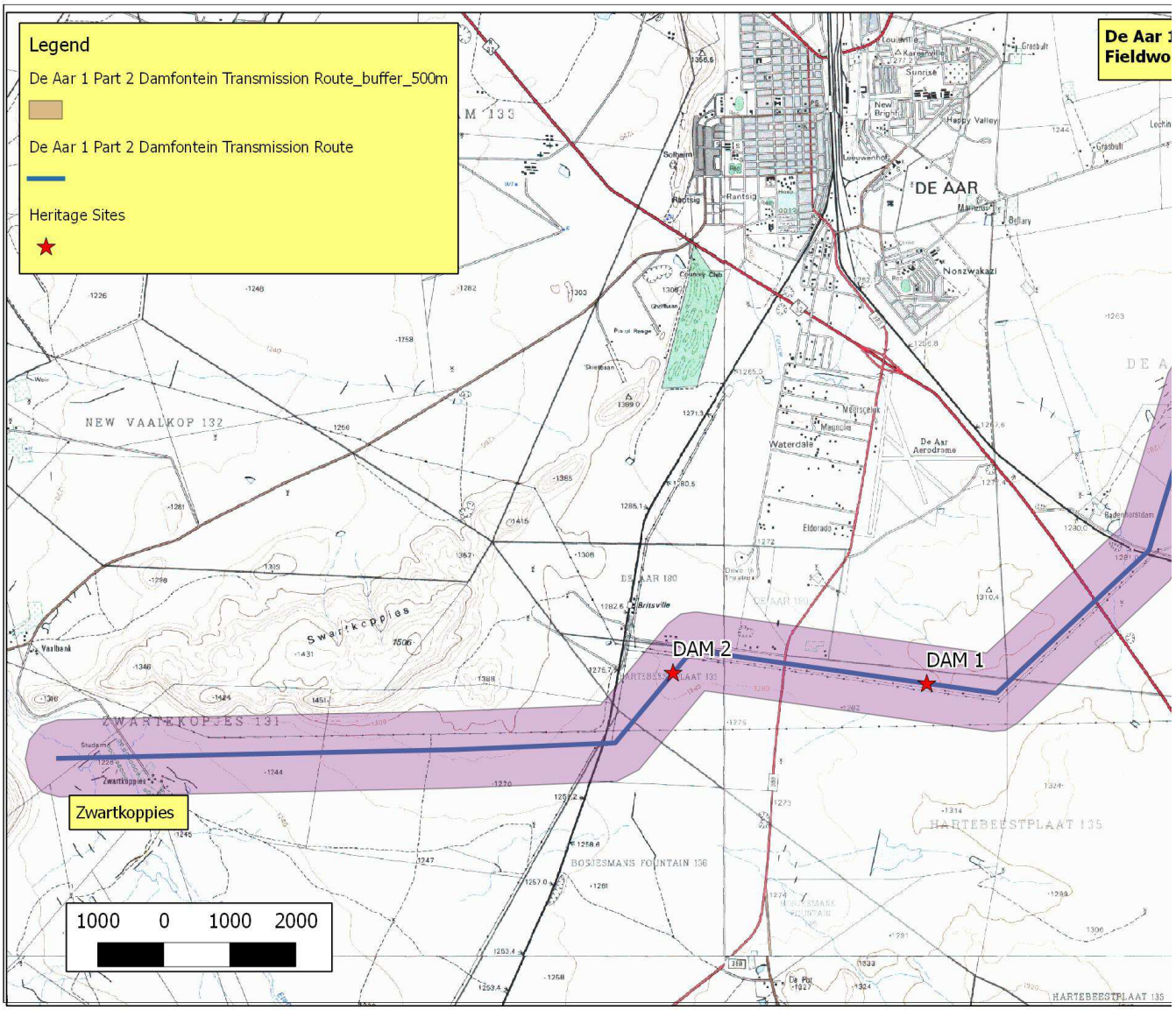
VAN JAARSVELD, Albert. 2006. Hydra-Perseus and Beta-Perseus 765kv transmission power lines environmental Impact Assessment Impact on Cultural Heritage Resources. Completed for Arcus Gibb.

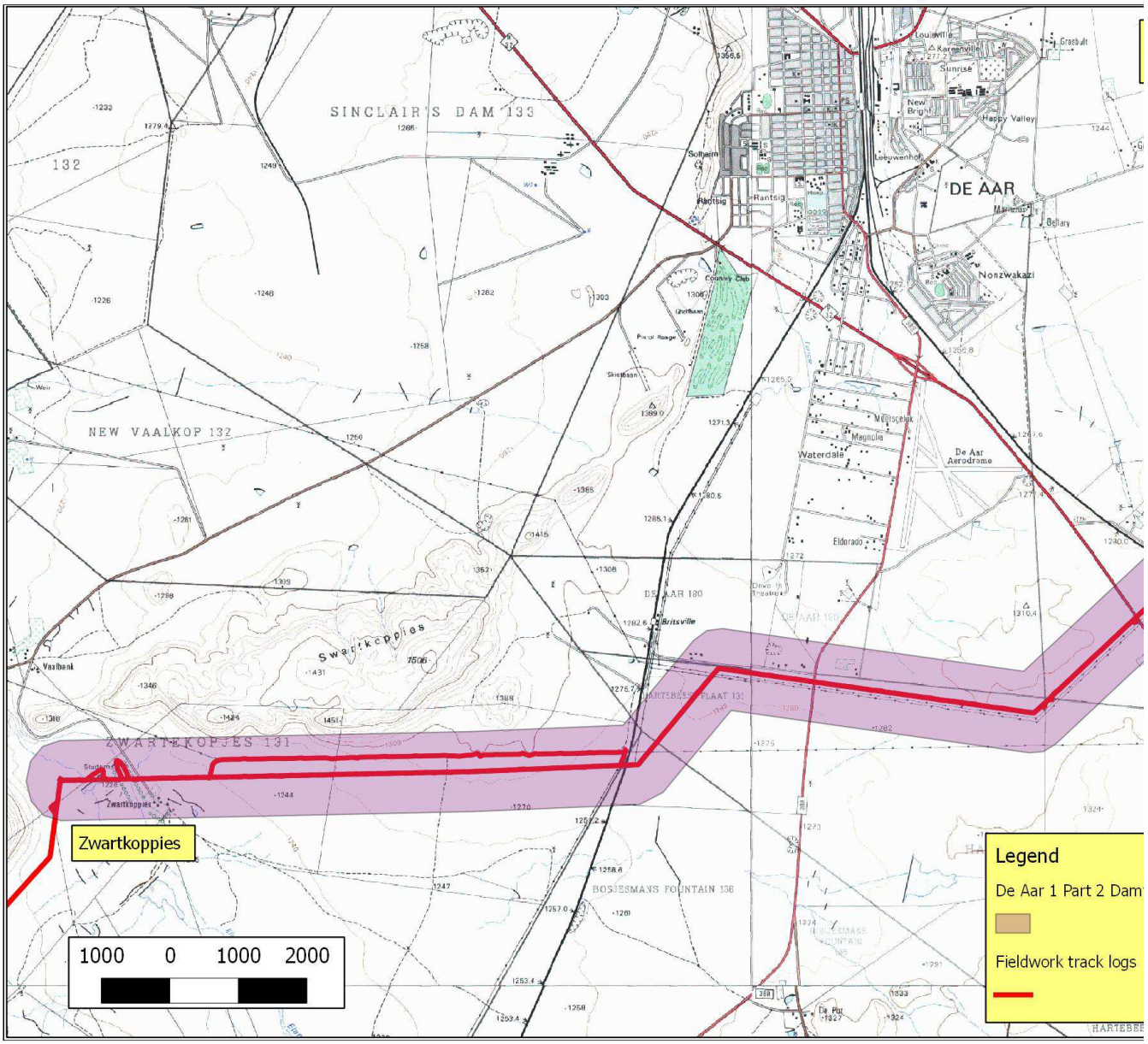
VAN RYNEVELD, KAREN. 2008. Archaeological Scoping - Establishment of an Ammunition Disposal Plant, Sinclair's Dam 133, De Aar, Northern Cape, South Africa. ArchaeoMaps

APPENDIX A
SITE DISTRIBUTION MAP


De Aar 132kV Damfontein Part 1
Heritage Structures
DE AAR 1 MAANH
Zwartkoppies
DAM 4B
DAM 4A
DAM 3
ZWARTEKOPJES 131
ZWARTEKOPJES 131
Platberg
Vaalbank
Aasvoelkop
Eselskop
Elandsfonteinrivier
Legend
De Aar 1 Part 1 Damfontein Transmission Route_buffer_500m
Heritage Sites
De Aar 1 Part 1 Damfontein Transmission Route
0
1000
2000


De Aar 132kV Damfontein Part 1
Fieldwork Track logs
Zwartkoppies
Zwartkoppies
ZWARTEKOPJES 131
ZWARTEKOPJES 131
B E R G E
Vaalbank
Studam
Aasvoelkop
Platberg
Pietsberg
Legend
De Aar 1 Part 1 Damfontein Transmission Route_buffer_500m
Tracklogs for field work
0
1000
2000


Legend
De Aar 1 Part 2 Damfontein Transmission Route_buffer_500m
De Aar 1 Part 2 Damfontein Transmission Route
Heritage Sites
De Aar 1
Fieldwo
DE AAR
NEW VAALKOP 132
ZWARTEKOPJES 131
HARTEBEESTPLAAT 135
BOSMANS FOUNTAIN 136
DE AAR 180
Waterdale
Eldorado
Nonzwakazi
De Aar Aerodrome
DAM 2
DAM 1
Zwartkoppies
1000 0 1000 2000


SINCLAIR'S DAM 133
132
DE AAR
NEW VAALKOP 132
ZWARTEKOPJES 131
BOSSIESMANS FOUNTAIN 136
Zwartkoppies
Legend
De Aar 1 Part 2 Dam
Fieldwork track logs
1000 0 1000 2000

APPENDIX B

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

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 construction company's cost. Thus, the construction company 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.

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 C

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 and Grave Relocation Consultants (PGS) for the proposed Copperleaf Project 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 consisted of three steps:

- Step I – Literature Review: The background information to the field survey leaned greatly on the initial Heritage Impact Assessment Report completed by Matakoma for the Gardener Ross Residential Golf Estate in 2004.

- Step II – Physical Survey: A physical survey was conducted by vehicle and on foot through the proposed project area by a qualified archaeologist and experienced staff, 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 mitigation

D - Preserve site, or extensive data collection and mapping of the site; and

E - Preserve site

- 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 4: *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 Significance	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium Significance	Recording before destruction
Generally Protected C (GP.A)	-	Low Significance	Destruction

APPENDIX D

IMPACT ASESSMENT METHODOLOGY

Methodology for Impact Assessment

Impact Rating

VERY HIGH

These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in severe or very severe effects, or beneficial or very beneficial effects.

Example: The loss of a species would be viewed by informed society as being of VERY HIGH significance.

Example: The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with a VERY HIGH significance.

HIGH

These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light.

Example: The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated.

Example: The change to soil conditions will impact the natural system, and the impact on affected parties (in this case people growing crops on the soil) would be HIGH.

MODERATE

These impacts will usually result in medium- to long-term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial.

Example: The loss of a sparse, open vegetation type of low diversity may be regarded as

MODERATELY significant.

Example: The provision of a clinic in a rural area would result in a benefit of MODERATE significance.

LOW

These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly

unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect.

Example: The temporary change in the water table of a wetland habitat, as these systems is adapted to fluctuating water levels.

Example: The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.

NO SIGNIFICANCE

There are no primary or secondary effects at all that are important to scientists or the public.

Example: A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.

Certainty

DEFINITE: More than 90% sure of a particular fact. Substantial supportive data exists to verify the assessment.

PROBABLE: Over 70% certainty of a particular fact, or of the likelihood of an impact occurring.

POSSIBLE: Only over 40% certainty of a particular fact or of the likelihood of an impact occurring.

UNSURE: Less than 40% certainty of a particular fact or likelihood of an impact occurring.

Duration

SHORT TERM: 0 to 5 years

MEDIUM: 6 to 20 years

LONG TERM: more than 20 years

PERMANENT: site will be demolished or is already demolished

An example of a ratings table:

Impact Grading

Impact	**Impact Significance**	**Heritage Significance**	**Certainty**	**Duration**	**Mitigation**
Negative	Moderate	Grade GP.C	Possible	Permanent	C

APPENDIX D

PALAEONTOLOGICAL DESKTOP ASSESSMENT REPORT

PALAEONTOLOGICAL DESKTOP ASSESSMENT OF THE PROPOSED DEVELOPMENT OF THE EASTERN PLATEAU AND MAANHAARBERG 132kV POWER LINES AT DE AAR IN THE NORTHERN CAPE

FOR

MULILO

HIA CONSULTANTS

DATE: 18 DECEMBER 2012

By

MMGES
Metsi Metseng Geological & Environmental Services

Suite 91
Private Bag X62
Bethlehem 9700
info@mmges.co.za
Fax 086 743 6864
+27 82 070 0735
+27 82 829 4978
www.mmges.co.za
VAT 4260183498
Reg 1999/30444/23

EXECUTIVE SUMMARY

Metsi-Metseng Geological and Environmental Services CC was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontology impact of the proposed 132kV overhead power line developments by Mulilo to connect Wind Energy Facilities around De Aar with the Eskom National Transmission Grid.

This report forms part of the Environmental Impact Assessment for the power line development 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 upgrade development.

De Aar is situated in the Emthanjeni Municipality in the Pixley ka Seme District of the Northern Cape. Numerous renewable energy projects are proposed for the De Aar area. The proposed 132kV transmission lines with associated substations developments will connect these renewable energy projects with the national transmission grid. The proposed transmission lines consist of the southern Maanhaarberg line of ±43.4km and the northern Eastern Plateau line of ±39km. Both lines will have steel monopole towers with a footprint of between 0.6 - 1.5m². Where possible existing roads will be used or 4x4 tracks will be made for access.

A basic desktop assessment of the topography and geology of the area was made by using 1:250 000 geological maps (3022 Britstown and 3024 Colesberg) in conjunction with Google Earth. The known fossil heritage within each rock unit was determined from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience. The major limitation of this study is that no supporting field assessment was made and the assumption that existing geological maps and datasets used to assess site sensitivity are correct and reliable.

The study area is mainly underlain by Permian sedimentary rocks of the Tierberg Formation of the Ecca Group of the Karoo Supergroup and the Abramskraal Formation of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite sills dominate the high laying areas while recent Quaternary Alluvium deposits occur in the river valleys.

There is a high and moderate possibility that fossils could be encountered during excavation of the Abramskraal and Tierberg Formations respectively. These fossil founds would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would be a highly negative palaeontological impact. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact.

It is therefore recommended that:

- A Palaeontologist be appointed as part of the Environmental Construction Team for preferable all identified palaeontological sensitive areas but definite for the identified high sensitive areas.
- A palaeontological rescue and/or destruction permit is obtained by the Palaeontologist.
- The Palaeontologist accompany the surveyor and foundation teams during the pylon construction phase to move pylons where possible from potential fossil bearing areas or rescue any fossils from construction footprint.
- Compile a Phase 2 report to the Heritage Authority responsible after palaeontological construction inputs.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Background

Metsi-Metseng Geological and Environmental Services CC was appointed by PSG Heritage and Grave Relocation Consultants to undertake a desktop survey, assessing the potential palaeontology impact of the proposed 132kV overhead power line developments by Mulilo to connect Wind Energy Facilities around De Aar with the Eskom national transmission grid.

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 upgrade development.

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 identifying exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assessing the level of palaeontological significance of these formations;
- to commenting on the impact of the development on these exposed and/or potential fossil resources and
- to making 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. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region and the author's field experience.

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.5 Palaeontological Sensitivity Analysis Outcome Classification

Sensitivity	Description
Low Sensitivity	Areas where there is likely to be a negligible impact on the fossil heritage. This category is reserved largely for areas underlain by igneous rocks. However, development in fossil bearing strata with shallow excavations or with deep soils or weathered bedrock can also form part of this category.
Moderate Sensitivity	Areas where fossil bearing rock units are present but fossil finds are localised or within thin or scattered sub-units. Pending the nature and scale of the proposed development the chances of finding fossils are moderate. A field-based assessment by a professional palaeontologist is usually warranted.
High Sensitivity	Areas where fossil bearing rock units are present with a very high possibility of finding fossils of a specific assemblage zone. Fossils will most probably be present in all outcrops and the chances of finding fossils during a field-based assessment by a professional palaeontologist are very high. Palaeontological mitigation measures need to be incorporated into the Environmental Management Plan

When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a field-based assessment by a professional palaeontologist is usually warranted.

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 are also 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 tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium etc).

2 DESCRIPTION OF THE PROPOSED DEVELOPMENT

The town of De Aar is situated in the Emthanjeni Municipality of the Pixley ka Seme District in the Northern Cape. Numerous renewable energy projects are proposed for the De Aar area. The proposed 132kV transmission lines with associated substations (Figure 2.1) will connect these renewable energy projects with the national transmission grid. The proposed transmission lines consist of the southern Maanhaarberg line of ±43.4km and the northern Eastern Plateau line of ±39km.

Figure Error! No text of specified style in document.**.23 Locality of the Proposed Maanhaarberg and Eastern Plateau 132kV Transmission Lines**

Both lines will be constructed from steel monopole poles. These poles weigh approximately 1 200 kg each and vary in height from approximately 17.4m to 21m. The size of the footprint depends on the type of pole, i.e. whether it is a self-supporting, guyed suspension or an angle strain pole structure. The size of the footprint ranges from 0.6m² to 1.5m², with the larger footprint associated with the guyed suspension and angle strain pole used as bend/strain structures.

The average span between two towers is 200m, but can vary between 250m and 375m depending on the ground profile (topography) and the terrain to be spanned. The self-supporting structure (suspension pole) is typically used along the straight sections of the power line, while the guyed intermediate or guyed suspension and angle strain structures are used where there is a bend in the power line alignment. The servitude width for a 132 kV Sub-transmission line is 31m and for 2 lines it will be 52m. Existing roads will be used and 4x4 jeep tracks will only be developed for access to the transmission route where no roads currently exist.

The final tower sizes and positions will only be determined once the project has received Environmental Authorisation and after negotiations with landowners.

3 GEOLOGY OF THE AREA

The study area is mainly underlain by Permian sedimentary rocks of the Karoo Supergroup (Figure 4.1). These Permian sedimentary rocks are classified as the Tierberg Formation (Pt) of the Ecca Group of the Karoo Supergroup and the Abramskraal Formation (Pa) of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite (Jd) sills dominate the hilltops while the low laying areas consist of recent Quaternary (^^) Alluvium deposits.

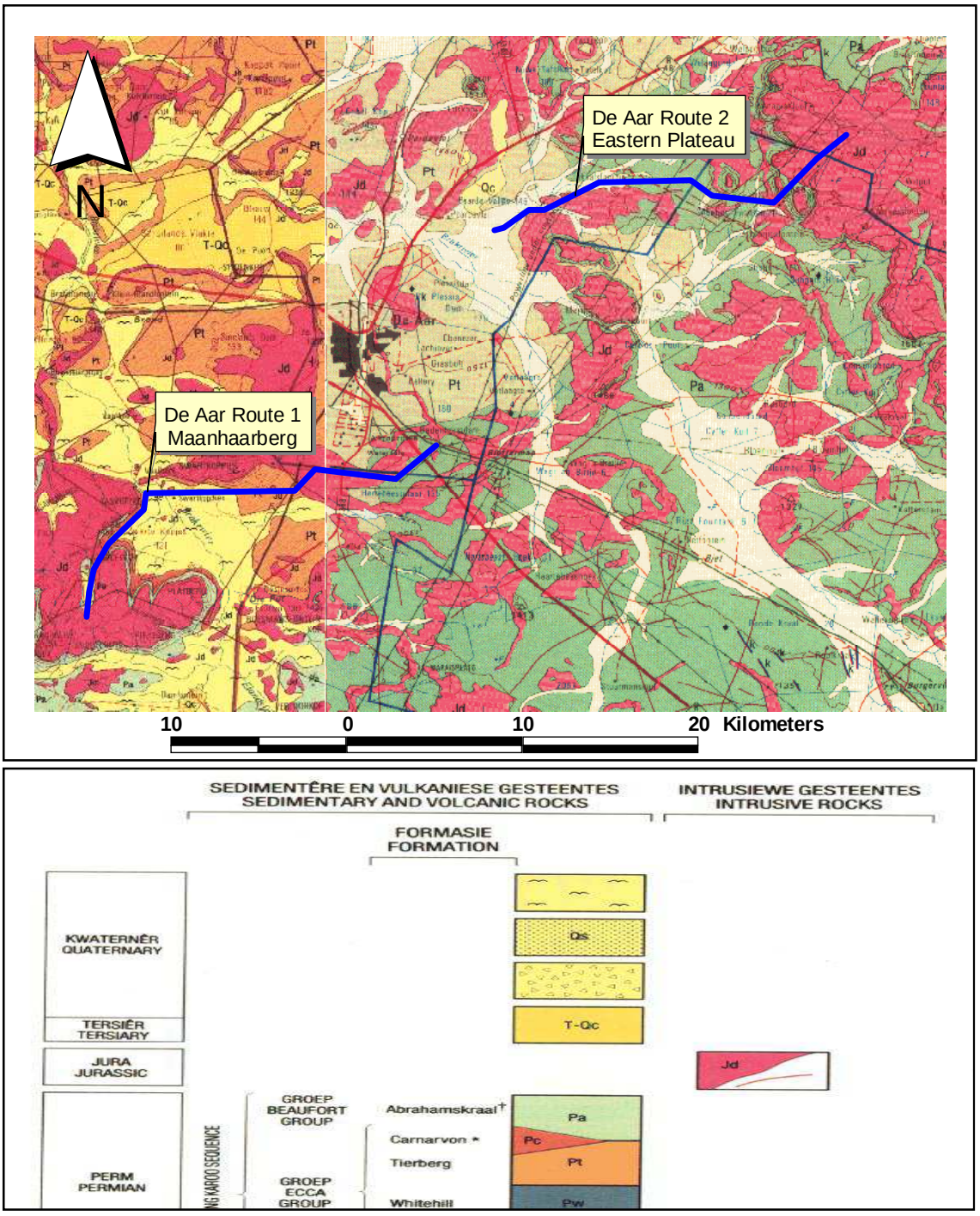


Figure Error! No text of specified style in document.**.24 Geology of the study area at De Aar (Geo Maps 3022 Britstown and 3024 Colesberg)**

3.1 The Tierberg Formation

The Tierberg Formation (Pt) is interpreted as offshore non-marine mudrocks with distal turbidite beds, prodeltaic sediments and represented by greenish weathering shale with subordinated siltstone and sandstone (Johnson *et al*, 2006).

3.2 The Abramskraal Formation

The Abramskraal Formation (Pa) is interpreted as fluvial sediments with channel sandstones (meandering rivers), thin mudflake conglomerates interbedded with floodplain mudrocks (grey-green, purplish), pedogenic calcretes, playa lake and pond deposits and occasional reworked volcanic ashes (Johnson *et al*, 2006 and Almond & Pether, 2008). The Abramskraal Formation is represented by blue-grey mudstone, sandstone and siltstone.

3.3 Karoo Dolerite

Dolerite (Jd) is a very hard igneous rock that intruded the sedimentary layers and can occur either as sills or dykes. Sills can be from a few meters to tens of meters thick.

3.4 Quaternary Deposits

The Quaternary Deposits consist of alluvial deposits, deposited by rivers in the valley floors.

4 PALAEONTOLOGY OF THE AREA

4.1 The Tierberg Formation

Trace fossils occur throughout the Tierberg Formation, reflecting specific water depths and energy conditions. Plant impressions, mud and vertebrate fragments in the upper sandstone layers are indications of a sallow water environment. These fossils have a low diversity but are locally abundant when found (Almond & Pether, 2008).

4.2 The Abramskraal Formation

The Abramskraal Formation have a diverse continental fossil biota dominated by a variety of *Therapsids* (eg *dinocephalians, dicynodonts, gorgonopsians, therocephalians, cynodonts*) and primitive reptiles (eg *pareiasaurs*), sparse *Glossopteris* Flora (petrified wood, rarer leaves, horsetail stems), tetrapod trackways, burrows and coprolites. Freshwater assemblages include temnospondyl amphibians, palaeoniscoid fish, non-marine bivalves, phyllopod crustaceans and trace fossils (esp. Arthropod trackways and burrows, “worm” burrows, fish fin trails plant rootlet horizons) (Almond & Pether, 2008).

4.3 Karoo Dolirite

Due to the ingenious character of Karoo Dolerite it will contain no fossils.

4.4 Quaternary Deposits

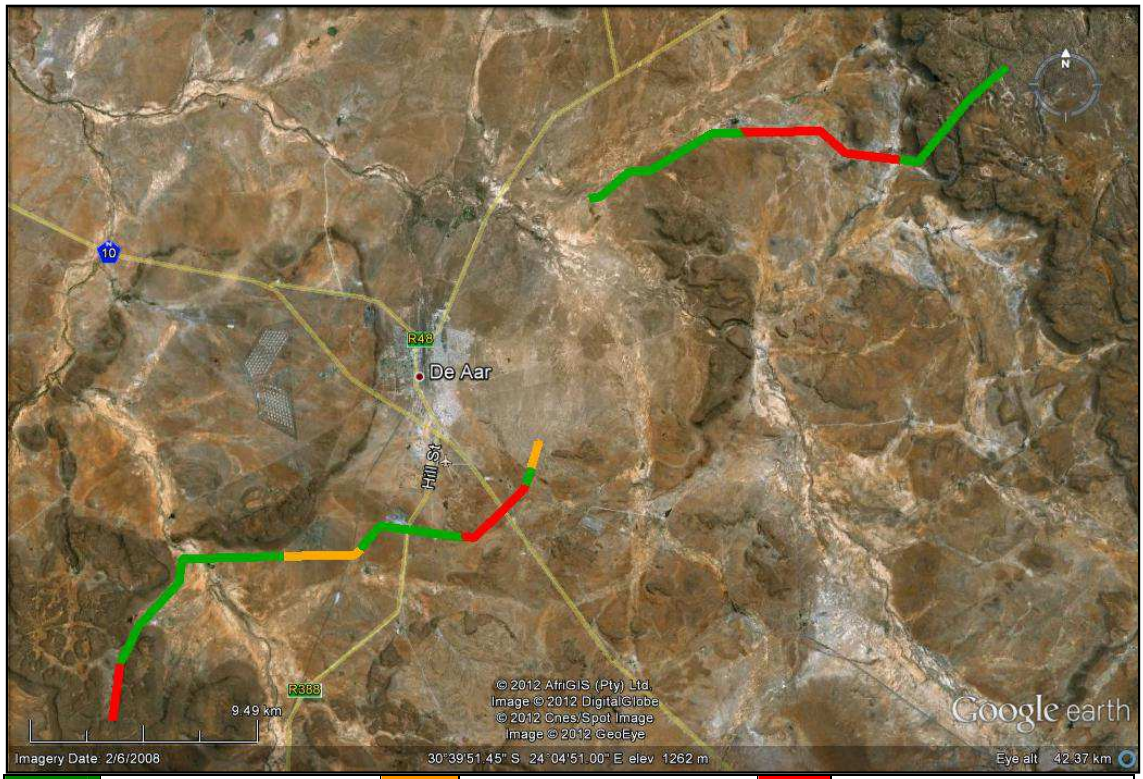
No fossils are expected in the alluvial deposits of recent rivers.

5 PALAEONTOLOGICAL SENSITIVITY

The palaeontological sensitivity is predicted after identifying potentially fossiliferous rock units; ascertain the fossil heritage from the literature and evaluating the nature and scale of the development itself. The palaeontological sensitivity is summarised in Table 4.1 and illustrated in Figure 4.1 below.

Table.6 Palaeontological Sensitivity of Geological Units on Site

Geological Unit	Rock Type and Age	Fossil Heritage	Vertebrate Biozone	Palaeontological Sensitivity
Tierberg Formation ECCA GROUP	Greenish weathered shale, subordinated siltstone and sandstone PERMIAN	Disarticulated microvertebrate remains (eg fish teeth, scales), sponge spicules, spare vascular plants (leaves, petrified wood), moderate diversity trace fossil assemblages such as locally abundant ichnofaunas (horizontal "worm" burrows, arthropod trackways).	*None*	Moderate sensitivity
Abramskraal Formation Adelaide Subgroup BEAUFORT GROUP	Blue-grey mudstone, sandstone and siltstone LATE PERMIAN	Vertebrate fossils of the *Therapsids* group e.g. *Gorgonopsian* and *Dicynodonts* and Plant fossils e.g. *Glossopteris* trees and leaves.	*Dicynodon* Assemblage Zone	High sensitivity



	Low Sensitivity		Moderate Sensitivity		High Sensitivity

Figure Error! No text of specified style in document.**.25** **Palaeontological Sensitivity Localities**

6 CONCLUSION AND RECOMMENDATIONS

The study area is mainly underlain by Permian sedimentary rocks of the Tierberg Formation of the Ecca Group of the Karoo Supergroup and the Abramskraal Formation of the Adelaide Subgroup of the Beaufort Group of the Karoo Supergroup. Jurassic Dolerite sills dominate the high laying areas while recent Quaternary Alluvium deposits occur in the river valleys.

There is a high and moderate possibility that fossils could be encountered during excavation of the Abramskraal and Tierberg Formations respectively. These fossil founds would be of international significance. The damage and/or loss of these fossils due to inadequate mitigation would be a highly negative palaeontological impact. The exposure and subsequent reporting of fossils (that would otherwise have remained undiscovered) to a qualified palaeontologist for excavation will be a beneficial palaeontological impact.

It is therefore recommended that:

- A Palaeontologist be appointed as part of the Environmental Construction Team for preferable all identified palaeontological sensitive areas but definite for the identified high sensitive areas.
- A palaeontological rescue and/or destruction permit is obtained by the Palaeontologist.
- The Palaeontologist accompany the surveyor and foundation teams during the pylon construction phase to move pylons where possible from potential fossil bearing areas or rescue any fossils from construction footprint.
- Compile a Phase 2 report to the Heritage Authority responsible after palaeontological construction inputs.

7 REFERENCES

Almond, J.E. and Pether, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA Technical Report. Natura Viva cc., Cape Town.

Groenewald GH.1996. Stratigraphy and Sedimentology of the Tarkastad Subgroup, Karoo Supergroup, South Africa. Unpubl PhD Thesis, University of Port Elizabeth.

Johnson MR , Anhaeusser CR and Thomas RJ (Eds) (2006). The Geology of South Africa. GSSA, Council for Geoscience, Pretoria.

Rubidge BS (ed) 1995. Biostratigraphy of the Beaufort Group (Karoo Supergroup), South Africa. South African Committee for Stratigraphy.

8 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

Dr Gideon Groenewald has a PhD in Geology from the Nelson Mandela Metropolitan University (1996) and the National Diploma in Nature Conservation from the University of South Africa (1990). 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).

9 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